



**ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH
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PROGRAM IN PUBLIC HEALTH**

**METABOLIC SYNDROME: EPIDEMIOLOGY AND
SOCIOCULTURAL CONTEXTS, AMONG PEOPLE LIVING
WITH HIV, IN GEDEO ZONE, SOUTHERN ETHIOPIA**

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**DISSERTATION TITLE: METABOLIC SYNDROME:
EPIDEMIOLOGY AND SOCIOCULTURAL CONTEXTS, AMONG
PEOPLE LIVING WITH HIV, IN THE GEDEO ZONE, SOUTHERN
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Dedication

.

This dissertation is devoted to my lovely wife (Tizita Tejisa Kefeni) and kid douter (Fenet Girma Tenkolu). Who have been endless springs of power and inspiration; one without whose love, care, and backing me never could have endeavored or finalized this trip. A commitment is as well made to my late mother (Gete Getachew Telila) and father (Tenkolu Bune Benti) who set aside before me the slogans, “Greater than the uppermost human thought can spread is God’s supreme for His children,” and “Make us gratified.”

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List of original papers

This dissertation is based on the following three original papers's, which are referred to in the text by their Roman numerals.

- I. G.T.Bune, A.W.Yalew, A. Kumie. ***The global magnitude of metabolic syndrome among antiretroviral therapy (ART) exposed and ART-naïve adult HIV-infected patients in Gedeo-zone, southern Ethiopia: Comparative cross-sectional study, using the Adult Treatment Panel III criteria.*** Published in Diabetes & Metabolic Syndrome: Clinical Research & Reviews 13 (2019) 2833e2841
- II. Bune GT, Yalew AW, Kumie A. ***Predictors of Metabolic Syndrome Among People Living with HIV in Gedeo-Zone, Southern-Ethiopia: A Case–Control Study.*** Published in Dove Press journal: HIV/AIDS - Research and Palliative Care 2020:12 535–549
- III. Girma Tenkolu Bune^{1*}, Alemayehu Worku Yalew², Abera Kumie³. ***The role of sociocultural contexts in forming adult HIV-patients' behavior towards metabolic syndrome and its lifestyle related risks (Paper-III): A descriptive phenomenological study*** (unpublished manuscript).

Acronyms and Abbreviations

ABC:	Abacavir
AZT/ZDV:	Zidovudine
AIDS :	Acquired Immunodeficiency syndrome
ART:	Antiretroviral Therapy
ARV:	Antiretroviral
CVD:	Cardio Vascular Disorder
EFV/EFZ:	Efavirenz
EDHS :	Ethiopia Demographic Health Survey
FBS:	Fasting Blood Sugar
FDC:	Fixed Dose Combination
HDL-c:	High Density Lipoprotein Cholesterol
HBV:	Hepatitis B Virus
HCV:	Hepatitis C Virus
HSTP II :	Health Sector Transformation Plan Two
IDF :	International Diabetes Federation
IRB:	Institutional Review Board
3TC:	Lamivudine
LDL-c;	Low Density Lipoprotein Cholesterol
MS:	Metabolic Syndrome
NCDs:	Non-communicable disease
NCEP/ATP-III:	National cholesterol Education program adult treatment panel three
NFV:	Nelfinavir
NRTI:	Nucleotides reverse transcriptase inhibitors
NNRTI :	Non-Nucleotides Reverse Transcriptase Inhibitors
NVP:	Nevirapine
PLHIVs:	People Living with HIV/AIDS
RNA:	RiboNucleic Acid
ZDV/ AZT:	Zidovudine

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MS:Metabolic syndrome , ART: Antiretroviral Therapy, WC:waist circumference, BMI:Body Mass Index,FBG: Fasting PlasmaGlucose, TGL:Triglyceride, HDL: High Density Lipoprotein,LDL:Low density Lipoprotein,CI: cultural Identity, RE:Relationship and expectation, CE:cultural Empwer , PEN:Person-Extended Family-Neighbour, PEN:Perception-Enabler-Nurture,PEN:Positive-Existential-Negative

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Abstract

Background: following an intensive global operation of antiretroviral therapy (ART), the worldwide morbidity and mortality from infectious diseases have occupied a backseat. Instead, a non-communicable diseases (NCDs) risk marker called metabolic syndrome (MS) has emerged. MS is risk factors for cardiovascular disease that has public health issue, which places social, economic, and disease conditions on the community within the geographical region of sub-Saharan Africa, including Ethiopia. Literature has shown that human immunodeficiency virus (HIV) infected patients on ART have a 2-fold risk of dying from MS. There are no such studies in Gedeo zone, southern Ethiopia; hence the need for this study to fill this gap.

Objective: To assess the epidemiology and the socio-cultural contexts of metabolic syndrome among people living with HIV (PLHIVs), in the Gedeo Zone, Southern Ethiopia.

Methods: This dissertation was conducted in the randomly selected two hospitals and health centers. A mixed approach was used to address the objectives of this dissertation. To estimate and compare the magnitude of overall MS among the two comparative groups, a comparative cross-sectional design was employed among the randomly chosen PLHIVs from two hospitals and two health centers, exist in the Gedeo zone, southern-Ethiopia (**Paper I**). The data collection for this study was run beginning from December 29th, 2017 up to January 22nd– 2019, using the WHO steep tool. Ultimately, the completed data was entered into Epidata (V-3.1) and exported to SPSS (V– 22) for analysis. The revised Adult Treatment Panel three (ATP III) criterion was used to define the overall MS and its corresponding traits. The mean, standard deviations, and proportions were used as a descriptive summary. Categorical data and the proportion of overall MS in the two groups were compared using binary logistic regression, and results were reported statistically significant at a p-value is less than 5%. To identify predictors of metabolic syndrome among PLHIVs (**Paper-II**), a health institution-based unmatched case-control study was conducted. All HIV-infected adult persons who are receiving routine care in the randomly selected two hospitals and two health centers of the Gedeo zone were involved in the study, from December 29th, 2017 to January 22nd, 2019. The PLHIVs diagnosed with overall MS using ATP III criteria were considered as a case, and those subjects free of it in the survey were enrolled as

controls. Binary logistic regression was employed to identify predictors of MS. In the crude analysis, all variables significant at ($P < 0.1$) were included in a multivariable logistic regression model, using the enter method to arrive at the final model. In which, the adjusted odds ratio (AOR) with 95% CI, was estimated to assess the presence and strength of associations, and was determined statistical significance at a p -value < 0.05 . To understand the role of sociocultural contexts in forming individual PLHIVs' behavior towards lifestyle-related MS risks, a deductive descriptive phenomenological approach, using the PEN-3 model as a theoretical basis and the knowledge, attitude, and practices (KAP) as a conceptual framework were used. Adult PLHIVs were chosen purposefully from Dilla University referral hospital and Wonago health center and were involved in the discussion. The data collection was enhanced with a focus group discussion (FGDs) and an in-depth interview method, starting from February 1st to 30th 2018. Finally, the primary data produced from the discussions were handled and analyzed iteratively, by using Atlas. ti (Version.7.5.7) and SPSS (Version.22) software.

Result: a total of 633 ($n=422$, ART exposed and $n=211$, ART naïve) PLHIVs were involved in the first paper, with a response rate of 92.1%. MS was diagnosed in (22.0%, 95% CI: 19.0-25.4) of PLHIVs. It was slightly higher in the ART-exposed (22.5%, 95% CI: 18.7-26.8) than ART naïve (20.9%, 95% CI: 15.2-27.1) group. However, the observed differences were not statistically significant ($P > 0.05$). In paper two, a total of 633 (139 cases and 494 controls) PLHIVs were included. The multivariable analysis result found that age (AOR=1.09, 95% CI (1.05-1.12)); educational status being completed secondary school (AOR=0.22, 95% CI (0.02-0.42)); occupational status being of students (AOR=0.11, 95% CI (0.24-0.51)); wealth index being in the middle quintile (AOR=0.22, 95% CI (0.06-0.79)); ART status exposed to ART (AOR=3.07, 95% CI (1.37-6.89)); total physical activity state being physically active (AOR=0.36, 95% CI (0.16-0.79)), and engaged in low levels physical activity (AOR=3.83, 95% CI (1.46-10.05)) were the factors significantly associated with MS. Furthermore, the result from the third paper revealed that a total of 32 male and female respondents were involved in the discussion. More than half, 68.8 % (22) of the subjects were found within the age range of (35-44) years, with a mean age of 36.96 (+8.94) years-old. The getting hold of MS risk associated health knowledge of a person encompasses multiple sources. Family, the spouse's children, sisters, and brothers; the government structure, mainly the health care structures; the social systems,

principally, the religious organization, the social calls 'Idir', were primary role player in educating the PLHIVs.

Conclusions and recommendations: Paper one demonstrated that the magnitude of overall MS was higher among PLHIVs in the Gedeo zone; with a relatively higher magnitude seen in the ART-exposed than ART naïve groups. However, the observed differences were not statistically significant. Implicated that at the time of implementation of the entire test and treatment policy in those vulnerable target groups, a routine screening program of MS will be a vibrant action. While education, occupation, wealth index, antiretroviral therapy status, total physical activity, and lower physical activity levels were concluded by the second paper as modifiable predictors of metabolic syndrome, age was found as a non-modifiable independent risk of metabolic syndrome. This suggested that there is a need for an ongoing effort to realize an integrated care plan that addresses the routine care, along with the regular screening and management programs of the risks associated with MS and its traits in these subjects. The sociocultural contexts dictate the PLHIVs' to have inadequate knowledge concerning risk factors and methods for preventing MS. And, this, in turn, contributed to form an unfavorable attitude and inadequate practices. The finding indicates the significance of the adoption of the healthy living practices associated awareness creation program, which targets the PLHIVs to bring behavior change that eventually enable them for the better prevention and control of MS and its long term consequences.

Keywords: Epidemiology, sociocultural-contexts, metabolic syndrome, overall magnitude, predictors, PEN-3 model, descriptive phenomenology, southern-Ethiopia

1. Introduction

1.1. Background of the study

Human immunodeficiency virus (HIV) is virus infects the individual through various routes of transmission and then invades the host's immune system. The immune system is thus compromised, thereby generating room for life-threatening opportunistic infections(OIs)(1). HIV has the potential of surviving in body fluids and be transmitted from person to person. Globally, there were 38.0 million [36.2 million adults] people living with HIV(PLHIVs), and 690000 died from AIDS-related illnesses at the end of 2019(2). East and Southern Africa are the regions hardest hit by HIV, during which there have been nearly 20.6 million people infected, and around 310,000 people died of AIDS-related illnesses in 2018(3). Sub-Saharan Africa (SSA) carries the highest-burden with an estimated 71% of the global total. In Ethiopia, about 715 404 people were living with HIV in 2015 and this increased to 722 248 in 2017(4).

Using anti-HIV drugs in the management of PLHIVs is called antiretroviral therapy (ART). The therapy is a combination of at least three drugs that reduces or suppresses the replication of HIV. The combined therapy is popularly called highly active antiretroviral therapy (HAART)(5). Using HAART reduces the rates of disease progression and mortality in this population of patients, thereby improving the quality of life of these patients (6-9). As of the end of 2019, globally, 25.4 million people were on ART(2). In East and Southern Africa, 85% of the 79% of PLHIVs were on treatment, in 2018(2). In Ethiopia, 71% of PLHIVs are current on ART, in 2016(3, 10). ART is used to reduce the chance of the virus emerging resistant to the drugs(5). Using ART in PLHIVs treatment has led to an increased prevalence of non-communicable diseases (NCDs)(11-13) risk marker called metabolic syndrome(MS) (5, 6, 14).

Metabolic syndrome is a clustering of several cardiovascular risk factors, which has been measured in various populations using different criteria(15), each with criteria that influence its diagnosis(8, 13, 15, 16). The criteria proposed by the revised National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP III) was the most widely used criterion in Africa. Based on the guideline, the presence of three of the five criteria below: Waist

circumference ≥ 102 cm (Men), ≥ 88 cm (Women); Triglycerides ≥ 150 mg/dl or treated or High-density lipoproteins (HDL): < 40 mg/dl (Men) or < 50 mg/dl (Women) or treated; fasting plasma glucose ≥ 110 mg/dl or treated; blood pressure (≥ 130 systolic or ≥ 85 mmHg diastolic) or treated with the antihypertensive drug were adopted to define overall MS in this dissertation(12, 17-19).

HIV is a multisystem infection that affects different body systems. It is further complicated by ART, which causes unwanted side effects, thereby affecting the everyday actions and quality of life of PLHIVs (6-9). Therefore, to prevent MS attributed to the side effects of HIV infections and ART, it is recommended that management packages that include lifestyle risks such as unhealthy diets, physical inactivity, and harmful substance use, as they are reversible risks (20-22). However, this demands a change in personal behavior towards these risks by acting upon the contexts surrounding it, since the risks are interrelated and rooted in sociocultural contexts (23, 24). The sociocultural context in this study perspective refers to shared norms, values, and codes that jointly shape a group's beliefs, attitudes, and behavior by interacting within themselves and with their surroundings (23-26). It is an important comprehensive package of primary prevention (27) that required to use of a theory (28, 29).

The PEN-3 model in this regards provides valuable guidelines for the sociocultural sensitivity of an individual's health behavior (23). The model consists of three primary domains; each consisted of three intrinsically linked factors that form the acronym PEN: The cultural identity domain is a tool that assesses the origins of health behavior at various levels of the person's extended family and neighborhood (25). The relationships and expectations domain is the tool having with perception, enabler, and nurtures sub-domains. The development and interpretation of behavior have usually supported by the interaction between these constructs. The cultural empowerment domain is the third tool with positive, existential, and negative sub-domains. It applied to identify the influence of the sociocultural on health behavior decisions (23-25). Therefore, the third paper in this dissertation was used all the three constructs of the model as a theoretical framework. The central idea was based on the concepts of Airhihenbuwa, 1989 (23).

1.2. Statement of the problem

Metabolic syndrome (MS) is a main medical and public health challenge that is on the increase globally(30). An individual with MS has a 2-3 times greater chance of developing the

cardiovascular disorder (CVDs)(31) and a 6-fold higher risk of developing type two DM (T2DM) than without MS. It is a predictor of future non-communicable diseases (NCDs)(15, 32). NCD causes 40.5 million, or 71% of the 56.9 million global deaths in 2016. Of which, 31.3 million deaths (about 77% of the world's NCDs deaths) are happening in low and middle-income countries(33). If the present rising burden of NCDs continues, the aggregate loss to the worldwide economy has been expected to reach \$47 trillion by 2030(30). In the SSA region, NCDs accounted for more than 50% of all reported adult mortality. In Ethiopia, it attributed to 52% of the entire mortality, in 2016(34). The Disability-Adjusted Life Years (DALYs) increased from below 20% in 1990 to 69%, in 2015 (35). Without any intervention, Ethiopia will be the first in Africa to experience untimely deaths and disability from NCDs by 2040(35).

These diseases are starting to rank on par with communicable diseases (CDs). Especially, in the SSA countries where per capita health expenditures are set at levels high enough to adequately CDs (36), properly finance adequate intervention for those who have or are developing NCDs will place extra pressure on resources (36, 37). The burden would be massive if HIV-infected individuals come down with other NCDs risks like MS(6, 16, 38)(32, 37).

The prevalence of MS among HIV patients across continents was estimated to be high, 13.0% to 58.8%, and was inconsistent. The highest was reported in Europe, 58.8%(39) to the lowest in Africa 13%(16). It was reportedly 13% to 58% within the SSA region (8, 16) and 21.1% to 24.3% in Ethiopia (18, 40-42).

Further, as several researchers conducted cross-sectional studies that observed that MS was prevalent in PLHIVs on ART (18.4 to 21.6%) than ART naïve (11.8 to 19.9%) (43)(44). (11, 15, 42, 43). For instance, a study from the USA (37% after 96 ART exposed)(45), Thailand (24.9% ART exposed)(46), South Africa (23.7-49.6% ART exposed)(47, 48). Although not exactly known, evidence has shown that mitochondrial dysfunction, oxidative stress, altered adipogenesis, and differentiations were the mechanisms expected to be mostly associated with the increasing magnitude of MS due to ART exposure(49-51). This portrayed that exposure to ART can worsen the situation and it is partly responsible for the increase in the rate of NCDs in PLHIVs with ART than ART naïve.

On the other hand, a greater magnitude of MS was also reported among ART naïve subjects considered in studies from South Africa (32.6%-40%)(47, 48), and Cameroon (47%)(52). This implicated that HIV infection alone is accountable for the increase in the rate of MS and NCDs in PLHIVs. HIV infection activates the inflammatory pathways that change the endothelial cells to prothrombotic from their phenotype, which results in increased carotid intima thickness. Correspondingly, the released pro-inflammatory agents and abnormal fat distribution contribute to impaired glucose homeostasis. All these phenomenon occurs as a result of the direct activation of the endothelial cells by HIV and explains why HIV increases the risk for MS prevalence and NCDs (11, 12). These arguments of knowledge about the growing concern for increasing magnitude of MS and risk of NCDs among PLHIVs with or without ART has demanded several observatory studies. Several studies on the magnitude of overall MS in all PLHIVS regardless of ART status have been done in the developed nations(45, 53-55), having a couple of outputs from the SSA countries (8, 40, 42). In Ethiopia, similar studies are scarce and were done having great inconsistency and disparity (6, 18, 56).

In line, as several studies have shown, due to the adverse effects of MS-related with or without ART, there have been reported cases of increased occurrences of NCDs in this target group of the population(45-48). These studies validated that the epidemiologic nature of MS is developing disturbingly that its magnitude varies by different predictors. Consequently, concern about what predicts MS among HIV-infected populations is increasing in the present time(14). For instance, in a recent crossectional study in Ethiopia Ataro, et al.2020 pinpointed, Age, education, and ART exposure as predictors of MS (10). Another narrative review has been done among PLHIVs in Africa Husain et al. 2017 (16) notified many mixed factors as predictors of MS. Similarly, a meta-analysis study across five continents of the world documented that despite additional influences unique to PLHIVs populations further to rise their vulnerability to MS lifestyle or behavioral risk factors contribute to MS (15). Although the occurrence of MS may differ by various non-modifiable factors, the studies showed that other modifiable risks vary within and between populations. Particularly, the SSA region shared many common modifiable and non-modifiable factors of MS (6, 14). Ethiopia, a developing country with fast economic growth, is facing a rapid growth of NCDs and allied mortality. The identification and prevention of common risk factors are the best means in Ethiopia. Despite; the significance of knowing

predictors of MS in PLHIVs for prevention of NCDs, there is a limitation in the literature in the study area contexts using the case-control approach (10, 14).

Furthermore, as noted before, early deaths from NCDs are largely avoidable by modifying individual behavior towards the four big lifestyle-related factors (20-22). Nevertheless, behavioral modification requires the popularity of the sociocultural contexts influencing the individual behavioral decisions that it often plays an important role in determining how MS and its risk factors are interpreted or managed by individuals (27). To enhance this, the PEN-3 model offers a sociocultural lens (23, 28, 57).

Despite this significance, there is no study assessing how the Gedeo zone PLHIVs residents' sociocultural contexts determine their relationship to in form on MS risks. Besides, most of the few studies attained MS quantitatively in Ethiopia (18, 40-42). This phenomenological study aimed to examine how sociocultural contexts form the knowledge, attitudes, and practices (KAP) of the study PLHIVs' toward MS risks. It is anticipated that this question will yield an expression of told, and accepted personal health behaviors that pave a better understanding of the role of sociocultural contexts in health behaviors related to MS risks. MS is a long-lasting health problem(8). The full impact of MS occurs in many years in the future (37).

Therefore, this dissertation sought to estimate and compare the magnitude of overall MS among ART exposed and naïve, assessing the predictor's of MS, and understand the role of sociocultural contexts on framing individual behavior towards lifestyle risk, using the PEN-3 model as a theoretical background and the KAP as a conceptual framework, and then plug the gap in the existing literature.

1.3. The rationale of the study

Most of the reviewed studies were inconsistent and often focused on the overall magnitude of MS among all PLHIVs. Much of these studies were produced from outside Ethiopia(45, 46, 53-55, 58-61), and having few from the SSA region (8, 40, 42), including Ethiopia (18, 40-42). What is unknown is the magnitude among all HIV-infected PLHIVs in the Gedeo zone, and its difference among ART exposed and ART naïve PLHIVs in this zone.

Besides, from the previous studies work, it can be seen that there existed little knowledge concerning factors associated with MS among PLHIVs in Ethiopia. This is borne out by the quantitative cross-sectional approaches using a smaller sample size (18, 40-42). However, what predicts MS occurrences and which of these factors were certainly modifiable and not modifiable using a case control study approaches among the PLHIVs in the Gedeo zone remains rare.

Furthermore, although the available studies have addressed MS among HIV infected Ethiopian people quantitatively, however, none of these researchers used qualitative approaches complemented with theory(18, 40-42). This study was aimed to address the gap in knowledge from a socio-cultural context using theory to attain a better understanding of the knowledge, attitude, and practices (KAP) of HIV-infected Ethiopians in regards to MS and its lifestyle risks. The PEN-3 model was the theoretical basis for this study. The application of the PEN-3 model to other research (cancer, diabetes, malaria, smoking cessation, etc) demonstrated its use as lenses for gaining an understanding of public health concerns facing underrepresented and/ or vulnerable segments of the population, like PLHIVs from the resource-constrained country of Ethiopia. In studies done by Ka'opua, 2008(62) and James, 2004(63) we found support for combining the PEN-3 Model as the theoretical framework with KAP as the conceptual framework. What was not known was the role of the family, extended family, and neighborhood in enabling or nurturing the prevailing practice, knowledge, and attitudinal positions toward MS and its lifestyle risks. Another unknown was the socio-cultural appropriateness of what is socioculturally known about MS and its risks among PLHIVs' What is socio-culturally acceptable and what is not about knowledge and prevention of MS risks?

Therefore, the results obtained could provide the following significances:

- The finding perhaps useful for clinicians to track the likely risks early and manage MS and reduce its long-term complications.
- Also, it provides insights into the factors that contribute to developing MS in HIV-infected peoples and recognize the area of focus of intervention programs definite to reduce MS occurrence and prevent NCDs while on ART. These could minimize the risk for NCDs, reduce patients' medical costs, and health care expenditure in general, thereby promoting

positive social change by improving the quality of life of these groups of HIV infected individuals.

- Finding of some responses to why individuals know comparatively little regarding MS risks and have not adopted attitudes and practices that counteract the effects of it can give an intuition for growth of socio-culturally suitable actions that can boost the knowledge held in between the PLHIVs to higher levels where applicable attitudes, dietary, physical activity and other substance use habits related practices can be broadly encouraged at all levels within community or society.
- As the study topic is a principal research urgency area, the result will also be essential for any interested researcher to use the finding as a springboard for further exploration of knowledge about the study contexts.

2. Literature review

2.1. Overview of Non-communicable diseases (NCDs)

As per the WHO Global Health Observatory (GHO) data report, of 56.9 million global deaths in 2016, 40.5 million, or 71%, were due to Non-Communicable Diseases (NCDs). Among the four leading NCDs, Cardiovascular Diseases (CVDs) cause (17.9 million deaths, or 44% of all NCD deaths), and Diabetes caused 1.6 million deaths (33). The burden of these diseases is rising disproportionately across countries, in 2016, over 3/4th of NCD deaths, 31.3 happenings in low and middle-income countries(33). In Ethiopia, NCDs account for 52% of the total mortality, in 2016(64).

Several sub-Saharan African (SSA) countries face a combined threat of communicable disease (CDs) and NCDs. NCDs are start to rank on a par with CDs in countries where per capita health expenditures still handicapped. In countries where per capita health expenditures are set at levels high enough to adequately CDs, properly finance adequate intervention for those who have or are developing MS will place an extra pressure on resources(37). Resources are tense because in addition to attacking CDs. This is because; in some cases the treatment lasts lifelong. For some, these costs pose an extreme personal suffering and a massive financial burden on countries (37).

As a result, there is growing recognition of NCDs as a worldwide challenge with a range of commitments made in recent years,(35), including the flagship UN high-level meeting conducted in 2011 recognizing the diseases as societal and economic threats that need to be high on development agenda (65). There are also regional commitments, such as the Brazzaville (7) and Lawanda declarations in the African continent (66). WHO, 2013 developed an action plan to translate these commitments into action(67). This action plan for prevention and control of NCDs for 2013-2020 emphasizes addressing population-based risk factors and the integrated management of NCDs at the primary healthcare level (67). As member state of the WHO, Ethiopia accepted the international strategy and established the national NCD strategy for 2014-2016 (68), which is now being updated(35).

Ethiopia has a large and diverse burden of NCDs risk factors, which may vary by socioeconomic factors. There is a high burden of common NCDs. There is also a high burden of

other NCDs, which requires increased attention. NCDs' services and their utilization are limited in Ethiopia. Only 54% of all health facilities are ready to provide general NCD health services. The diseases have a dramatic impact on out-of-pocket expenditures (OOP); which accounts for 23% of total OOP expenditures. Despite the large burden of disease (approximately half of morbidity and mortality) and economic impact comprised by NCDs, the National Health Account demonstrates that only 15% of total health expenditure is currently allocated to NCDs. There are proven interventions that can address these NCDs. These interventions would require integration into existing services. However, resources may still be limited. NCD policies are emerging in Ethiopia, however available data on NCDs is still poor(34). Hence, this dissertation was aimed at collecting of primary data on a constellation of NCDs risk marker known as Metabolic syndrome (MS). The paragraph below presents different criteria to define MS.

2.2. Definition of metabolic syndrome (MS)

The metabolic syndrome (MS) refers to the co-occurrence of several known cardiovascular risk factors(69). It is usually diagnosed with a cluster of metabolic abnormalities such as hypertension, central obesity, insulin resistance, and atherogenic dyslipidemia (8, 15, 43, 70). Also, it is labeled as 'insulin resistance syndrome', 'syndrome X', 'hypertriglyceridemia and waist'(13), which are interrelated and share underlying mediators, mechanisms, and pathways(69), which are increasingly being recognized as an important CVD risk factor(13). The diabetes consultation group of the World Health Organization created the first internationally recognized definition of MS in 1998. They defined MS as the presence of insulin resistance (impaired fasting glucose, impaired glucose tolerance, or type 2 diabetes mellitus) in addition to two of the following risk factors: obesity (waist-hip ratio or body mass index), hyperlipidemia (hypertriglyceridemia, low high-density lipoprotein cholesterol), hypertension, or microalbuminuria(71). Beginning with the initial description of MS, numerous duplications of this description have been proposed (8, 15, 43, 70, 72). Since then, MS has been reported from all countries around the globe through varying prevalence rates(71). The four most commonly used definitions are released from the International Diabetes Federation (IDF), National Cholesterol Educational Guidelines (NCEP), the World Health Organization (WHO), and the European Group for the Study of Insulin Resistance (EGIR) (12, 17, 18, 42, 71, 73). The table below indicated the detailed features of each criterion. Of the listed criterion, the NCEP ATP III

(2005 revision) (17) was used to define the outcome of interest for the first and second papers in this dissertation (Table 1).

Table 1; the Work definitions for overall MS and MS traits, applied on the study among PLHIVs, Gedeo-Zone, Southern Ethiopia, 2019

S. N		NCEP III (2005 revision)(18)	ATP (2005 (71)	WHO (1998) (71)	EGIR (1999)(69)	IDF (2006 revision)(18)
1	Mandatory criteria(absolutely require)	None		Insulin resistance* (IGT, IFG, T2D or other evidence of IR)	Insulin resistance defined as the top 25% of the fasting insulin values among no diabetic individuals	Waist circumference* with ethnicity-specific values ≥ 94 cm (male), ≥ 80 cm (female)
2	Criteria	Any three of the five criteria below		Insulin resistance or diabetes, plus two of the five criteria below	At least two of the following:	At least two of the following:
3	Central obesity	Waist circumference ≥ 102 cm or 40 inches (male), ≥ 88 cm or 35 inches (female) or BMI ≥ 30 kg/m ²		Waist/hip ratio: >0.90 (M), >0.85 (F); or BMI >30 kg/m ²	Waist circumference ≥ 94 cm (male), ≥ 80 cm (female)	See mandatory criteria
4	Hyperglycemia	Fasting plasma glucose ≥ 6.1 mmol/L (≥ 110 mg/dl)		Fasting plasma glucose ≥ 6.1 mmol/L	Insulin resistance already required	Raised fasting plasma glucose: >100 mg/dL (5.6 mmol/L), or previously diagnosed

Type 2 DM					
5	Dyslipidemia	TGL $\geq$ 150 mg/dl or Rx or HDL cholesterol: $\leq$ 40 mg/dl (M), $\leq$ 50 mg/dl (F); or medication	TG $\geq$ 2.0 mmol/L and/or HDL-C $<$ 1.0 mmol/L or treated for dyslipidemia	TGL $\geq$ 177 mg/dl or HDL-C $<$ 39 mg/dl	TG $\geq$ 150 mg/dL (1.7 mmol/L), or specific treatment for this lipid abnormality OR HDL-C $<$ 40 mg/dL (1.03 mmol/L) in males, $<$ 50 mg/dL (1.29 mmol/L) in females, or specific treatment for this lipid abnormality
4	Hypertension	$\geq$ 130mmHg systolic or $\geq$ 85 mmHg diastolic or antihypertensive medication	$\geq$ 140/90 mmHg or antihypertensive medication	$\geq$ 140/90 mmHg	Systolic BP $\geq$ 130 OR diastolic BP $\geq$ 85 mmHg, or treatment of previously diagnosed hypertension

2.3. Epidemiology of metabolic syndrome (MS)

2.3.1. Literature searching strategies

The current review aimed to identify works of literature that were conducted across the globe on the overall magnitude, and factors associated with metabolic syndrome among people living with HIV. A comprehensive electronic search on most vital databases like,— Hinari Access to Research for Health program using the country login code, PubMed (NLM), MEDLINE, Africa-Wide Information, Academic Search Premier, and Google scholar, using the subsequent searching terms "Metabolic syndrome OR syndrome X OR insulin resistance syndrome", and "Human Immunodeficiency Virus OR Acquired Immune Deficiency Syndrome Virus OR AIDS Virus OR HIV OR HIV Seropositivities OR Seropositivity, HIV "Human Immune deficiency Virus", enhanced with with 'key and 'MeSH' terms and Boolean operators words (AND / OR / NOT) were wont to retrieve any studies (cross-sectional, case-control, cohort studies, and randomized control trials) among adults (18+) published materials in between 1998 - 2020, and written in English. The magnitude and predictors of MS and its traits in PLHIVs with

or without ART populations were considered for inclusion. Later, EndNote X6 was used to handle data.

2.3.2. Characteristics of included studies

A total of 45 studies were included for the review. Of which, more than half of studies (22) were reported on the overall MS magnitude among PLHIVs, regardless of the ART status of the participants (8, 16, 39, 41, 42, 46, 53, 55, 58, 59, 61, 74-80); 17 studies have designated the magnitude supported the ART exposed individuals (15, 17, 18, 42, 45, 48, 53, 54, 81, 82), and just one study was explicitly presented the comparative effects of MS magnitude among ART exposed and ART naïve groups (18). Furthermore, of the six studies seen the comparative effect of MS estimates using HIV positive and HIV negative (uninfected) individuals as a control (8, 46, 58, 75, 81, 83), only two studies were determined the magnitude of MS simultaneously and compared its effect among ART exposed, ART naïve and HIV negative controls (58, 81).

All studies included under review were represented by five continents. The study breaks from the five continents were as follows: intercontinental: 2(15, 84), America 7 (North 4 (45, 53-55) and South 3(17, 80, 85)), Europe: 7(39, 77-79, 81, 86, 87), Asia: 5(46, 58-61), and Africa: (18, 40-42, 74). With regards to studies distribution by continent: America (North & South), Europe, Asia, and Africa(15) and USA, Europe, Australia, Asia, and South America (84) were the countries involved on producing data for the studies found from the above continents, respectively. On the other hands, of the seven studies found from North and South America (17, 45, 53-55, 80, 85), while half of the studies (4) have emerged from North America (USA) (45, 53-55), the remaining three studies were identified from the southern part, specifically from Brazil(17, 80, 85). As well, out of the seven studies produced in Europe(39, 77-79, 81, 86, 87), two of the studies came from Portugal (39, 86) and the rest five studies, each has come from Poland(79), Spain(77), Switzerland(78), Italy(81), and France (87). Correspondingly, of the five studies from Asia(46, 58-61), three studies were from India(58-60), one was in Taiwan(61) and Thailand(46), respectively.

Categories with the region for about the 23 studies of Africa (18, 40-42, 47, 74, 88), were as follows: totally from Africa, 1(16); SSA, 1(8); Southern Africa, 4(47, 48, 83, 88), West Africa, 9 (52, 75, 76, 82, 89-93); and Eastern Africa, 8(18, 40-42, 74). The distribution of studies by countries seemed as: one was in Africa (16) and SSA (8), South Africa, 4(47, 48, 83, 88), Burkina Faso, 2(89, 90); Nigeria, 2(82, 91); Ghana, 1(92): Cameroon,2(52, 75); Cote d'Ivoire,

1(76), Tanzania, 1(94), Kenya, 1(44), Benin, 1(93), Uganda, 1(74) and six studies from Ethiopia(10, 14, 18, 40-42).

As to the approaches employed, while 4 studies (8, 15, 16, 47) were used secondary data sources, the remaining were used a primary data sources (18, 40-42, 74). The highest numbers of the primary studies were cross-sectionally designed (18, 40-42, 52, 61, 74-76, 87) with 2 prospective cohorts(76, 88), narrative review(16, 47), 2 Meta studies(8, 15), 2 randomized control trials(45, 54), and one case-control study(58). Among the 38 studies designated the study sites, 36 of them were reported to be fully hospital or clinic-based (18, 40-42, 74), one was purely community-based (53) and one considered both sites (84). Quite half of the studies were indicated the data collection period, of which, 19 studies were collected data before or during 2015, (15, 53-55, 58, 87, 92), just one study was collected within the latest time of 2016(40).

In reference to the publication period, while 5 of the included studies were published between 2006-2009 (77, 78, 84, 87, 93), the greatest number, 18 and 16 studies correspondingly, were reported to be published in between 2010-2014(17, 52, 53, 60, 61, 75), and 2015–2016 (8, 16, 47, 58, 76), and the rest six studies were published recently within 2017-2020 period of time (8, 10, 14, 16, 44, 94). The studies were considered, a minimum of 68 (in India)(60) and a maximum of 2247 (in the USA) (54) number of study subjects, with most of the samples, were mixed in their sexes (i.e. Men and women).

Moreover, 22 of the studies were reported to be used different standard criteria to ascertain the outcome of interest (MS) (17, 54, 60, 61), however, the rest were did not indicate the method used. Eight studies were used a single set of criteria; with 7 of them frequently used the National Cholesterol Education Program-Adult Treatment Panel III criteria (NCEP-ATP III) of various years (2001-2005) (41, 54, 55, 58, 59, 61, 87), and one study employed the IDF criteria (80). Fourteen studies were used a mixed set of criteria; the NCEP-ATP III (2001-2005), International Diabetes Federation (IDF)-2005, and Joint Interim Statement (JIS)-2009 criteria were used in each of the three studies(16, 48, 91), but, the NCEP-ATP III(2001-2005) and IDF-2005 were utilized in eight studies each (18, 42, 60, 83-86, 89). Furthermore, in three studies, each reported the subsequent combinations: the NCEP-ATPIII (2001-2005), IDF-2005, JIS-2009 and the European Group for the study of Insulin Resistance (EGIR)(15), and the NCEP-ATP III(2001-2005), IDF-2005 and American Heart Association/National Heart Lung and Blood

Institute criteria (AHA/NHLBI) (17), and NCEP-ATP III(2001-2005), IDF, and the WHO criteria (8).

2.3.3. Magnitude of overall MS

The overall MS burdens among PLHIVs within the globe, regardless of the standards criteria utilized and ART status, breakdown across continents were as follows: America, 30-46.9%(17, 45, 53-55, 80, 85); Europe: 15.8-58.8% (39, 77-79, 81, 86, 87), Asia: 20-49.6%(46, 58-61), and Africa, 13% - 58% (18, 40-42, 47, 50, 88). The highest reported in Europe (58.8%)(39) (in Portugal) to the lowest in Africa (13%)(16). The distributions on the prevalence of MS estimates by countries were also as follows: USA, 30-33%(45, 53-55), Brazil, 49.9%(17, 80, 85); Portugal, 22-58.8%(39); Switzerland, 20%(78); Spain, 15.8%(77); India 20-49.6%(58-60); Thailand, 22.2%(46); Taiwan, 26.2%(61); SSA region, 13%-58%(8, 16); Cote d'Ivoire, 14.4%(76); Cameroon, 15.6%(52, 75); Uganda, 58%(74), and Ethiopia 21.1-24.3%(18, 40-42).

Correspondingly, the prevalence estimates of MS among PLHIVs with or without ART, regardless of the standard criteria used by the studies breakdown across continents were look like this: Worldwide, (18.4% ART exposed vs. 11.8% ART naïve)(15, 84); America, ((37%-65.7%) ART exposed Vs (20%-34.3%) ART naïve)(17, 45, 53-55, 80, 85); Europe, (19.4% ART exposed Vs. 13.8% ART naïve)(39, 77-79, 81, 86, 87); Asia, (24.9% ART exposed Vs. 15.9% ART-naïve) (46, 58-61); and Africa, (18.1%-49.6%) ART exposed Vs. (9.0%-40%) ART naïve) (18, 40-42). Based on this, the extent of MS estimates ranged from the highest observed in (America(in Brazil) (65.7% ART exposed) (17) and Africa (in South African)(40% ART naïve) (47)) to the lowest in (Africa (in Ethiopia)(18.1% ART exposed)(18) and (in Nigeria)(9.0% ART naïve)(82)), PLHIVs.

Despite the criteria employed by each of the included studies in this review, the distributions of burden of MS estimates for the two comparative groups by countries were as follows: Worldwide, (ART exposed 18.4% vs. ART naïve 11.8%)(15); USA (after 3 years on ART 8.5 Per 100 person-years Vs. 20% at ART initiation) (54); USA (37% after 96 weeks of ART initiation vs. 20% at ART imitation) (45), and Brazil, (ART exposed 65.7% Vs. ART naïve 34.3%)(17); Italy, (ART exposed 19.4% Vs. ART naïve 13.8%)(81); Thailand (on ART 24.9% Vs. ART naïve 15.9%)(46); South Africa, (ART exposed (23.7-49.6%) Vs. ART naïve (32.6%-40%))(47, 48); Nigeria, (ART exposed 21.0%; ART naïve 9.0%)(82), and Ethiopia, (ART exposed 18.1%-25% Vs. ART naïve 15.6%-22.5%)(10, 14, 18, 40-42).

The prevalence ranges across the criteria were 7.3% - 58.0 % (by NCEP-ATPIII 2001-2005) (8, 15, 17, 18, 48, 60), 11.2% - 46.9% (by IDF 2005) (8, 40, 92), and 21% - 31.3% (by other criteria like: JIS, EGIR, WHO, and AHA/NHLBI) (15, 17, 40, 48, 91, 92). Of all criteria used by the majority of the studies in the review, the estimated magnitude of MS was greater based on the NCEP-ATPIII 2001-2005 criteria (58%) (In Uganda)(74). The magnitude of MS was shown differences as per the criteria used among PLHIVs with or without ART. For instance, within the ART exposed subjects, MS was assumed a ranges of 18.1–25.7% (by NCEP-ATPIII 2001-2005) (15, 18, 48); 25–25.7% (by IDF 2005) (18, 48) and 24.1–31.0% (by JIS)(48). In the ART-naive individuals, the estimates was similarly assumed a ranges of 11.8–32.6% (by NCEP-ATPIII 2001-2005) (15, 18, 48, 89); 22.5–32.6% (by IDF) (18, 48), and 21–48.6% (by JIS) (48). The highest estimates reported by JIS 27.6 (24.1–31.0) and 34.8% (21–48.6) (in South Africa) (48) criteria and the lowest by NCEP-ATPIII 2001-2005 (25.7 (22.4–29.1)) and IDF-2005 (32.6% (19.1–46.2)) (in South Africa) (48) criteria, to those corresponding groups.

2.3.5. Predictors of metabolic syndrome

1) Mechanisms of MS occurrence among PLHIVs

The exact mechanism for the occurrence of MS is not well known; however, recent literature thought that it is to be the result of a complex interplay between environmental and genetic factors (50, 51, 95, 96). The situation among PLHIVs, although not well predicted it was reported to be attributed to the interaction between HIV infection and ART exposure (8, 9, 97).

Evidences shown that MS begins early in the course of HIV infection (11, 12). It is associated with deregulated inflammatory response, through suppressing genes necessary to extinguish inflammation (50, 51, 95, 96). This long-term inflammatory environment along with higher white blood cell count acts as a metabolic risks in the pathogenesis of HIV infection.

While obesity is initial events and a central component of MS, Adipose tissue in the abdomen is known to be metabolically active and produce a variety of cytokines –adipocytokines comprised of: glycerol, Free Fatty Acids (FFA), pro-inflammatory mediators (Tumor Necrosis Factor Alpha (TNF α) and Interleukin-6 (IL-6)), Plasminogen Activator Inhibitor-1 (PAI-1), and C-Reactive Protein (CRP). These increased production of free fatty acids, inflammatory cytokines, and adipokines and mitochondrial dysfunction in turn contributed to

impaired insulin signaling, decreased skeletal muscle glucose uptake, increased hepatic gluconeogenesis, and β cell dysfunction, leading to hyperglycemia(9, 13). The insulin resistance also leads to the development of hypertension by impairing vasodilation induced by nitric oxide. (11, 13, 50, 51, 95, 96).

Furthermore, the mechanisms of MS in regard with ART exposure; however, it was not entirely clear, but different hypotheses had been proposed to explain the pathogenesis. Mainly, the mitochondrial dysfunction, oxidative stress, altered adipogenesis, and differentiations were reported to be mostly associated with the development of every cluster of MS (specifically, impaired glucose transport, altered expression of lipid metabolism genes, and impaired lipolysis), where they too appear following exposure to ART drug regimen were supposed to be the reason (49-51).

2) The socioeconomic and demographic factors

a) Sex / Gender

Without taking the criteria into account, studies under review were notified that the prevalence of MS varies across sex groups; however, the differences seen were not invariably significant among studies. The majority of studies were agreed on the presence of a significantly higher magnitude among females (15, 41, 48). In different from the above concepts, studies besides agreed that the prevalence of MS within the sex groups were different across criteria. For example, in study across five continents revealed that the magnitude of MS in men and women were look like this: ATP III 2001: 14.6% (95%CI: 11.5–18.1) and 17.5% (95%CI: 14.0–21.2); ATP III 2004–2005: 23.7% (95%CI: 19.0–28.7) and 26.7% (95%CI: 20.8–33.0); and IDF 2005: 13.4% (95%CI: 8.7–18.9) and 23.2% (95%CI: 15.9–31.4) (15). Different studies from SSA (8), Brazil(17), and Thailand were also revealed sex as a predictor of MS (61).

b) Age

Diffrent litreatures were reported that age is an independent risk factor associated with the increase in MS prevalence among PLHIVs. For instance, study across five continents designates, irrespective of the criteria employed the MS prevalence varied significantly by participant age; older (median age > 41 years old) compared with younger participants ($\leq$ 41) had a higher prevalence of MS ATP III-2001: 19.7% vs. 13.2%, ATIII 2004–2005: 26.6% vs. 21.5%, and IDF-2005: 22.3% vs. 16.4%)(15). The proportion of MS was increasing in those over

50 years of age, as proven in a study in the USA (53). Similarly, a marked disturbance in the MS with aging has also been reported by several epidemiological studies done worldwide (15, 18, 42, 46, 50, 61, 98-100). Correlated with this, a study from Brazil (17), Portugal (39, 86), and Spain (77) were as well uncovered this condition. Strengthening this situation, a study from Poland (79) and South Africa (83) were revealed that age was predictors of MS. Above all, studies from Thailand, age ≥ 35 (61), Cote d'Ivoire (age > 42 years) (76), Burkina Faso (age > 42 years) (90), Ethiopia (age ≥ 45 years) (18), Uganda and Ethiopia (age > 40 years old) (42, 74), respectively were shown to be age was significantly associated with MS occurrence. In the reverse, Boshu, et al. 2018 (40), Livia D. Akl et al. 2017 (80), Tesfaye et al. 2014 (18), and Kaduk et al 2012 (101), were reported that age is not an independent predictor of MS.

c) Place of resident

Studies consistently describe the presented difference in the magnitude of MS based on their area of residence. For example, in a study from South Africa, MS prevalence more common in those rural populations exposed to HAART than its counterpart group of the population; and the observed difference was statistically significant (99). As well, significantly higher MS among ART naïve groups living outside Bangkok (rural area), as it was demonstrated in a study in Thailand (46).

d) Education

Education is a significant predictor of MS occurrences, as reported by different literature across the world. In this regard, for instance, a study from Ethiopia revealed that those who were not enrolled informal education were less likely to have MS (AOR = 0.252, 95% CI 0.072–0.879) (40). Another study from Ethiopia in the Harar region reveals education is a significant predictor of MS (10). The study reported that not enrolled in formal education and lack of formal education a protective factor associated with metabolic syndrome. These reports were correspondingly aligned with the studies from Kenya (Kiama, 2018 and Kaduk, 2012) (44, 101). For instance, as Kagaruki, 2015, (94) study from Tanzania shared, metabolic syndrome was significantly greater with a higher level of education. On top of that, a study from Kenya revealed that a lack of formal education (AOR = 5.20, P = 0.002) is associated with the odds of MS (44).

e) Occupations

Of the reviewed studies, Mashinya, et al. 2015 (99) reports from Ethiopia disclosed the existed significant association between occupation and metabolic syndrome among PLHIVs.

f) Income

Literature prevailed that income is associated with the occurrence of MS among PLHIVs. However, against the above concepts, a crosssectional study was done in St.Paul's Hospital, in Ethiopia(102) disclosed the lack of association between income and metabolic syndrome among all adult HIV infected individuals. On the other hands, a cross-sectional study conducted on people living with HIV/AIDS (PLWHA) in Jimma health centre, in the south west Oromia, Ethiopia among 286 PLHIVs by Besho, 2018 revealed that monthly income level above 2501 ETB (COR = 4.141, 95% CI 1.007–17.02) was associated with MS.

3) HIV/AIDS-associated factors

a. ART exposure state

Overall studies included under the review reveal exposure to ART, irrespective of the criteria used, and impacts of other factors were found to be a risk factor for an increase in MS prevalence(15, 18, 58, 77, 81, 82, 92). In this regards, for example, a meta-study did use (n=65 studies, n=5094 PLHIVs aged 17–73 years) across five shown that the MS prevalence, at 18.4% (95% CI: 15.9–21.1) in the ART exposed, was significantly higher ($p = 0.001$) than in the ART-naïve (11.8%, 95%CI: 9.3–14.7)(15). Consistently, studies from Italy (81), Spain(77), India (58), Thailand(46), Ghana (92), Burkina Faso(90), and Nigeria(82) were also affirmed the existed significant difference in magnitude of MS in between ART exposed and ART naïve individual PLHIVs. Furthermore, a study from the southern region of Ethiopia done among (n=374 PLHIVs, n=188 ART exposed, and n=186 ART naïve) concluded that almost a quarter of HIV patients on ART developed MS (18).

Contrary to the above concept, some other studies were argued that there are no significant differences between ART exposed and ART naïve subjects (45, 52, 58, 59, 81, 91). In this regard, for instance, an AIDS Clinical Trials Group Longitudinal Linked Randomized Trials study from the USA, conducted among ART-naïve HIV-infected individuals-cohort demonstrated that one in 5 ART-naïve subjects diagnosed with MS at ART initiation. Although

more than half of these individuals continued to have MS after 96 weeks of ART, 37% with MS at ART initiation no longer had MS(45). A cross-sectional study in Italy, conducted among (n=108 HIV-infected subjects without known cardiovascular risk factors: n=72 on HAART (group A) and n=36 a naive group (group B), and n= 224 healthy controls (group C)) shown that MS was more frequent in HIV-positive subjects than in controls (for groups A, B, and C; $P<0.001$), with no significant difference between HAART and naive (81). A case-control study in India initiated among (n=300 PLHIVs with or without ART, and n=300 HIV-negative controls) besides noted that the incidence of MS among the PLHIVs was significantly higher than the controls groups, with a significant variation among ART-naive groups (58). Correlating with this, another study from India(59), and Nigeria (91) were also reported the same. In supporting this, a cross-sectional community-based study in South Africa among (n=300 newly diagnosed PLHIVs and n=300 uninfected controls) reveals, the absence of difference in the prevalence of MS between the two groups (83). Furthermore, a cross-sectional study in Cameroon among (n=96 healthy (controls) compared to n=108 ART naïve Cameroonian PLHIVs) besides explained that ART-naive subjects exhibited a twice-higher magnitude of MS than controls (47% vs. 21%; $P = 0.02$). Overall, the above studies demonstrated that it is not exposure to ART predispose individual PLHIVs to have developed MS, rather indicates the HIV infection per se is a risk factor that leads these subjects to have developed the syndrome (45, 52, 58, 59, 81, 91).

b. ART exposure state and type of criteria used

Studies were also agreed with the presence of a significant association between the standard criteria used to diagnose MS prevalence among ART exposed and ART naïve individual PLHIVs (15, 18, 42, 91). With this respect, a study conducted across countries from five continents noted that the (ATPIII 2001) was the commonly used criterion, and based on this criterion MS magnitude in the ART-exposed was significantly above within the ART-naïve. Analogously, a study from Nigeria (91), in Ethiopia by Hirgo, et al (42) and Tesfaye, et al (18) were also reported that the prevalence of MS varied with the criteria used.

On the other hands, the same study done across five continents was pinpointed that using the (IDF 2005) criteria, MS magnitude was greater in the ART-exposed than ART-naïve however this variation was not significant; it was similarly based on the (ATPIII 2004–2005) criteria(15). Further, this study indicated that the MS magnitude was similar in the ART-exposed ($p = 0.730$) but significantly different in the ART-naïve by the different criteria (15). However, a

study from Ethiopia contradicted that using the ATP criteria alone, ART exposure was significantly associated with higher odds of MS (18). Apart from the above arguments, a study from Brazil concluded that there were no statistically significant associations on MS prevalence based on the different criteria used (17).

c. Duration since diagnosed with HIV infection and duration on ART

Regardless of the criteria used, studies were likewise found that the duration since diagnosed with HIV infection alone and or in combination with the duration since exposed to ART are risk factors for increased MS prevalence(15, 40, 41, 88, 89). With this respect, for instance, a study did worldwide across five continents reveals, the prevalence of MS significantly differed by the duration of HIV infection (with median cut-off point 68 months) (15). Studies from South Africa as well noted that a longer duration of diagnosed with HIV infection (all $p \leq 0.003$) was a predictor of MS (48, 88). An inline, study from Burkina Faso, duration exposure to ART longer in patients with MS (89). On top of, studies from Ethiopia point out that patients who received ART for more than 5 years have 15.6% higher odds of having MS than those below 5 year(40). In another study in the same area besides reported that taking the ART for more than 12 months (AOR=4.2; 95% CI=1.24-14.23) was independently associated with MS (41). On the contrary, a study from across five continents revealed that using (a cut-off point of 27 months) for the average lengths of ART exposure, MS was not significantly different for longer or shorter treatment duration(15); meanwhile disclosed that duration on ART was not a risk factor MS prevalence.

d. ART regimen

As well, the reviewed studies have shown that having controlled the effect of other factors, either of the 1st line (2-NRTI+NNRTI), 2nd line (2-NRTI+PI), and 3rd line ART regimens (2-PI+2-NRTI) correlates with the difference in MS prevalence. However, the relationships were not invariably significant (15, 18, 48, 58, 61, 78). Regarding first-line ART (2-NRTI+NNRTI) regimens, while few studies disclosed the NRTI-based regimens association with MS presence (15, 58, 61, 78), only one study was shown the link between NNRTI based regimen and MS(48). However, there were no consistencies among studies about the link between that regimen and MS (15, 48, 58, 61, 78). For instance, a study from across continents revealed that in studies with a great percentage of subjects on NRTI (median>77.0%), the MS

prevalence was 17.9% (95%CI: 9.4–28.7) compared to 22.8% (95%CI: 14.3–32.7) in studies with fewer individuals on NRTIs ($p = 0.474$)(15). Besides, a study from Taiwan explained that exposure to NRTI(s) for ≥ 6 years was significantly associated with the presence of MS (61), and the study meanwhile verifies the synergetic effects of duration on that regimens. Correspondingly, a study from Switzerland, Stavudine (d4T) based first-line regimens exposure associated with MS presence (78). This was consistent with a study from India(58), and Ethiopia; taking 1st line regimen containing (d4T-3TC-EFV) was significantly associated with higher odds of MS(18). Furthermore, specific to NNRTIs based first-line regimens, the MS contained by the two NNRTI subgroups, classified using the average percentage of individuals with it (43.4%), as the cut-off value to determine a high and low proportion of users was significantly varied by the various MS criteria (all $p=0.007$), as demonstrated a study from across continents(15). On the other hand, a study from South Africa noted that MS was always higher in ART users not receiving 1st-line regimens (all $p \leq 0.039$) (48).

Concerning the 2nd line regimen, while certain studies demonstrated the presented significant relationship with the PI-based regimens and MS occurrences (15, 48, 58, 61, 78, 84, 90), only one study was described against it(80). For example, a study from across continents revealed that the prevalence of MS differed across studies of PI users and in those with fewer median participants on PIs (15). It was more common in the PIs ($P= 0.04$) users, as verified in an international study conducted across countries of the USA, Europe, Australia, Asia, and South America (84).

Correlating with this concept, a study from different continents, such as Switzerland, (78), India(58), and Taiwan, and Burkina Faso (90), were also disclosed that the use of PIs based regimen was significantly related to MS presence. Furthermore, while a study from Taiwan uncovered that exposure to PI for ≥ 3 years was significantly associated with MS (61), a study from South Africa was justified that all ART users other than 1st-line based regimens were at risk of developing MS (48). On the contrary, there was no association between PI use and MS, as it has been reported in a study in Brazil (80). In different from the stated regimens, a recent study from the Oromia region of Ethiopia reveals facts on the third line regimens that the odds of having MS were increased by 15.9% among patients treated with D-drugs, however, the difference was not statistically significant (40).

e. HIV disease staging

The severity of disease indicators comprised of HIV RNA level, CD4 count, and WHO-staging. Studies considered under this review revealed an inconsistent association between those factors and MS occurrences. For instance, a study done across five continents revealed that the prevalence of MS was varied significantly with CD4 count levels (15). It was similar to the studies from the USA (53, 54) and Taiwan by Wu PY.et.al (2012) study (61).

Corresponding findings among (n= 500 patients, n=315 HAART-naïve patients, and n=185 ART-experienced patients from northeastern Nigeria show the existed positive association between different MS traits and CD4 count (200 cells/ μ L) (50). Supplementing the above concept, another study from Nigeria by Aydole et al (91) and Cameroon reveals, the CD4 count levels (CD4 count from 246.2 ± 166.5 to 437.2 ± 274.6) have a significant relation with MS(100). On the other hand, a study from South Africa was stated that CD4 count and HIV-1 RNA levels did not predict MS (88). Though not statistically significant, the CD4 cell count levels of respondents (CD4 < 350 cells/ μ L) have a link with MS traits, mainly dyslipidemia, as per the study report in Cameroon (98). With regards to HIV-confections associated factors, while Pefura Yone EW. Et al (2011) study uncovered that co-infection with tuberculosis(TB-HIV co-infection) was significantly associated with raised components of MS, principally of dyslipidemia(100). In the reverse, a study from Nigeria was signified, the TB-HIV co-infection was not significantly associated with MS(50).

4) Lifestyle / Behavioral risk factors

Behavioral risks are comprised of dietary habits, smoking and alcohol consumption, and physical activities. For instance, Westernization of lifestyle in a cohort of HIV-infected patients of Sub-Saharan origin leads to a progressive increase in the risk of MS, as demonstrated in a study in Ivory Coast (Côte d'Ivoire)(76). In Nigeria, MS correlates with lifestyle-related risk factors rather than ART-related factors (91). In a study from Cameroon, the behavioral variables smoking and alcohol consumption was linked with the very high proportion of, either of the clusters of MS (98).

a. Smoking tobacco

Studies were reported that smoking cigarettes were a risk factor associated with the variabilities of MS prevalence. In this regard, for example, in A study across five continents, the

magnitude of MS differed significantly across criteria in studies with a higher proportion of smokers ($p = 0.010$)(15). Correlating with the above theme, a study from Taiwan (61) and Cameroon (98) revealed that smoking as a direct significant predictor of MS. On the other hand, the self-reported consumption of smoking did not differ between the groups, as demonstrated in a study in the USA (55). As the same, a cross-sectional studies from Ethiopia besides noted the absence of significant association in smoking cigarette and MS occurrences (40, 103).

b. Alcohol consumption

Regarding alcohol use habits, studies were determined that it has an association with MS occurrences; however, the relationships were not statistically significant. In this respect, for example, a study from the USA by Tizzo, E et al (2015) revealed that self-reported alcohol consumption did not differ between the groups with or without MS (55). Likewise, a study from Cameroon(98) and Ethiopia pinpointed a similar report about the relationship between alcohols and MS occurrences(40). In a study from Ethiopia, alcohol use increases the risk of MS occurrences by about two-fold, but the observed variation was not statistically significant (103).

c. Diet

With regard to the relationship of dieting habits with MS, there were no consistencies among studies. For instance: in a study from the USA, the elevated high total sugar consumption was the strongest predictor and accounted for a 30% occurrence of MS (55). This study also reported that the intake of fruit, vegetables, and fiber was not significantly associated with MS occurrences among those PLHIVs (55). Similarly, in a study from Thailand, food insecurity in the ART-experienced group was a risk factor for MS occurrence (46).

d. Physical activity

Concerning physical activities, few studies were noted that it has an association with the variability of MS occurrences; however, the demonstrated differences were reported to be not significant. For instance, as Tizzo, E, et al (2015) study noted, although not statistically significant, MS was associated with less favorable physical characteristics and physical fitness levels. This corresponds with different epidemiological studies conducted in the world (55, 99, 104). On the other hand, against the above studies report a study from Ethiopia revealed that physical activity was not independent predictors' of MS (40). Similarly, several works of literature have stated the absence of association among physical activity and MS (18, 40, 84).

5) MS-traits and overall MS

a. Hypertension or elevated blood pressure

Hypertension or elevated blood pressure (BP) was one of the MS traits. It was diagnosed with the presence of elevated BP or treatment taking, as per the ATP III criteria. A published study from Brazil showed that systolic and diastolic arterial pressure were significantly associated with the presence of MS (p-value <0,05)(85) occurrences. Hypertension developed in 10.3%, as indicated in the study in Indian (60). In the SSA, it was reported to be the foremost prevalent MS trait, with diverse proportions of among PLHIVs (5.2–50.0%) with respect to the uninfected (10.0–59.0%) populations (8). Further, a study from Ghana shown that ART-exposed individuals developed MS and high blood pressure was the major trait predicting MS (92). Consistent with this condition, studies from Cameroon(52) and in Ethiopia were found elevated blood pressure as a common MS feature(40).

b. Diabetes (DM) and pre-DM agents

Diabetes and or pre-diabetic markers (such as dysglycaemia, insulin resistance, impaired fasting glucose) are the other form of MS traits, diagnosed as per the ATP III criteria. Different studies were reported that it is the risk factor associated with increased in MS prevalence among PLHIVs with or without ART. However, studies were not consistent in disclosing the significant levels of the association among the two variables (8, 18, 40, 52, 60, 80, 84, 85, 88, 93). For instance, type 2 diabetes prevalence was five-to nine-fold higher in those with elevated MS, as demonstrated in a meta study done across countries (84). A study from Brazil likewise shown that elevated fasting sugar level was related with MS occurrences (p = 0.008) (80). In another study from Brazil and Indian (60) as well reported that raised glucose was the most common MS trait significantly associated with the presence of MS (p <0,05)(85). Different studies conducted in SSA and Benin were reported similar results that elevated glucose was independently associated with MS(8, 93).

Moreover, while a study from South Africa was found the family history of diabetes as an independent predictor of MS (88). A study from Cameroon noted that the prevalence of impaired fasting glucose and diabetes were higher in ART naïve PLHIVs diagnosed with MS (52). In the contrary, a study from Ethiopia ,in Hawassa referral hospital revealed that ART exposed subjects diagnosed with MS had glucose disturbance than the ART-naive groups with MS (18).

Nevertheless, another study from Ethiopia was argued that fasting blood glucose was the less common MS trait (40).

c. Dyslipidemia

Dyslipidemia another MS traits diagnosed with the presence of elevated lipid profiles stipulated in the ATP III criteria. In this respect, as few studies from Africa pointed out that the MS prevalence varied based on the abnormal lipid profiles and the differences were reported to be significant (52, 92). For instance, in a study from Burkina Faso, dyslipidemia was reported to be the most common MS traits in ART exposed individuals (92). It was inconsistent with the study from Cameroon that it is significantly higher in ART naïve group of PLHIVs(52).

Furthermore, different studies conducted in different areas reported that regardless of the ART status and the criteria employed several lipid profiles such as: elevated Triglycerides (TGL), low-level High-density lipoprotein cholesterol (HDL_c), raised levels of Total cholesterol (TC) and Low-density lipoprotein cholesterol (LDL_c) and other lipid profiles were found to be a risk factor associated with the occurrence of MS(8, 17, 18, 40, 59, 83, 85). The paragraphs below presented reports from different literatures on the specific lipid profiles's association with MS occurrences.

i. Triglycerides

Triglycerides accounted for the highest impact on the prevalence of MS in all criteria, and was significantly associated with the increase magnitude of MS (p-value <0,05), among PLHIVs, independently of age, skin color, and ART used, as reported by studies done in Brazil, (8, 17, 59, 85). Compared to the uninfected individuals, the PLHIVs showed higher Triglycerides levels (83). Essentially, as study from Ethiopia noted, ART exposed PLHIVs diagnosed with MS had significantly elevated Triglycerides (29.9%) (18, 40).

ii. High-density lipoprotein

High-density lipoprotein was a closely linked lipid disorder associated with MS, and it appears as stronger predictive markers in HIV+ populations (85, 87). Consistently, different studies conducted in India, SSA, and Ethiopia revealed that a low level of HDL was present in 50%(59), 39.0%(8), and 49.3% (40) of subjects diagnosed with MS, respectively. In South Africa, compared to the uninfected group, the PLHIVs showed lower HDL levels, and confirmed that it is a strong predictors of MS occurrences among PLHIVs(83).

iii. Total cholesterol

Total cholesterol was the common MS trait that accounts for 35% of PLHIVs diagnosed with MS as it was reported by a study from Benin(93). It was the most frequently observed feature of MS components responsible to account 18.7% among HIV positive subjects diagnosed with MS, as demonstrated in a study in Ethiopia (40). In another study from Ethiopia, ART exposed PLHIVs having TC of at least 200mg/dl was significantly associated with the presence of MS (18). The studies as a whole confirmed that Total cholesterol is the risk factor highly associated with the elevated MS among all PLHIVs.

iv. Low-density lipoproteins

As, a study from South Africa revealed, the PLHIVs with MS have shown elevated Low-density lipoproteinscholesterol(83). Specifically, the situation had significantly higher levels in the ART exposed subjects than the Pre-ART groups diagnosed with MS occurrences (18).

d. Waist Circumferences (WC)

Studies included under this review revealed that obesity and or pre-obesity risk markers a risk factor associated with MS occurrences among men (17, 60). Regarding the relationship of raised WC and MS prevalence, for instance, a study from Brazil noted that the population attributable risk for WC explained 80% of the prevalence of MS using AHA/NHLBI definition among men (17). A study from in Indian elevated WC increased significantly among PLHIVs with MS(60).

e. Body Mass Index (BMI)

As well, the reviewed studies were agreed that BMI is a risk factor for MS occurrence (18, 60, 91, 92). In this respect, for example, a study from in Indian shown that the BMI increased significantly among PLHIVs with MS(60). The BMI was higher (BMI 25.2 vs. 22.5 kg/m², $p < 10(-3)$ with ATP III and BMI 26.6 vs. 22.4 kg/m², $p < 10(-3)$ with IDF) in patients with MS, regardless of the definition used, as reported in a study in Ghana(92) and a study from Nigeria (91). In Ethiopia, having a BMI of at least 25was significantly associated with the presence of MS (18).

f. Central Obesity

In this regard, several studies reported from different countries noted it's presented the association with the increase in the prevalence of MS (8, 39, 40, 50, 60, 90, 92). For example, a study by Neves et al. (2018) from Poland revealed that obesity and related comorbidities are the most common traits found among PLHIVs with MS(39). Total body fat and lean body mass were increased significantly among PLHIVs with MS, as demonstrated in a study in Indian(60). Correspondingly, the visceral obesity prevalence was found to be 39.0% among HIV-infected cohorts with MS (8), as it had been reported in studies in the SSA. Furthermore, a study from Nigeria (overweight/obese is a significant association with MS traits)(50); in Ghana(ART exposed individuals developed MS, which is mostly explained by abnormal body fat) (92), Overweight individual PLHIVs were reported to be 13.4 times more likely to have MS (AOR = 13.398, 95% CI 3.943–45.525), as it was verified in a study in Ethiopia (40).

Lipodystrophy either of the two (hypertrophy and lipo-atrophy) was the factor that predicts the variability's in MS among PLHIVs, as it was demonstrated in few studies. In this respect, for instance, in a study from Spain, the prevalence of MS is significantly increased in PLHIVs on ART and its presence is associated with lipodystrophy (77). Similarly, in a study from Benin, lipodystrophy ($p=0.01$) was identified as a significant predictor of MS (90).

2.4. The sociocultural contexts

2.4.1. Literature searching strategies and inclusion criteria

An electronic database engine (i.e. Medline, Google, and PubMed) was wont to search and retrieve the studies published, between 1989 and up to the top of December 2017. The subsequent were keywords used: PEN-3 model + sociocultural contexts or PEN-3 model + health or PEN-3 model + public health problems or PEN-3 cultural model+ Diseases or NCDs or Non-communicable disease (mental illness or mental disorders or cancer or carcinoma or cervical cancer or heart condition or cardiac problem or diabetes or hypertension or obesity or overweight or dyslipidemia or MS or metabolic syndrome, maternal health, CDs or disease (HIV/Aids or malaria), behavior or practice (diet or exercise or smoking or alcohol). The term PEN-3 model and Airhihenbuwa was likewise applied to broaden the search. If articles met the next criteria were involved within the review: used the PEN-3 model as a theoretical framework; reported

health outcome or health behavior data that demonstrates how the PEN-3 model was used to guide data collection and/or analysis, and presentation of results; and involved women, children, men, or communities in data collection. Studies of socio-culturally modified interventions supported the PEN-3 model were besides of specific interest. Articles that were found in books and dissertations and mainly review articles were excluded. The abstracts of all of the documents and therefore the full-text was first screened retrieved and re-screened with the author supported this; overall 45 studies were included within the review. Review Manager Version 5.3 software was applied to guide studies and references entry, data entry, analysis and reporting of the studies result. The documents that were initially arranged supported the overall public health issue explored. Next, each document was reviewed to figure out how the PEN-3 model was used to guide data collection and/or analysis, also as an interpretation of the findings. Furthermore, thematic analysis was applied across the available literature to identify common themes that emerge when the PEN-3 cultural model is applied to affect cultural aspects of health behaviors.

2.4.2. Theoretical basis

a. The socio-culture, contexts, and health

Socio-culture in this study context refers to shared norms, codes, and values that together shape a group's attitudes, beliefs, and practices or behavior through their interaction in and with their settings (105). To discover the effect of socio-culture on personal health is 'to recognize that the forest is more important than the individual tree'. This is because, discovering the sociocultural context of the forest allows one to know and appreciate how each tree is formed and explore the connections, roles, and relationships whether positive or negative that present between the trees. These sociocultural dynamics are vital for any public health intervention to be real and sustainable (25). The sociocultural context is shown to have both positive and negative influences on health behavior(9, 106), and is a blueprint for living that guides the thought, actions, and sentiments of individuals, families, and communities to model healthy behaviors (26, 105). It's a key to the practices and behavior of organizational structures and professions, including the health professions; the health priorities of people, groups, and systems of health delivery; and therefore the practices of execs that compile or alienate givers and receivers of care (9, 106). Health and illness are defined, labeled, evaluated, and acted upon in the sociocultural context (9, 106). It plays an important role in determining how any disease and its risk factors are

interpreted or managed by individuals(27). As an example, to scale back the burden of one of MS traits like hypertension, principal prevention through a discount in population-wide salt consumption is viewed as a top priority action (107). However, decreasing salt intake can't be detached from socio-cultural factors determining nutrition-related behavior towards the use of salt in food preparation(27, 57).

b. The PEN-3 model

Research conducted within an operational theory-based, the culture-rich paradigm needs the use of a theory that permits an understanding of the study respondents' knowledge, attitude, and practices and a culturally relevant method. The PEN-3 model has been used in different kinds of literature to address concerns within a sociocultural framework, since its introduction in 1989. Beginning from the time of its publication, the PEN-3 model was employed in different cultures of the globe to address a range of public health complexities, entails cancer, diabetes, HIV/AIDS, smoking, food choices, and obesity in those margins of society called as "Others"(25). Since then, the model was used as a theoretical ground in more than 100 studies worldwide to explore how the sociocultural contexts affect the perceptions of health behavior, and then eventually used to guide the sociocultural context centered intervention (26, 108).

Within this framework, the community is first addressed within a qualitative perspective to gain an understanding of how the public feels about metabolic problems, knowledge of risk factors, attitudes and practices for prevention and control. Airhihenbuwa, 2010(109) suggested that the best questions are positive, negative, and distinctive in their wording. These questions are utilized by researchers and society as they work together to reduce areas of divergence and convergence. The study is informed by the community and better able to decide the true thoughts of the community on its knowledge, attitude, and practices toward metabolic syndrome associated lifestyle. This theoretical framework, PEN-3, has three primary domains each form an acronym of PEN: The cultural identity domain (person, extended family, and neighborhoods); the relationships and expectations domain (perception, enablers, and nurturers); and the cultural empowerment domain (positive, existential, and negative (Figure 1) (23, 25, 26). Everyone has three dimensions of understanding or knowing the sociocultural context of the public health concerns in question. A discussion of the three domains of the PEN-3, as follows:

i. The cultural identity domain

The cultural identity (CI) is an important origins of health behavior or intervention entry point at various levels: personal, family and Neighbour level to affect the level of knowledge and shaping of individuals' behavior (23, 105). It is the dimension of defining the target groups and approaches to the individual in a way that accepts their right to make an informed decision about their health. In this study, identification of whom to use as a study respondents and giving them access to the similar information we have as a base for making decisions is how this section of dimension was met. Family is commonly more than the nuclear family; therefore, health choices must also comprise the extended family. The support of the extended family may spell the success or failure of any actions the individual made to improve health through MS monitoring or MS prevention, management, and control behaviors(25, 26). The neighborhood where one lives offers the extra-familial social livelihood structure(Figure 1) (26).

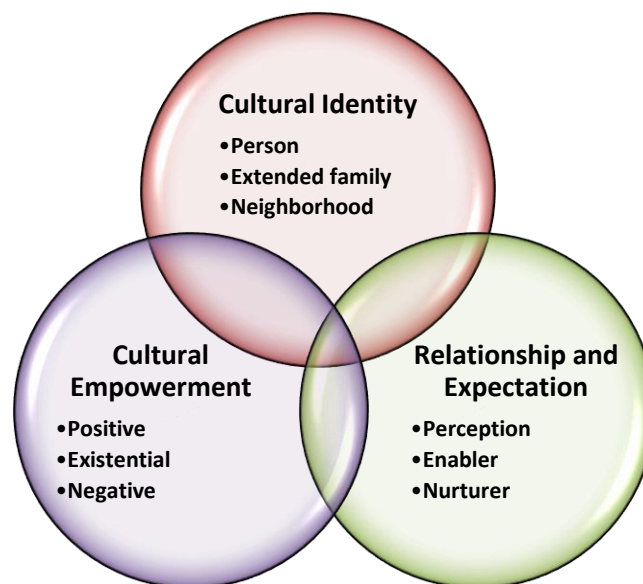


Figure 1; PEN-3 model adopted from (Iwelunmor, 2014(25) and C. Airhihenbuwa, 1995(26)), Airhihenbuwa, 1989 (23), applied on the study among PLHIVs, Gedeo-Zone, Southern Ethiopia, 2017-2019

ii. Relationships and expectations domain

Indeed, the relationships and expectations (RE) domain is often termed as an educational diagnostics of healthy behavior domain. It focuses on the purpose of view of how the sociocultural contexts define the roles of persons and their expectations in family and community

relationships. This domain allows examining the personal private actions as functions of broader social-cultural contexts of "perception, enabler, and nurturer" (23, 105). It permits assessing the key influence of the cultural and social factors, values, and norms of health behavior that highlight the knowledge, attitudes, and risk perceptions, and what enables and nurtures the perception of health (25, 26). The development and interpretation of behavior have usually supported with the interaction between the perception we have about that behavior, the resources and institutional forces that enable or disable actions, and also the influence of family, kin, and friends in nurturing the behavior(25, 105). The perceptions one hold encompasses the sum of knowledge, attitudes, values, and beliefs that are supported by one's socioculture. Attitude one holds regarding MS risk factors, its prevention, monitoring, and control directed by family and community perceptions on MS(26). A community or public has enablers, that are social, societal, resource-based structural that may function as an obstacles to the positive individual, family, or community modification. Health beliefs, actions, and attitudes toward MS risk factors, monitoring, and prevention are encouraged or mediated by the individual, family, community, and other societal nurturers(Figure 1) (26).

iii. Cultural Empowerment (CE) domains

The Cultural Empowerment (CE) domain of the model is composed of three subdomains: positive, existential, and negative. Airhihenbuwa, 1995 considered the dimension the foremost critics of the three, since this dimension inspects the sociocultural appropriateness of any public health behaviors(26). It is a tool accustomed to identify the influence of the sociocultural on health behavioral decision first by exploring the positive followed by the existential and negative ones (23, 25, 26). It's an important segment of the model often applied to explore the positive decision of health behavior of individual to be promoted, the existential /harmless to be recognized, and the harmful to be controlled. While the positive include values and relationships that promote the health behavior of interest, the existential examines the qualities of behavior that make it unique(23, 26).

The positive behaviors are those behaviors that instigate knowing about MS, and taking steps to decrease personal risks, prevent, and/or monitor practices that have got to be enhanced for the person or individual within families, neighborhoods, and communities. Existential behaviors are neither useful nor harmful but are practiced and must not be discouraged behavior that doesn't,

increase or decrease MS is not discouraged within the research process. Practices that may be compared to study aims will be encouraged. The negative aspects include health beliefs and actions that are harmful to health and want to be modified(25, 26). Health practices and behaviors that are known to be risky or harmful to any health like sedentary lifestyles, insufficient consumption of fruits and green leafy vegetables, use of tobacco and alcohol, and increased use of sodium or sugar gorgeous foods are negative practices (behaviors). Actions must first be focused on understanding political, historical, social, and cultural contexts before efforts are introduced to handle or reduce them (25, 26). Hence, utilization of the PEN-3 cultural model confirms the sociocultural context, and its various attitudes, beliefs, and practices as practiced individually, within families, the neighborhood, and therefore, the public or community at large(Figure 1).

c. Application of the PEN-3 model in former studies

Overall, exactly 130 numbers of references fulfilled the search criteria were originally retrieved next to the elimination of duplicates. Nevertheless, **45** studies meeting the eligibility criteria were reserved for the review, following the careful screening. Overall studies were exhibited variability's in their use of the PEN-3 model to address public health behaviors through a sociocultural lens. Although there were no differences in the use of the model by country studied or language, however it was common for articles to use the PEN-3 model as a theoretical background to mediate sociocultural contexts in the research of health behaviors and to incorporate socio-culturally appropriate factors in the growth of interventions. For instance, Sheppard et al.2010(110) used qualitative results linked to the PEN-3 domains to notify the implementation of a decision to support intervention for black women with breast cancer. Erwin et al.2010 (111) utilized the model to form and explain the messages structure and program content of their cancer control intervention for Latinas. Correspondingly, Kannan et al.2010(112) applied the construct of the model to develop a curriculum to help increase nutrition support and improve the pre-conception nutrition of African-American women in Southeast Michigan.

Moreover, several works of literature likewise used the PEN-3 model to dictate the collection, analysis, and interpretation of qualitative data produced. Categorization, Cross-Tabulation, and Recontextualization were data analytical techniques that appeared with the application of PEN-3. With the data categorization, it was typical for literature to use the PEN-3 model as an organizing framework to categorize ideas created from the qualitative data within

one of the three domains of the PEN-3 model. Besides, although some articles used all of the three domains of the model to categorize the concept produced for data analysis, it was unusual for literature to utilize one of the domains only to be used based on the nature of the study type. For instance, in interpreting the perceptions, experiences, and knowledge about cervical and breast cancer screening of Latina immigrants', Erwin et al. 2010 (111) utilized all of the three domains of the PEN-3 model to categorize themes emerged from respondent's focus group replies. Nonetheless, Iwelunmor et al.2010(113) applied only the Cultural Empowerment domain in understanding mothers' treatment decisions about child febrile illness to examine positive health beliefs and practices held by mothers, existential practices that have no harmful health outcome, and negative beliefs and practices that hinder suggested replies to febrile illness in children.

Cross-tabulation was the other form of data analysis method commonly utilized method with the PEN-3 model is reviewed literature. In this method, it was a common trend for studies to cross-tabulate the Relationships and Expectations domain with the Cultural Empowerment domain of the PEN-3 model to create a 3×3 table consisting of nine groups. This technique is often denoted as the assessment phase of the model given the chance to arrange the themes that emerged at the crossing of two domains to assess the domain interactions (114). For instance, in assessing the challenges nurses caring for PLHIVs in South Africa(SA) encounter with balancing personal and professional lives, Sofalahan et al.2010(115) completed a 3×3 table of emerging themes by crossing the Relationships and Expectations domain with the Cultural Empowerment domain to capture the complete range of nurses' experiences from positive to negative. In Recontextualization, Morse, 1995(116) suggest that the goal is to locate the themes generated from qualitative data within the context of established knowledge. For instance, in their articles, 'Rethinking HIV and AIDS disclosure within the context of motherhood in SA,' Iwelunmor, et al.2010(117) used the conventional Cultural Empowerment domain of the PEN-3 model to increase knowledge on women's disclosure of HIV seropositive status within the context of motherhood in SA. Similarly, in a breast cancer education program that targets African-American women, Kline, 2007(118) used the model to identify representations of Cultural Identity, Relationships and Expectations, and Cultural Empowerment domains. This implicates the compatibility of the model as a theoretical framework to mediate sociocultural contexts in the

study of health behaviors and to incorporate socio-culturally appropriate variables in the development of interventions.

d. The role of socio-culture and contexts in mediating health behaviors

The significance of centralizing socio-culture in the study of health behaviors was important in research studies using the PEN-3 model. In recognizing the precise ways in which socio-culture forms health behaviors, for example, Abernethy et al. 2005 underlined the significance of understanding how traditional views of masculinity influence men's perceptions of their health, particularly in African-American groups. The powerful effect of the sociocultural context in a study on Type 2 Diabetes among British Bangladeshis in the United Kingdom (119) and Maltese immigrants in Australia(120) was likewise central. Congruently, the study of Ka'opua,2016 (121) was highlighted the influences of sociocultural contexts on HIV-infected subject's knowledge to participate in anal cancer screening.

Grace et al. 2008(119) established that numerous traditional social norms and expectations possibly disagreed with efforts to attain health-associated lifestyle change. Several sociocultural influences and traditions amongst Maltese immigrants affected their motivation regarding self-management of diabetes was noted by Barbara, 2013(120), in Australia. For instance, subjects reported that traditional social behaviors including the receipt of hospitality impacted their adherence to dietary interventions(120). With the context of HIV and AIDS; the PEN-3 model was utilized to assess the influence of sociocultural context in clarifying stigma and HIV disclosure in SA. Petros et al. 2006(122), employed the model to discover how PLHIVs experience 'othering.' The researcher identified that ample of the current blame and othering of HIV and AIDS can be traced to the country's complex history of racism, patriarchy, and homophobia. Correspondingly, utilizing the model as a guide, Iwelunmor et al. 2010 (117), found that the discourse on motherhood in SA cannot be separated from the history of institutional discrimination that occurred during the apartheid era. The researcher concluded that the legacy of apartheid may affect traditional and societal expectations of mothering particularly about disclosing seropositive status. The sociocultural context similarly delivers a vibrant lens through which authors might observe and understand health behavior while highlighting factors that may be most salient in the future intervention plan. Literature utilizing the PEN-3 model verified how sociocultural context matters when establishing interventions focused on addressing

health behaviors such as anal cancer screening behaviour (121), domestic violence (123), nutrition attitudes (63, 124), depression prevention(125), reproductive desires(126, 127), HIV and AIDS (114, 117, 128-131), cancer screening and awareness (111, 132, 133) , physical inactivity, stress(134), and smoking(135-137). In short, the review result might suggest the applicability of the model to explore the sociocultural intercepts associated with the diverse public health mater type (i.e. NCDs or CDs) related to individual health behavior. Nonetheless, none of the reviewed studies were indicated the current study concerns (i.e. MS and lifestyle risks) in those PLHIVs.

a. Positive aspects of socio-culture as a critical domain in PEN-3

A positive aspect of socio-culture can support or promote public healthy behaviors (i.e., knowledge of screening and testing, dietary habits, etc.) that lead to better health outcomes, like personal behaviors. For instance, Ka'opua, 2008(62) utilized talk story, a socio-culturally familiar style of discussion to engage women in dialog on the importance of breast cancer screening, among Native Hawaiian women. Also, in telling breast cancer treatment experiences, socio-cultural values like personalismo (warm and personal relationships with individuals, i.e., clinicians) were essential in enabling Latinas to expand their knowledge of treatment options and create a better understanding and willingness to take chemotherapy, as noted by Sheppard et al. 2008(138). Regarding the nutritional context, in describing how socio-culture affects dietary habits, James, 2004 noted that food, mainly 'soul food' could also be a positive and existential dietary behavior practiced among Africa Americans and used to celebrate and affirm culture. The researcher noted that though food myths, imprecise information, and negative behaviors or practices surrounding food choices and dietary consumption are common among African-Americans, the positive aspects of traditional African-American diets should be stressed, even when highlighting the need for modifying or reducing the negative practices, like frying foods, which is known to be harmful to health (63). Within the understanding that health research and interventions must be the utmost amount about supporting positive values as modifying negative ones, Ochs-Balcom, 2011(139), used the model to explore positive and negative subjects important to developing community partnership to optimize recruitment of African-American women during a carcinoma epidemiology study. The necessity for extra information about carcinoma and potential benefits to younger generations were among the positive subjects found, while negative subjects included lack of knowledge regarding research participation, issues

related to confidentiality of data, and carcinoma research generally. In describing their overall recruitment and study protocol, the researcher enhanced positive subjects and revised negative subjects in a kind of way. Discussing the positive contexts of socio-culture and behavior, while reframing those socio-cultural occurrences traditionally considered negative allows these researchers to develop socio-culturally consistent descriptions and socio-culturally important interventions for public health.

b. Family or community as a common intervention entry point

The PEN-3 model emphasizes the influence of the collective (i.e. the family or community) in defining the individuals' health experiences and highlighted its significance in forming health-related decisions. For instance, Ka'opua, 2008(62) identified that responsibility to the family role screening for breast cancer, among Native Hawaiian women. Likewise, Sheppard et al. 2008(138), noted that members in the family were important nurturers in influencing breast cancer treatment decision making among Latinas. Also, as Scarinci et al. 2012 (140) identified the specific sociocultural values considered essential to the Latino culture that may play a role in cervical cancer prevention. For example, the researcher found that family is one of the basic Latino values heavily dependent on when dealing with health problems. It was beside the case in a cancer intervention for diverse Latinas where Erwin et al. 2010 (111) noted that family takes priority when speaking ways to harvest positive screening behavior change in subgroups of Latinas. Garcés, 2006(141) who similarly used the PEN-3 model to highlight the importance of support from the extended family with health maintenance and healthcare-seeking practices among Latina immigrants were found the need and motivation to keep families healthy. Qualitative PEN-3 findings likewise delivered indicators for planning a tailored recruitment protocol for family-based genetic research on breast cancer(139). Family systems can be sources of support, sources of stress, and unique indigenous entities when addressing the care and support needs of family members living with HIV and AIDS, in an article on family systems and HIV and AIDS, by Iwelunmor et al. 2006(142) report. Nonetheless, the necessity to take families' experiences with HIV and AIDS into account was critical in the establishment of interventions intended at decreasing the magnitude of HIV and AIDS-related stigma in the family and improve care and support for PLHIVs(142). In telling the influence of AIDS-associated stigma, utilizing the model, Airhihenbuwa et al. 2009(114), found that recognizing

how families deal with illness and health is essential to establishing sustainable health interventions intended at decreasing HIV and AIDS stigma, chiefly with finding important family members who have made a change in the lives of PLHIVs. James, 2004(63) noted that African-American women are important agents of sociocultural transformation as they are typically concerned with the family's health, accountable for food preparation, set standards for healthful and unhealthy eating, and offer access to other family members, in determining targets for health interventions as part of the Cultural Identity domain of the PEN-3 model. Underwood et al.1997(143) found that infant feeding practices amongst low-income African-American women were 'learned' from members in the family and others in the community and 'shared' with other new women in the society too.

c. The rationale to choose the PEN-3 model

Every study from the SSA regions as a whole and Ethiopia is precise, there is no use of theory or models to the increasing burden of chronic disease, particularly metabolic syndrome. Improving research within the socio-culture-rich paradigm, requires the use of a theory, which allows an understanding of the respondents, ' knowledge, attitude, and practices and develop a culturally relevant actions (23, 25, 26). However, all the previously existed theories to intermediating public health concerns were developed within the Western mindset (28, 108). In the search for one model or theory that more precisely addressed the effect of the family and community on health decision-making, has been at the forefront of understanding the influence of sociocultural on public health is the PEN-3 model. It is created by Airhihenbuwa, 1989 (23), in response to the obvious omission of socio-culture in explaining public health outcomes in existing health behavior theories and models(144). The PEN-3 model mediates socio-culture in the research of health beliefs, behaviors, and health outcomes (26). It takes itself away from traditional health promotion models that address health issues as a three-dimensional problem. The model emphasized behavior within the broader context of socio-cultural contexts to detect the roles, values, and norms that are supportive or not supportive of different types of activities aimed at promoting health behavior (23, 25, 26). It places the sociocultural at the core of the growth, implementation, and assessment of effective public health interventions (26, 145). Similarly, the model offers an organizing frame to mediate sociocultural when defining public health problems and framing their solutions (26). Furthermore, these solutions are framed to

enhance and reward positive values that are better sustained, rather than concentrating on the negative values only(25). This study wanted a description of told, and accepted health behaviors within a sociocultural perspective. The use of such approaches was designed to gain qualitative data on personally gained knowledge attitude and practices (KAP), and a clarification of socio-cultural effects that encouraging the acceptance of present attitudes, and practices. Hence, the PEN-3 model was intended for just such a rationale. An additional convincing purpose for using the model was that it is the only model extant that was established by home-grown African, more specifically, East African and Ethiopia, for the reason for giving a framework for researchers to use a sociocultural context for describing and outlining public health problems.

d. The use of the Knowledge, attitude, and practices (KAP) concept in research

A search within (PubMed and Google) an electronic engine has shown that different articles discussed the concept of KAP in the context of various public health concerns. However, the conceptual framework of knowledge, attitude, and practices was well established in malaria research. There was at least a study in each of the subsequent areas' of focus utilizing the KAP concept: exercise among pregnant women, lead exposure, avian flu, pandemic influenza, breastfeeding, dengue fever, communicable disease, and experiences of private doctors in Taiwan, participants in a vaccine trial, and epilepsy. Since these studies dealt with a diverse range of topics, such as lead exposure, malaria, epilepsy, pregnant women and exercise, and others, they were not discovered within this review. These articles are revealed to show the comprehensive application of the use of the KAP conceptual framework, in other areas of public health studies. The current qualitative study theme: Knowledge, attitude, and practices do not appear in much literature on MS and other allied NCDs at the present among HIV-infected populations. This is possibly due to an emphasis on the prevalence within the chronic diseases research community. It can also be due to the absence of any groundbreaking research in the area using such a qualitative approach by integrating the PEN-3 Model as a theoretical frame and KAP as a conceptual framework. The link among the two may be seen in (Figure 2).

e. The concept of KAP as a qualitative approach and also the research questions

Research that reviews quantitative data only lacks the ability to realize contextual background from the study respondents. The potential to grasp the respondent's ideas, viewpoints, and prospects is very important to attaining a real understanding of the phenomena

observed(146). The intent of this a deductive descriptive phenomenological approaches employed in the qualitative portion of this dissertation was to deal with such an understanding of the knowledge, attitude, and practices (KAP) of MS and its lifestyle-related risk factors. None of the studies reviewed have a qualitative context from which to draw conclusion. The research questions for the qualitative part of the study provide some insight into the connection between KAP. The employment of qualitative interviews provides respondents the opportunity to clarify the acquisition of data of MS risks and the way they use that knowledge to create attitudes and develop practices associated with mitigating MS risks. The elemental conception of the study was that the behaviors individuals hold toward the reduction of lifestyle risk for and prevention of metabolic syndrome (MS) are directly affected by the knowledge one has of MS, and also the attitudes one holds towards MS risks and prevention. The sociocultural contexts during which one exists dictates to a huge level what's known, the attitudes individual holds, and therefore the practices (behaviors) one develops.

f. The relationship of the PEN-3 Model with study concept

All of the litreatures demonstrate the wide practicality of the PEN-3 model in identifying socio cultural contexts associated with health. However, as previously indicated, none of the studies referenced so far used all three of the PEN-3 domains. Two of the following studies; the work of Ka'opua, 2008(62) and James, 2004(63) more closely redirect the application of the model within this study concept.

James, 2004(63) conducted 6 focus groups across North Central Florida to investigate factors influencing dietary choices among African Americans. She employed all three domains to sort the themes and noted their influence as positive or negative. In the cultural identity domain after persons, extended family, and neighborhood were identified each theme was classified as having a negative or positive effect upon choices for food intake. Within the expectation and relationship domain perceptions, enablers, and nurturers were classified correspondingly. The cultural empowerment of health behavior domain was used to classify various aspects of eating habits as positive, existential, or negative. Ka'opua, 2008(62) used all the three domains to categorize concepts, however, went further and used the cultural identity domain to recognize the socio-culture centered knowledge, attitudes, and values that determine the observed health behavior. Likewise, the third objective in this dissertation was intended to concede such a connection to the sociocultural truth. It was besides used to assess what in the

contexts of MS prevention, monitoring, control, and use of evidence gained can notify the present and prospect health teaching actions within the Ethiopian contexts.

The MS of HIV positive inhabitants of the Gedeo zone in this study was influenced by the sociocultural contexts that are comprehended within the three dimensions of the PEN-3 model. They all are individuals (person), who may or may not have an extended family, lived within a neighborhood. Their health behavior is mediated by their perception or knowledge contexts (beliefs, attitudes, and values). Enablers within the community encourage or discourage adopted health behaviors or practices, and the nurturers, on the other hand, play a role in developing and maintenance of the chosen set of health behaviors (Figure 2).

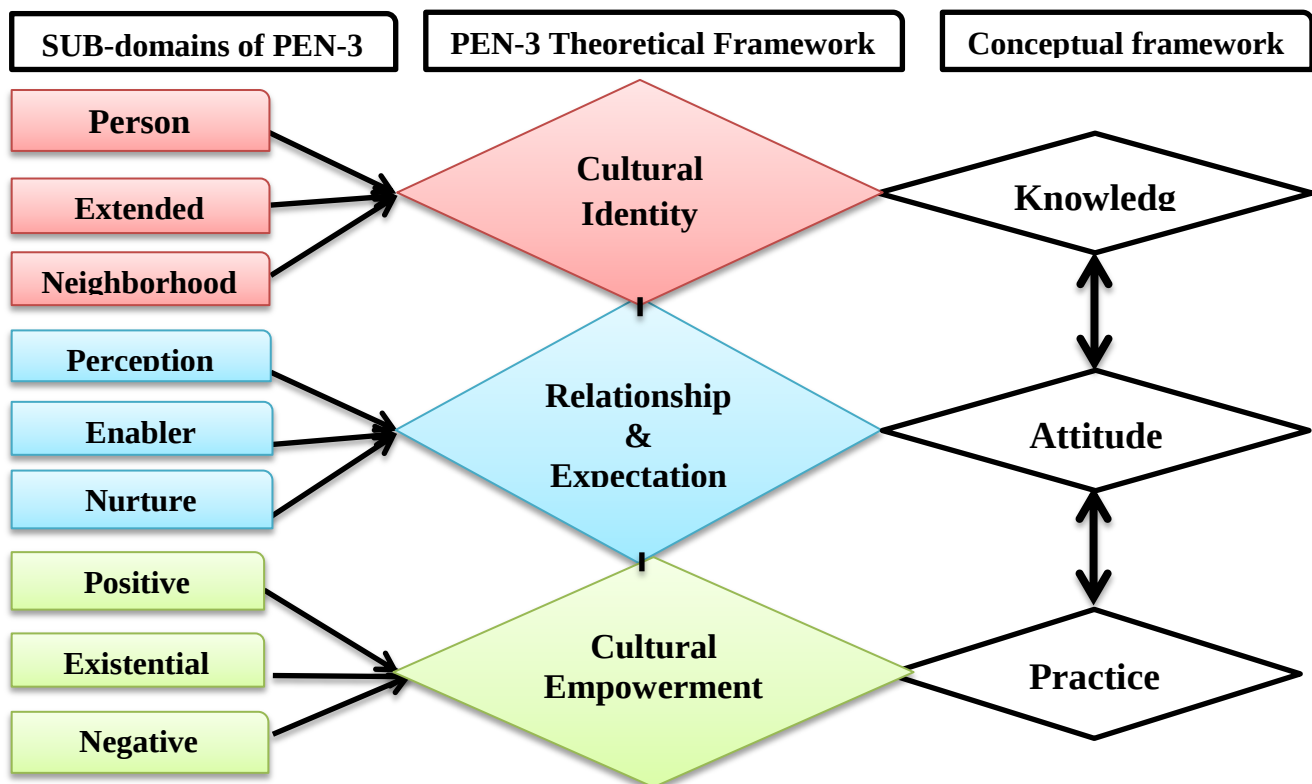


Figure 2; the pathway of the emergence of the conceptual framework through the domains of the PEN-3 Model adopted from Iwelunmor, 2014(25) and Airhihenbuwa, 1995(26) and adapted into the study contexts

The preferred set of behaviors might be positive (known to be beneficial), existential (have no known negative and or positive effect upon health behavior), or negative actions (known to be harmful). The study questions are: How and in what ways does personal knowledge form the basis of personal attitudes toward MS and methods for preventing its long term effect? How and in what ways does personal knowledge form the basis of personal attitudes

toward risk factors and methods for coping MS? How does knowledge gained and attitude hold about MS and its risk factors influence eating habits, physical exercise, smoking, and alcohol intake practices?

Recognizing how individual PLHIVs knowledge of MS, lifestyle risk factors, and long-term effects are educated is established from considerations of the cultural identity domain. In which, the roles of a person, extended family, and neighborhood are discovered for their impact upon MS and lifestyle risks knowledge. This is the foundation of all knowledge in health education. The development of individual attitudes is formed out of the perceptions of relationships and expectations of public health behavior and enabled or nurtured by various personal, extended family, and neighborhood components(Figure 2).

Practices formed to diminish or tackle MS can be positive, existential, or negative in its outcome upon an individual's life. By tracking a line of inquiring within the focus group discussion to direct discussion to an examination of these themes, it can be verified that the study questions share to and construct upon the PEN-3 model. In responding to the study questions, the PEN-3 model's emphasis on the person, extended family, and neighborhood, all were crucial to the finding of dietary habits, as individuals incline to eat as they were raised. Growth of individual habits associated to diet, physical activities, and other harmful substance use habit as well as those who inspire, nurture or enables those behaviors together with their net result upon health life positive, negative, or neither discovers responses in the entire three domains PEN-3 model (Figure 2).

2.5. Gaps identified from literature reviewed

Most of the reviewed studies were inconsistent and often focused on the overall magnitude of MS among all PLHIVs. Much of these studies were produced from outside Ethiopia(45, 46, 53-55, 58-61), and having few from the SSA region (8, 40, 42). Few studies in Ethiopia were addressed MS among all PLHIVs, using a smaller number of study participants at single health institution level(18, 40-42). What is unknown is the magnitude among all HIV-infected PLHIVs in the Gedeo zone, and its difference among ART exposed and ART naïve PLHIVs in this zone.

Besides, from the previous studies work, it can be seen that there existed little knowledge concerning factors associated with MS among PLHIVs in Ethiopia. This is borne out by the

quantitative cross-sectional approaches using a smaller sample size (18, 40-42). Despite; what predicts MS occurrence and which of these risk factors were modifiable and not modifiable using a case control approach among the PLHIVs in the Gedeo zone remains not known. Furthermore, although the available studies have addressed MS among HIV infected Ethiopian people quantitatively, however, none of these researchers used qualitative approaches complemented with theory(18, 40-42).

2.6. Research questions and Hypotheses of the dissertation

1. **Rq1: Magnitude of MS;** What is the magnitude of overall MS among all PLHIVs, ART exposed, and ART naïve PLHIVs in the Gedeo zone, Southern Ethiopia? Is there a significant difference of magnitude of overall MS among ART exposed and ART naïve PLHIVs in this zone?
 - H0: There is no statistically significant difference of magnitude of overall MS based on ART status, among PLHIVs in the Gedeo zone Southern Ethiopia
 - Ha: There is a statistically significant differences of magnitude of overall MS based on ART status.
2. **Rq2: The predictors of MS;** What predicts the odds of MS occurrence and which of these risk factors are modifiable, among PLHIVs in the Gedeo zone Southern Ethiopia?
 - H0: Each exposure variables have no statistically significant effect on the odds of MS occurrences, among PLHIVs in the Gedeo zone Southern Ethiopia
 - HA; Each exposure variables have statistically significant effect on the odds of MS occurrences
3. **RQ2: The role of sociocultural contexts;** How and in what ways the PLHIVs came to learn about MS and its risks and the part that information gained played in the development of their attitudes and practices? How and in what ways do personal knowledge of, and attitudes toward, MS and its risks influences the exercise, diet, physical activity and other harmful practices people choose to reduce the risk of MS?

2.5. Dissertation conceptual frameworks

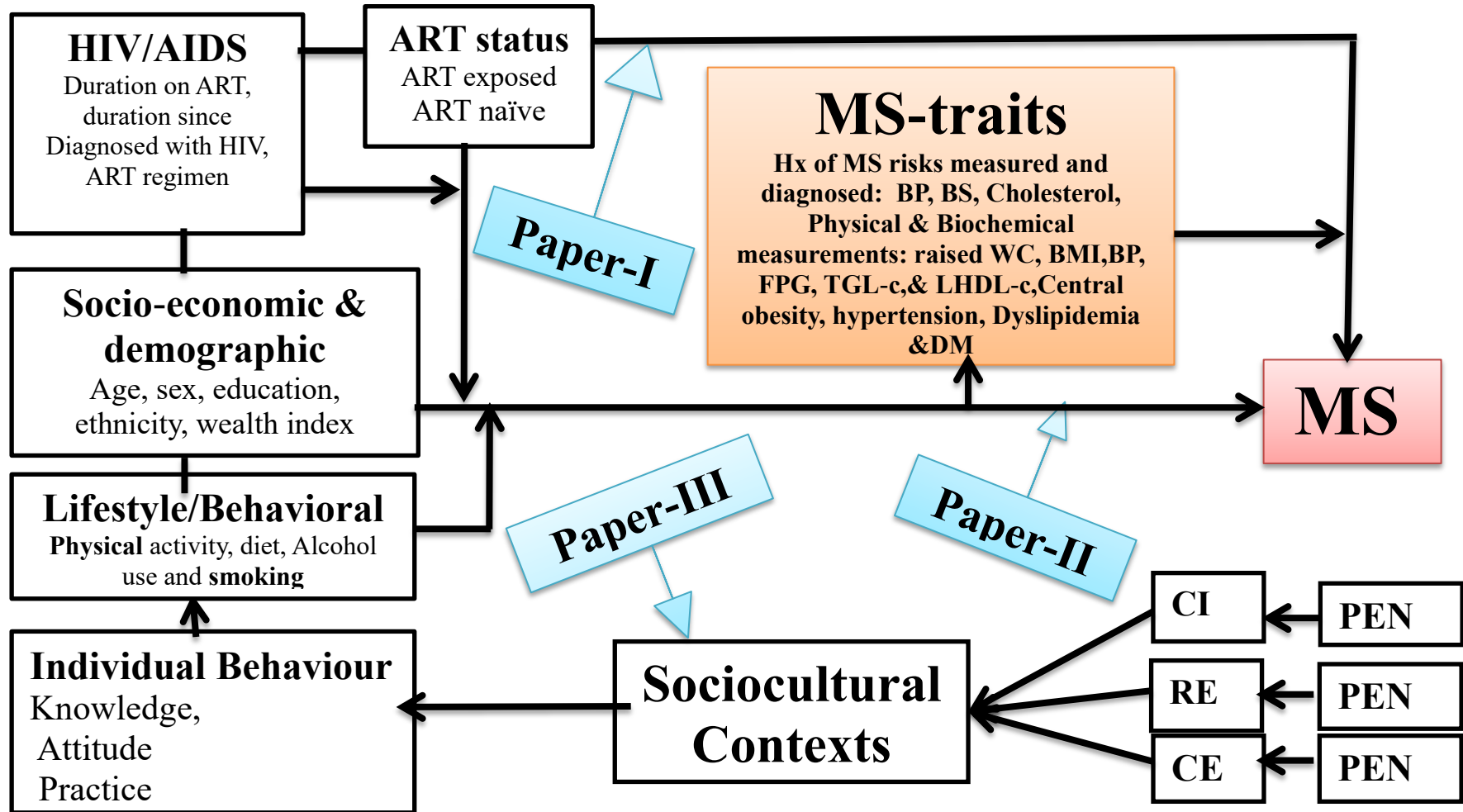


Figure 3 ; Constructed Conceptual framework for a study of epidemiology and sociocultural contexts of MS, among PLHIVs, in Gedeo zone, southern Ethiopia 2018/2019

3. Objectives

3.1. General objective

To assess the epidemiology and the socio cultural contexts of metabolic syndrome among people living with HIV, in the Gedeo Zone, Southern-Ethiopia, 2017-2019.

3.2. Specific objective

1. To estimate and compare the magnitude of overall metabolic syndrome, among HIV infected patients exposed for antiretroviral therapy and ART naïve (Paper-I)
2. To determine the predictors of metabolic syndrome, among people living with HIV(Paper-II)
3. To understand the role of sociocultural contexts in forming adult HIV-patients' behavior towards metabolic syndrome and its lifestyle related risks(Paper-III)

4. Methods and materials

4.1. The setting

This study was conducted in the Gedeo zone; which is located in the Southern Nations, Nationalities, and Peoples regions (SNNPRs); 360km to the south of Addis Ababa, which is the capital city of Ethiopia, and 86 km away to the south of Hawassa that is the capital city of the SNNPRs (Figure 4). In the zone, there are 141 health posts, 21 private clinics, 10 health centers, and 1 referral and teaching hospital, and 3 primary hospitals.

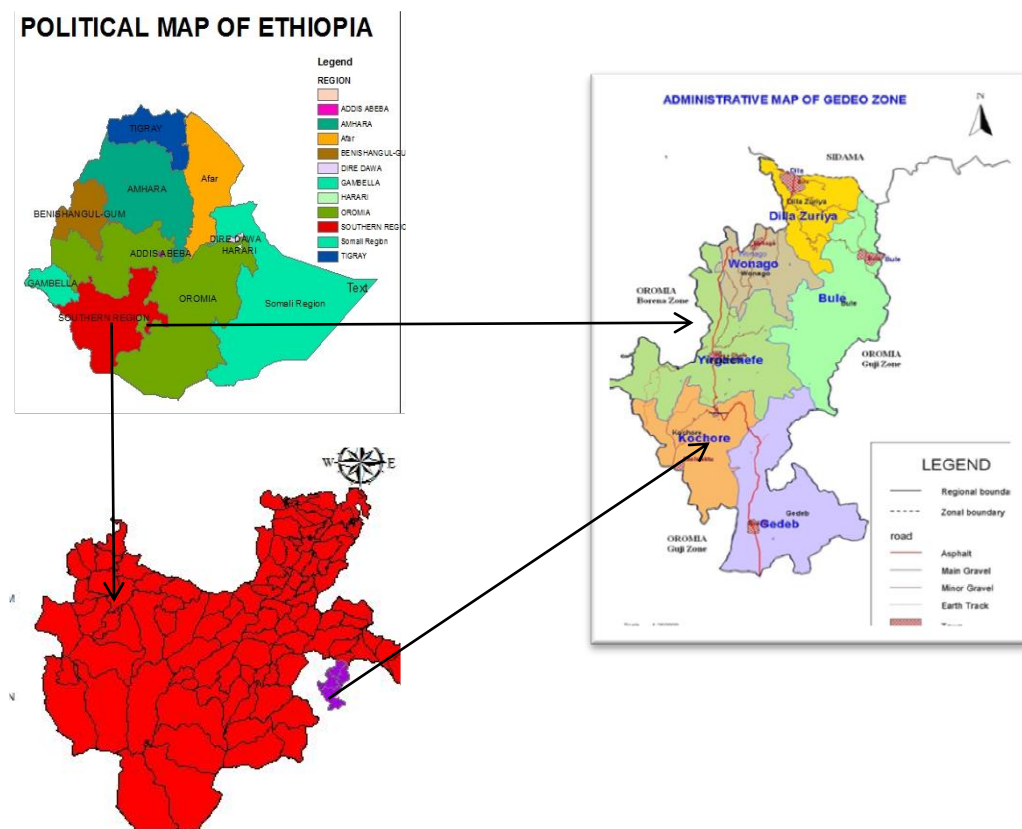


Figure 4; political map of the country, the southern region and administrative map of Gedeo zone, applied on the study among PLHIVs, Gedeo-Zone, Southern Ethiopia, 2017-2019

Of the above listed public health organizations, some of them are engaged in chronic HIV care services (CHCCs). Of which, while five of the institutions were health centers(HC) comprised of Wonago health center (HC), Chelelekitu HC, Dilla HC, Dilla Zuria HC, and Gerese HC; four of

the institutions such as Gedeb primary hospital (HP); Bulle HP; Yirgachefe HP, and Dilla university tertiary referral and teaching HP. All the referenced health institutions were old enough on providing CHCCs, which are now supported by CDC-organization, except Dilla zuria, Gerese HC, and Bulle primary HP, which were engaged lately on the service provision. From those public health institutions actively engaged in the delivery of chronic HIV care services, the quantitative studies of the dissertation (i.e. Paper I and Paper II) were conducted in the randomly chosen two hospitals (HP) and health centers (HC), namely: Dilla University referral and teaching hospital (DURH), Yirga-Cheffe primary hospital, Wonago HC and Dilla town HC. Similarly, the qualitative study (Paper III) was conducted in DURH and Wonago HC; for their convenience to transportation services, its daily patient flow rate, and also by taking the health facilities as a natural set up of the participants in to account. The specific places in each facility were likewise selected by taking the quality of the room, in terms of its illumination, sound protection capacity, and loneliness from any attention diversion situation.

During the study period, as the Gedeo zone ART case team Health Management Information system (HMIS) report reveals, there were 3597 adult PLHIVs (629 ART-naïve (370 female) and 2968 current on ART (1813 female)). Of whom, while (n=135 ART naïve and n=537 ART exposed) were enrolled in the ART clinics of all public health centers, 412 and 2395 corresponding groups took services under the ART clinics of the public hospitals.

As per the current national consolidated guidelines for comprehensive HIV prevention, care, and treatment guideline for Ethiopia, all HIV positives are eligible for ART irrespective of their WHO clinical staging and/or CD4 count. The ideal time for ART initiation depends on the clinical condition and readiness of the client, which should be offered on the same day to people who are ready to start. Rapid ART initiation (i.e. defined as the initiation of ART within seven days of HIV diagnosis, provided that there are no contraindications) ought to be offered to all PLHIVs following a confirmed HIV diagnosis, clinical assessment, and assessment of client readiness. As a priority, ART should be initiated in all adolescents and adults with severe or advanced HIV clinical disease (WHO clinical stage 3 or 4) and adults with a CD4 count of ≤ 350 cells/mm³. There are three recommended adult ART regimens. All of these regimens are based

on the nucleoside reverse transcriptase inhibitors (NRTI), none nucleoside reverse transcriptase inhibitor (NNRTI) and a boosted Protease Inhibitor (PI). The preferred first-line regimen for adults and adolescents is TDF+3TC+DTG or TDF+3TC+EFV as a once-daily dose. Fixed-dose combinations and once-daily regimens are preferred for antiretroviral therapy (147).

The dissertation period varies as per the study types; while the quantitative studies (Paper I and Paper II) were conducted between December 29th -2017, and January 22nd -2019, the qualitative (Paper III) was initiated from February, 1st to 30th, 2018.

4.2. Study design

The dissertation project employed three types of designs, having to take their feasibilities and inquired resources into account.

- **Paper I:** a comparative crosssectional study was used.
- **Paper-II:** the unmatched case-control study design was employed. The cases were defined based on the revised National Cholesterol Education Program (NCEP)-Adult Treatment Panel three (ATP III) criteria(12). The presence of three of the following criteria was used to diagnose cases with overall MS: Waist circumference ≥ 102 cm (Men), ≥ 88 cm (Women); Triglycerides ≥ 150 mg/dl or treated or High-density lipoproteins (HDL): ≤ 40 mg/dl (Men) or ≤ 50 mg/dl (Women), fasting plasma glucose ≥ 110 mg/dl or on treatment for diabetes; ≥ 130 mmHg systolic or ≥ 85 mmHg diastolic or treated with antihypertensive medication(12, 17-19). The control was individuals free of MS (i.e. fulfills, ≤ 2 of the above criteria).
- **Paper III:** The study applied a deductive descriptive phenomenological qualitative approach using a thematic data analysis strategy. It was decided based on the ontology and epistemological stances of the research questions. This study used the case study approach from the social epistemology paradigm with a nod towards the phenomenon. The main concept was that the behaviors individuals hold toward the reduction of lifestyle risk for and prevention of metabolic syndrome (MS) are directly affected by the knowledge one has of MS, and the attitudes one holds towards MS risks and prevention. The sociocultural contexts in which one exists dictates to a very huge level what is known, the attitudes individual holds, and the practices one develops. This is because, the sociocultural context is a socially

formed knowledge circumstance, shaped by the relations of a human being with their realm.

4.3. Source and study populations

4.3.1. Source populations

The source populations for paper I, paper II, and Paper III were all confirmed HIV positive adult patients in the Gedeo zone.

4.3.2. Study population

Paper I

A confirmed HIV-positive ART exposed or unexposed individual PLHIVs taken their routine services in the chronic HIV care clinics of the selected health facilities in the previous time or newly for the first time and were chosen based on the eligibility criteria set for the two comparative HIV cohorts.

Eligibility criteria

- **Inclusion criteria for both study groups:** a confirmed HIV positive adults (age $\geq$ to 18 years old) individuals, enrolled in the chronic HIV-care clinics of the public health institutions for the first time and or stayed in the clinics for the unrestricted period, and not yet exposed for ART were used as inclusion criteria for the ART naïve groups. However, those PLHIVs exposed to either the 1st or 2nd or 3rd line ART regimen for unrestricted time, and with similar sociodemographic characteristics of ART naïve groups were employed as inclusion criteria for the counter groups.
- **Exclusion criteria for both study groups:** those PLHIVs with mental disorders, communication barriers, pregnant women, and severely ill subjects with or without the treatment regimens, and have restrictions impede their participation were excluded from the study.

Paper-II

A confirmed HIV-positive individual, previously enrolled in the chronic HIV care clinics of randomly selected health facility and took part in the prior study, who enumerated by the time as a case (i.e. with the outcome of interest overall MS) and controls (i.e. without the outcome of interest) determined based on the ATP III criteria stipulated elsewhere, and who fitted with the eligibility criteria set for the cases and controls were used as study populations.

Case finding

Cases were identified when they came into those randomly chosen public health institutions' chronic HIV care clinics for their routine care and participated and eventually enumerated as a case (i.e. with the outcome of interest) in the prior survey, and fulfilled the eligibility criteria set below.

Eligibility criteria for the cases

- **Inclusion criteria:** confirmed HIV positive adults with or without antiretroviral therapy, who enrolled in the chronic HIV-care clinics of the public health institutions for the unrestricted period or for the first time and was recorded a case ascertained as per the revised ATP III criterion, whose age was $\geq$ to 18 years and below 70 years old were included in the study. The underline reason to take that age limit is due to the association of age range more than or equal to 70 years old with metabolic dysfunction in most adults, after controlling for various factors, as suggested by various studies(10, 16)
- **Exclusion criteria:** individual PLHIVs with the following conditions such as mental disorders, communication barriers, pregnant women, severely ill subjects, and have restrictions that impede their participation were excluded from the study.

Control selection

The control selection was accomplished using a cumulative case-control design. Accordingly, the control groups were sampled from those who did not become cases (free of MS) or with

lower than two numbers of ATP III criteria established to ascertain the outcome of interest in the prior survey.

Eligibility criteria for the Controls

The controls were eligible for the study if they fulfill the same eligibility criteria set to the cases indicated just in the above section, except for the outcome of interstage.

Paper III

A volunteers' urban and rural resident male and female adult people living with the virus, who fulfilled the eligibility criteria of the study were involved as a study population.

Eligibility criteria

Inclusion criteria: HIV positive above 18 years old adult peoples and permanent resident of Gedeo-zone, who speak the Amharic language and took the routine care at least for $\geq$ six months in the above referenced HIV clinics and willing to come back as per the schedule set for the focus groups discussion were used as inclusion criteria.

Exclusion criteria: Inactive participants during the study time for various reasons and have restrictions that impeding their participation were correspondingly used as exclusion criteria.

4.4. Sample size and sampling methods

4.4.1. Sample size determination

Paper I

The sample size estimation was made using OpenEpi version 3.03 software and by taking the following assumptions into account: the two population proportion identified from the previous study done in Hawassa university specialized Hospital, Southern Ethiopia ($P_1=15.6\%$ ART naïve and $P_2=18.1\%$ ART-exposed) (18), with 1:2 ratio of the ART naïve and ART-exposed groups, 95% confidence level, and 5% level of significance. Based on these assumptions, the calculated sample size for the ART naïve group, for power 80% and 90% became ($n_1=3378$) and

(n1=4521), respectively. However, due to the constraints of resources, we made different assumptions for our sample size estimation. By considering all of the above assumptions, the final sample size required for the ART-naïve group, with power 90 % to detect an increment of 13.2% of the proportion of MS in the ART group from the baseline (i.e.15.6%) was (n1=208). By adding 10% non-response, the total sample size required for the study became N=687 (n1=229 for ART naïve and n2=458 for ART exposed) (Table 2).

Table 2; sample size options estimated based on expected effect size difference of proportion from the baseline against power, PLHIVs, Gedeo Zone, Ethiopia, 2019

80% power					90% power				
Baseline P1 (P% of MS in ART naïve)	Baseline P2(P% of MS in ART-exposed)	Expected Difference of P% (d=P2-P1)	S.Size for the 1 st group	Size for the 2 nd group	Baseline P1	Baseline P2	Expected Difference of P%	S.Size for the 1 st group	Size for the 2 nd group
15.6%	25.0%	9.4%	290	580	15.6%	25.0%	9.4%	388	776
15.6%	28.8%	13.2%	156	312	15.6%	28.8%	13.2%	208	416

a-ART: Antiretroviral Therapy, b-P1: Population proportion for the 1st group, c-P2: Population proportion for the 2nd group, d-S.Size: Sample size

Paper-II

As this study is unmatched case-control, different sample sizes were calculated using OpenEpi Version 3.03 with the assumption of power (% chance of detecting) of 80 %, two-sided confidence level (1-alpha) of 95%, the case-control ratio of 1:3, the hypothetical proportion of controls to be 19.1% and hypothetical proportion of cases with exposure to be 32.0%, determined from a meta-analysis study done in the globe by taking duration with HIV infection as one of the main exposure variables for MS that provide the maximum sample size (15).

Accordingly, that yields a minimum sample size of 126 cases and 376 controls. Adding a 10% non-response rate, the final sample size required for the study was cases 139 and controls 414. To increase the power of the study, all cases observed during a year along with the corresponding three controls were included in the study (Table 3).

Table 3; Summary of assumption and the sample sizes determined, based on previous studies, PLHIVs, in the Gedeo-Zone, southern Ethiopia, 2019

Variable	CI	Po	Hypothetica	HY	%	OR	The	Samp	SS	Tot	Ref.
		we	l (HY) % of	of		to be	ratio	le	for	al	
		r	cases(Ca)wi	control(		dete	of	size(S	un-	SS	
		th		Co)		cted	Co/C	S) for	Ex		
		exposure(Ex	with Ex				a	Ex			
ART regimen (1 st line =exposed; protease inhibitors=un-exposed)	95	80	24.2	10		2.87	3	230	77	307	(75)
Sex(male = exposed and female =unexposed)	95	80	41	59		0.48	3	257	86	343	(55)
ART status (ART user = exposed and ART-naive=unexposed)	95	80	21.0	9.0		2.69	3	287	96	383	(82)
Duration with HIV infection (longer than 68 months =exposed & shorter than 68 months=unexposed)	95	80	32.0	19.1		1.99	3	376	126	502	(15)

Paper III

The sample size was determined by data saturation and varies as per the type of the data collection methods used. Hence, four focus group discussions (FGDs) were organized with (6-8 male and female individuals) and two spontaneous in-depth interviews were made. Based on that a total of 32 participants were considered for paper III (n=30 PLHIVs in the FGDs, n=2 in the in-depth interview run with latecomer).

4.4.2. Sampling methods

Paper I and II

A proportionate stratified consecutive sampling technique was employed. First, stratification of the health care institutions of the zone based on their health care delivery levels (as hospital and health center) was made to select participants. The underline reason to stratified them was due to the difference in daily patient flow in the former and later institutions, and to eventually obtained representative study subjects. Subsequently, two of the hospitals (Dilla University referral hospital (DURH) and Yirga-Cheffe primary hospital (Y/CHP)) and two of the health centers (Dilla health center (DHC) and Wonago Health centers (WHC)) were chosen randomly by lottery method.

However, before commencing recruitment of the study subjects, a survey supplemented with the data logs at the data clerk of the ART clinics of the selected health facility's was arranged for a month, to evaluate the daily/weekly/monthly patient flow. Using the compiled assessment monthly result and the proportional allocation to sample size (PPS), the required number of ART-exposed and ART naïve groups under each health institutions required for a year was determined (Table 4). Finally, daily recruitment, selection, and enrollment of subjects based on the eligibility criteria were carried on consecutively, until the estimated sample size for each study site was attained (Figure 5).

Table 4; Average monthly patient flows and PPS to ART and ART naïve monthly required cases, PLHIV, Gedeo-Zone, and south Ethiopia, 2019

Facility Name	Average monthly ART naïve patient flow rate	Estimated total ART naïve population size for 1 year (N)	Estimated ART naïve patient sample size requirement for 1year using PPS* technique(n)	Average monthly ART exposed patient flow rate	Estimated total ART exposed population size for 1 year	Estimated ART exposed patient sample size for 1year using PPS* technique
Dilla university referral hospital	14	168	106	132	1584	282
Wonago Health center	6	72	43	18	216	38
Dilla Health center	3	36	19	12	144	25
Yirga-Cheffe hospital	7	84	50	43	516	92
Total	30	360	219	203	2460	438

*PPS: Population proportion to size estimated for the study period

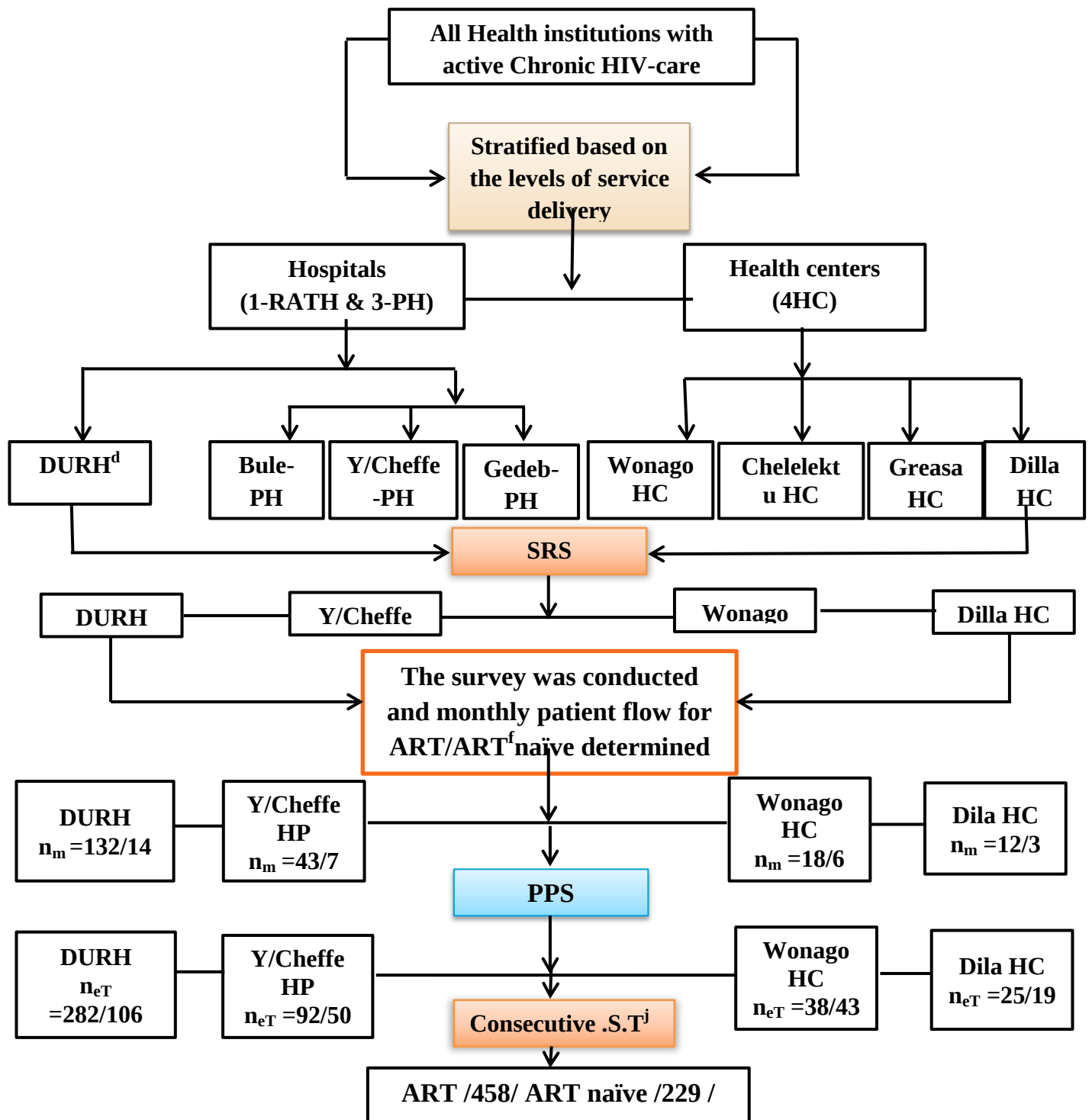


Figure 5; the schematic representation of the study procedure, among PLHIVs, Gedeo zone, Southern Ethiopia, 2017-2019

Paper III

A purposive sampling technique was employed to choose the health institutions, and recruit and enrolled the study participants. To select the study participants, initially, the subjects were informed orally about the study's aims before they took their routine care. Soon, the team appreciated the subjects' willingness' and immediately linked with the health workers to map out and enriched them with more information about the study aims. Subsequently, securing written consent and demographic data collection were quickly initiated and appointed for the discussions. The recruitment and data collection time schedules of the participant were undergone sequentially; running first in DURH among the female group followed by the male, and then the discussion in Wonago HC continues. These health care institutions were preferred and considered in the current study for their's convenience of access to transport, the number of daily patient flow rate together with study aims.

4.5. Survey instruments

Paper I and II

An interviewer assisted data collection methods was used to accomplish the quantitative data collection procedure. It was done using a checklist and the WHO /NCD STEPS instrument version 3.2 (148). The checklist was developed following reviewing the different medical records and employed to collect data from Pre ART/ART logbooks. It consisted of questions regarding HIV/AIDS-related factors such as duration since diagnosed with HIV, ART status, ART drug types, duration of ART use, CD4+ levels, RNA levels, Opportunistic Infections(OI's) status, and other illness associated risk factors. The WHO steps tool comprised of three different levels or 'steps' of risk factor assessment: Step 1 (questionnaire), Step 2 (physical measurements), and Step 3 (biochemical measurements). The generic STEPS Instrument (version 3.2), where countries used to develop their instrument, contains CORE items (unshaded boxes), EXPANDED items (shaded boxes), OPTIONAL modules, and Response options, and coding column, used to facilitate data management (Table 4). The STEPS instrument was supplemented with the WHO step tool recommended show cards that were used to enhance the recalling capacity of the participants. These validated questionnaires were translated into Amharic

languages (i.e. the regional and local working language). The questionnaire is translated into English, reviewed by the STEPS, and then back into the Amharic language, **with the help of a multi-lingual individual**, and ultimately used for the data collection (Table 5).

Table 5; Components of step tools variables used, PLHIV, Gedeo-Zone, Southern Ethiopia, 2017-2019

Steps	Core	Expanded	Optional
Step 1: Behavioral	Basic demographic information, including age, sex, literacy, and the highest level of education.	Expanded demographic information including years at school, marital status, employment status, household income	
	Tobacco use, alcohol consumption, fruit and vegetable consumption, physical activity	Smokeless tobacco use, Past 7 days drinking, History of blood pressure, treatment for raised blood pressure, history of raised blood pressure and diabetes, CVD/cholesterol and their treatment	
Step 2: Physical measurement	Weight and height, waist circumference, blood pressure	Hip circumference,	
Step 3: Biochemical measurement	Fasting blood sugar, Total cholesterol,	HDL-cholesterol, LDL-cholesterol, and fasting triglycerides	

Adopted from the WHO Stepwise survey manual attached in the annex for reference (148).

Step Tool 1: Questionnaire

The purpose of the questionnaire tool was to gather demographic and behavioral characteristics. It was used to collect data on respondent's demographic and socioeconomic status; like age, sex,

occupation, marital status, and ethnicity, etc. Also, it was employed to collect behavioral characteristics like tobacco use; alcohol consumption; diet, including fruit and vegetable consumption, oil and fat consumption, meal consumption outside the home; physical activity; Khat use, history of raised blood pressure, diabetes, raised cholesterol and/or CVDs, and lifestyle advice.

Step Tool 2: Physical measurements

The purpose of the physical measurement tool was to build on the core data in step 1 and to determine the proportion of the study subjects with raised blood pressure, overweight, and obesity.

Height and body weight were measured using the 220 SECA Scale placed on a firm, flat surface. During measuring of height, the PLHIVs are asked to remove their shoes, heavy outer garments, and hair ornaments, and headdresses. Also, he/she is asked to stand with his/her back to the height rule and is asked to look straight. Often, at the beginning and end of each examination day, the height rule checked with standardized rods and reported if the error is above 2 mm. during measuring of weight, the PLHIVs are asked to remove their heavy outer garments (jacket, coat, trousers, skirts, etc.) and shoes. For subjects refuse to remove trousers or skirt, orienting of the subjects to empty their pockets and then, recording of the fact in the data collection form was made by the data collectors. After that subjects were asked to stands in the center of the platform, to ensure an even weight distributed to both feet and then to reduce observer-associated measurement error. Moreover, a daily calibration of the measurement scale was run. Usually, calibration of the scale is made at the beginning and end of each examining day by using the standardized weights and then reported if the error was above 0.2 kg. Ultimately, the data gathered on body weight and height were used to determine body mass index(BMI). The BMI is calculated based on the formula ($BMI = \text{Body weight (kg)} : \text{Body height}^2$), which is a ratio of body weight in kilograms to the square of body height in meters.

Waist and hip circumferences were measured by using a constant tension tape meter with millimeter precision. Waist circumference (WC) was measured by placing a tape measure around

the abdomen at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest of the hip bone, with the bare or light clothing, at the end of a normal expiration. Hip circumference (HC) was measured by placing a tape measure around the hip at the maximum circumference over the buttocks or around the greater trochanter of the femoral bone. Once per month, the length of the measuring tape is checked with the calibrated length rod (usually the 150 cm one) and the replacement was made if the measuring tape is stretched.

Blood pressure(BP) measurements were taken in a sitting position, with the arm and back are supported, and feet resting firmly on the floor (not dangling). The measurements were taken three times on the right arm of the PLHIVs in a sitting position, by using the NUTEC BP09 Arm-type Fully Automatic Digital Blood Pressure Monitor with Cuff Circumference (Approx.135 (W) 485(L) in mm (medium Cuff; Fits arm Circumference 22-36 Cm)). The measurement was taken after the participant had rested for 15 minutes, and each with three minutes of rest between the measurements (with the maximum tolerable deviation of cuff pressure measurement ± 3 mmHg among the measurements). Finally, the mean of the three measurements was taken for analysis.

Note that all the physical measurements were run in a place where that has been screened off from other people that maintain the privacy of the study subjects. Also, the development of good leadership and management within the data collecting teams, making of right measurements, use of a robust and similar instrument to all study sites, documenting of standard operating procedures (SOP's), provision of training for data collectors and supervisors along with what to do when to do schedules, recording of the time of the day of measurement, close monitoring and taking off early corrective and preventive actions were the different activities made to the standardization of all physical measurements. Lastly, the ATP III criterion reference cut-off was used for each physical measurement and define abnormal measurement indices.

Step Tool 3: Laboratory analysis

The purpose of the laboratory analysis tool was to build on the core data in step 1 and step 2 and measure the proportion of the study subjects with diabetes, raised blood glucose, and abnormal

lipid levels. Laboratory tests were performed the next day or sometime after completion of STEPS 1 and 2 of the data collection process, with 8–12 hour overnight fast by drawing of 3-5 mL Venous blood. All blood samples were drawn in a sitting position. Blood samples were taken from the vein in the antecubital fossa. Before blood collection, the subject was instructed to remove tight clothes that might constrict the upper arm. During blood collection, the arm should rest on a pillow or other supportive prop.

The blood samples were collected into gel tubes and centrifuged with 5000 (rpm) for 5-15 minutes using a centrifuge machine to separate the serum from the whole blood. All samples were centrifuged no later than 20-35 minutes after drawn and at a temperature of 15-24°C. After centrifugation, the tubes were inspected carefully to recognize possible hemolysis, and the serum/plasma promptly separated from the clot or cells and transferred to a clean tube. The serum/plasma analysis is not possible on the day of sample collection, but within the next three days, samples are stored at +4°C in the refrigerator. For analysis is not possible within three days, the serum or plasma immediately stored and frozen at preferably at least -20°C until analysis. Transporting frozen samples was undertaken with great care by properly recorded separated tools marked with identification codes, time of sample collection and transfer lists kept to check for possible disappearance of samples.

The biochemical analyses were done to all serum transported from other study sites and also the samples collected at Dilla University College of health science and medicine hospital (DUCHMH) clinical Diagnostic Laboratory (i.e. the centralized unit where the biochemistry analyses were fully performed). The serum samples were analyzed for lipid profile (High-density lipoprotein cholesterol (HDL-c), Triglyceride cholesterol (TGL_c), Low-density lipoprotein cholesterol (LDL-c), and Total cholesterol (TC),) and fasting plasma glucose level measurement, using MENDRAY BS-200E Clinical Chemistry Analyzer. While an enzymatic colorimetric assay method was used for the measurement of TC (CHOD-PAP method) and triglyceride (GPO-PAP method). A direct homogeneous enzymatic colorimetric assay technique was employed for HDL-c and LDL-c measurements. Also, the glucose level was measured by the

glucose oxidase method (GOD-PAP). All the reagents used for the biochemical analysis were from Human Gesellschaft für Biochemica und Diagnostica mBH (Germany).

Often, to check the correct functioning of instruments, laboratory reagents, and technical performances, the quality control samples together with patient samples were run before running patient samples. For each type of assay, the laboratory obtains quality control materials. The linearity over the usual working range of the assay was tested and checked repeatedly, with at least three standards in each run during the study time. All laboratory performances were done by lab technologists and using standard operating procedures (SOPs) from sample collection to result in release. Besides, documentation of time and date of sample collection and completion of analysis were made to each sample to standardize the analysis. Finally, the revised ATP III criteria reference cut-off was used to define any abnormal biochemical measurements.

Paper III

Focus Group Discussions (FGDs) guide: a semi-structured open-ended FGD guide was used to enhance the discussion. The guide was first adopted from previous studies done (25, 26), and then adapted into the current study contexts of the phenomenon under investigation. It contains all the fundamental components that help the participants feel a sense of comfort while they give an answer to delicate questions and develop a feeling of closure before they leave. The introduction section fully explains the purpose of the study, consent, confidentiality, and the reimbursement scheme. The main questions were structured based on the conceptual framework of knowledge, attitude, and practice (KAP) using PEN-3 model-constructs as a theoretical basis. In which questions were sequenced in the logical sense holding a neutral ice-breaker, the transition, and wrap-up questions to mark the end of the discussion and give one more chance to participate to share their opinion and thought. The rest main questions were similarly structured in (Table 6). Exactly 2-hours were allotted for the discussion, after pre-testing of the guiding, arranged in Dilla health center in between five (two male and three female PLHIVs) not considered for the main study.

Table 6; Simple schematic structure of the FGDs Guide, the sociocultural contexts of MS, among PLHIVs, Gedeo-Zone, Sothorn Ethiopia, 2018

S.N	Topic	PEN-3 domain	Conceptual Framework
1	Personal source of knowledge about MS, risks and long-term outcome Extended families role in knowledge acquisition Neighborhood role in knowledge acquisition	Cultural Identity	Knowledge
2	Personal perception of MS, risks and long-term outcome Enabler of personal attitude towards MS risks Nurturer of personal attitude towards MS risks	Cultural relationship and expectation	Attitude
3	Positive (beneficial) practice held about MS risks Existential (neither beneficial nor harmful) practice held about MS risks Negative (detrimental) practices held about MS risks	Cultural empower	Practice

4.6. Data management and analysis

4.6.1. Data management

Paper I and II

Training and pre-test:

Four teams were formed in each of the selected health institutions' chronic HIV care clinics (CHCCs), in collaboration with the laboratory unit in each site, to accomplish the data collection procedures. Each team comprised of six people; data collectors (nurses and laboratory technicians) and supervisors (health officers, medical doctors, or nurses with 1st degree and

above) who were recruited based on their quality of work experience in the data collection. They were deployed in the study after two days of on-site training, which has been organized by the principal investigator(PI) in collaboration with each health care institution selected for the study. A total of 19 data collectors and 5 supervisors were attended the training. This training was followed procedures outlined in the STEPS Training Manual provided by the publisher that primarily focused on the survey questionnaire, physical measurement, and blood collection, and sample transportation to the central biochemistry laboratory unit located in Dilla University referral hospital. The training also comprised interactive sessions to introduce data collection methods for STEPS 1, 2, and 3 of the survey. Subsequently, pretesting of the questionnaire by considering 5% of the total sample size required was made to detect any possible problems in the flow of the questionnaires, language, the length of time, required for interviews, as well as any problems anticipated by the time. The pre-test was taken place in Kebado health center, Sidama Zone, Ethiopia; which was not included in the main survey; eventually, group rectifications were cautiously discussed and explained.

On the day of data collection, the ART nurses delivered general information verbally on the study's aims and assess their eligibility. This was followed by securing written consent to each volunteer, one by one. The collection of 3-5 mL of venous blood was carried out on the day for those fasted or at any time after completion of STEP 1 and STEP 2 data collection and whenever they came back fasted at least for 8 hours. The blood collection was conducted at each of the selected health facility laboratory units of study; in which blood was centrifuged for plasma separation, stored in the deep freeze refrigerator for some time until analysis. Hence, the overall role of the laboratory professionals was to act as per the SOPs established for the study site; to routinely withdraw the required amount of venous blood, and transported the serum to the central area for performing biochemical analysis. The role of the supervisors assigned in each health facility was to mentoring the overall activities of the data collectors; whether or not abiding with the necessary study protocols, resolving of any of the matters encountered, by the data collectors during the study time, and even taking part on checking data completeness, before it was submitted to the principal investigator.

All the time, after the completion of data collection, the completeness of each tool was checked by the immediate supervisor. The data collectors filled in the date and signed each questionnaire, which was later checked, edited, and signed by the supervisors regularly at each institution. Usually, for any incompleteness encountered, the teams were initiated by those supervisors to directly react and took all the necessary corrections. This checkup was supplemented by the principal investigator sometime later by taking 5% of the sample collected. The data that was collected using hard copies were kept in a locked file cabinet by each supervisor until gathered by the PI during supervision. Last of all, merging of the completed data, which were separately filled clinical (step 1 and 2) and laboratory (step 3) data tools as per the labeled unique ID number were made by the PI, and then stored in the locked file cabinet of the PI office arranged in the university hospital until initiation of the data entry process.

The cleaned and coded as per the unique patient ID were entered into a template formed using Epidata version 3.1 software and then transformed into Statistical Package for Social Sciences (SPSS) Version 22 for further analysis. In which, descriptive statistics using frequency and summary measures like mean, minimum, maximum, and outliers were used to clean the data before further analysis.

Paper III

Team's formation and training provision: Two weeks before conducting the study, there were three teams established in the selected health institutions for the current study; a research team and two task teams. The research team was formed with the combination of the chief author and two public health professionals; all having with 2nd Degrees and sound experiences in research and the profession. The particular role of the main author was in moderating the whole discussions, while the rest research team members were engaged in note-taking, documentation of audiovisual data, and field notes expansion. The other team was the two task teams', which were formed with the combination of three health workers and two adherence counselors (male and female), served under each ART-clinic of the study health facilities. Their main role was to engage in the recruitment of subjects. During which, each participant has got a chance to spend some time with the team members' that the likely chance of introduction amongst each other was

obvious. All these members were deployed in the study after they were provided with two days of onsite training.

The audio recording of all discussions was made by using a Huawei P7 smartphone digital sound recorder and was saved to a micro SD-card in the MP3 format and backed up daily to the lead author's laptop computer to prevent any unnecessary events. All the discussions were correspondingly recorded on video and pictures using a Sony digital camera (Sony Lens, 5X Optical Zoom; 3,2-6,4/4,6-23). In which the files were stored on the SD-card, and then backed up to the researcher's computer as usual for similar reasons. These audio-visual data are used to recall the events. Besides, the field note on verbal and non-verbal cues was taken partly using a short way of nonfiction using a Sinar-Line notepad and Lexi-pen. The documentation of all of the originally formed physical data was accomplished in one place in a locked filing cabinet for each study site, using the large heavy-duty archival envelope per-event with an archival information sheet. These envelop consists of typed transcripts, expanded field notes, debriefing notes, handwritten versions of the notes, and SD digital audio and video records. Subsequently, all of the above qualitative primary data formed and existed in the form of soft copy were uploaded into Atlas. ti 7, version 7.5.7 qualitative data analysis (QDA) software, as a primary documents family (PD). The entire primary document families of the study were then stored in a large electronic envelope called "project unit" or "Hermeneutic Unit," made with the title of the study. Together, SPSS (version 22) software was used to handle and analyze the quantitative (survey) data. The underline reason to use SPSS than the QDA software was due to the limited capacity of the later software to accommodate each socio-demographic related characteristics as a primary documents family (PD), together with the qualitative data.

4.6.2. Data analysis

Paper I

Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) Version 22 by the principal investigator in consultation with the primary and secondary supervisors, using appropriate methods. The proportion, mean, and standard deviation measures were statistical techniques used to estimate the physical and biochemical associated risk factors.

Charts were produced using Microsoft® Excel 2010. The proportion of each MS trait and overall MS were estimated through frequency analysis and differences between groups were calculated with a 95% CI. Margins of error in proportion are represented by numeric values for the lower and upper limits of a 95% CI. Further, a binary logistic regression analysis, using a two-sided test of significance of the difference of the estimated magnitude of overall MS among ART exposed and ART naïve groups were used and considered significant at a P-value of <0.05.

Paper-II

As well, for this paper, the proportion, mean, and standard deviation measures were statistical techniques used to measure socioeconomic and demographic, HIV/AIDS, and lifestyle/behavioral and biochemical associated exposure factors. The dependent outcome variable was dichotomized as having metabolic syndrome (MS), and not having MS. Bivariable logistic regression was performed to see the crude association between the exposure and the outcome variable. All variables significant at $p < 0.1$ level, in the bivariable analysis were moved to multivariable analysis using an enter method to control the effects of confounding and to identify predictors of MS occurrence. All exposure factors with $P < 0.1$ in the bivariable analysis were entered once in the multivariable analysis, and those significant variables at ($p < 0.05$) were determined as predictors. To each predictor, the adjusted odds ratio (AOR) together with 95% CI was estimated to assess the presence and strength of associations. All statistical tests were two-sided and considered statistically significant at a P-value of <0.05. Moreover, the goodness of fit of the model was checked using the Omnibus test of significance, model summary, Hosmer-Lemeshow goodness of fit test, and the classification table, before interpretation of the finding. The presence of multicollinearity was correspondingly checked using the variance inflation factor (VIF) before multivariable regression analysis (objectives II). The result indicated that multicollinearity was a problem using VIF more than 10 as a cut of point for the type of ART regimen and first-line ART regimen variables against with the ART status. Thus, while the later factor along with the rest significant exposure variables determined in the Bivariable analysis decided to be entered in the final analysis, the prior two factors were decided to be removed from further analysis for their lower correlation with the outcome.

Principal Component Analysis (PCA)

The index of wealth status, as a composite indicator of socio-economic status, was computed by the application of the principal component analysis (PCA). Originally, household asset data were prepared for analysis. Before the PCA, using frequency, important variables that can discriminate households were selected to reduce the number of variables. The binary variables were coded to 0 and 1 and categorical variable options were converted into binary variables and the dummy variable was created as 0 and 1. Missed values of binary variables were coded as 0. After data preparation, variables were standardized to change variables into the same scale for comparison by subtracting the mean from each value and then dividing by the standard deviation. Once standardized, the variables have a mean of zero and a standard deviation of 1.

A total of 28 variables were considered for wealth index construction. A Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy was made and identified as meritorious (0.83, which is > 0.5 the lowest acceptable value) together with Bartlett's Test of Sphericity that determined as statistically significant (< 0.001). Of all entered variables, however, 8 variables were dropped as their communality scores were less than 50%. The rest 20 variables, including having of electricity, kerosene, watch/clock, radio, television, mobile phone, nonmobile phone, table and chair in the households; mainly use natural gas, biogas, wood, straw/shrub/grass for cooking, agriculture crop, and animal dung for cooking; a place where cooking made and presence of separate room used as a kitchen; having corrugated iron sheet roof; having any agricultural land and any livestock/herds in the households were included for further PCA. In PCA, the sum of the components with Eigenvalues greater than one should explain 40-60% of the total variance explained. And in the current study, the eight components explained 56.6% of the total variance, which was above the recommended minimum value. Wealth index values were calculated by summing up the scores for the 8 components. Finally, the index was developed by categorizing the sum of components into five equal parts, and the parts were ranked as 1-lowest quintiles, 2-second quintiles 3-middle quintiles, 4-fourth quintiles, and 5-highest quintiles.

Paper III

The data analysis procedure was iterative accomplished through use of a thematic data analysis strategy or methods. Although the final step of the analytic procedures was done by

GirmaTenkolu (GT) alone, however, Sadat Mohamed(SM) was besides involved in the first phase of the analysis. To enhance this, GT and SM were met several times and discussed the extent to which categories reflected in the data and reached consensus on the segmentation, a summary text data formation, and partial determination of coding and code category. In the coding process, each data item has been given equal attention and codes have been thoroughly inclusive and comprehensive. All relevant extracts for each code have been collated and checked against each other and back to the original data set to maintain it to be internally coherent, consistent, and distinctive. Overall, enough time has been allocated to complete all phases of the analysis adequately without rushing a phase or giving it a once-over-lightly. Based on the individual and approaches used, the analysis was completed in 3 phases.

The first phase was iteratively characterized with step by step activities of data capturing and transcription. It was accomplished with the integration of GT and SM manually using the pre-established codebook, which was constructed using the model as a theoretical basis and the KAP as conceptual frameworks (*Codebook attached in annex 2*).

The second phase of the analysis likewise lasted from data transformation to translation. Initially, all transcribed text data existed in hard copy, and the Amharic language was soon transformed into soft data, with the help of two secretaries. Subsequently, translation of each document from its original language to English, which accomplished sometime after all data collections were ended with the assistance of a bachelor's degree holder English teacher on a foreign language from Cambridge University, in the UK. After that, the transformed and translated text data was cross-checked against its original document through the taking of several samples by the lead author, before using it in consecutive phases.

The third phase of the analysis was a step by step activity that ranges from uploading primary data into computer software up to the synthesis and formulation of the themes. In this phase, themes were established using the PEN-3 model constructs to push the conclusions toward the conceptual framework of knowledge, attitude, and practices (KAP). Uploading primary data was made using the above-referenced software. The synthesis and theme formation processes were

made in five steps. Initially, reading the transcript document several times, back and forth, and understanding the overall contexts of each transcripts was made. After that a summary of each transcript was formed. Subsequently, reviewing of the summarized transcripts and coding (labeling) of them was done openly by selecting the words, phrases, clauses, and sentences as a meaning unit using thematic analysis method. Then, sorting (grouping) of each codes based on the relationship amongst each other, code frequencies and the underline meaning were made to categorizing them. Lastly, synthesizing (i.e. putting them in to peace's) of the categories, and developing of the main theme as the Knowledge attitude and practices.

The codes, categories, and theme were then compared with initial codings, made manually in the previous data analysis phases and with the interview data to ensure exhaustiveness of the participants' stories told. Moreover, a review of the conceptual and theoretical frameworks revealed a pattern not seen before analysis, constraining of the themes along with the lines of the theoretical framework and the conceptual framework were completed. This is because, since the current study was grounded with the model, coding the data along with the major domains and sub-domain of the model allows the lines of connection between the theoretical and conceptual frameworks more direct and clearer. Finally, production of the reports with the selection of vivid and compelling extract examples was made and then sent to the study participants for further verification of the findings.

4.7. Variables and operational definition

4.7.1. Outcome variable

- iv. Metabolic syndrome (MS):** The outcome of interest for the first and the second papers was measured using both the revised National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP III) criteria. Based on this criteria; MS is defined with the presence of three of the five criteria below: Waist circumference ≥ 102 cm or 40 inches (man), ≥ 88 cm or 35 inches (woman); Triglycerides ≥ 150 mg/dl or treated; HDL cholesterol: < 40 mg/dl (Man), < 50 mg/dl (woman) or Treated; Fasting plasma

glucose ≥ 110 mg/dl ; Blood pressure (≥ 130 mmHg systolic or ≥ 85 mmHg diastolic) or treated with antihypertensive medication(12, 17-19).

- v. **MS-traits: are measured as ATP III criteria**, which comprised of: the history of raised Blood Pressure/Diabetes/Cholesterol: Blood pressure/Diabetes/cholesterol measurement and diagnosis among all respondents; Blood pressure/ Diabetes/Cholesterol treatment among those diagnosed: Raised blood pressure/ Diabetes/Cholesterol /treatment results among those previously diagnosed with raised blood pressure/ Diabetes/Cholesterol; Physical measurements: elevated waist circumference, body mass index, systolic and diastolic blood pressure; Biochemical measurements: elevated fasting plasma glucose, elevated triglycerides, and lower high-density lipoproteins(12); where all dichotomized as (yes=1, no=0).

4.7.2. Explanatory variables and operational definition

- i. **Socio-economic and demographic characteristics:** Age in year categorized in to (0= ≤ 34 , 1=35-44, and 3= ≥ 45); educational status grouped in to (0=no formal schooling, 1=less than primary school, 2=primary school completed, 3= secondary school completed, 4=high school completed), and occupation considered in to (0=government employed, 1=NGO-employed, 2=self-employed, 3=student, 4=homemaker). Wealth index (1-lowest quintiles, 2-second quintiles 3-middle quintiles, 4-fourth quintile, and 5-highest quintiles) (149).
- ii. **HIV/AIDS-related factors:** Antiretroviral therapy state categorized into (0=ART exposed and 1=ART naïve), and the WHO staging categorized in to ($<$ stage III and $\geq$ III stage). The WHO staging is categorized in to (0 $<$ stage III and 1 $\geq$ III stage). Besides, it also incorporated the following exposure factors, which entails duration since diagnosed with HIV, duration on ART, functional status, CD4 levels, Viral RNA levels, TB status, and Opportunistic infection (OI's) other than TB; where all dichotomized as (yes=1, no=0).
- iii. **Lifestyle/behavioral risk factors:**
 - **Smoking state** is measured based on classifying all respondents as Non-smoker or ever not smoked, which is coded as (0=no) and all smoker smoker (current, current daily, and past smokers) which is coded as (1=yes).

- **Alcohol consumption status** is measured based on classifying all respondents as ever consumer of any alcohol coded as (1=yes) and lifetime abstainer that is coded as (0=no). Ever consumer / consumer of any alcohol represents current alcoholic drinker (past 30 days) which is coded as (0=No and 1=Yes) and past alcoholic drinker (drank in the past 12 months) which is coded as (0=No and 1=Yes).
- **Physical activity (or inactivity)** can be described in different ways. The two most common ways are (1) to estimate a population's mean or median physical activity using a continuous indicator (MET-minutes per week or time spent in physical activity) (2) to classify certain percentages of a population in specific groups by setting up cut points for a specific amount of physical activity. When analyzing GPAQ data, both continuous as well as categorical indicators are used.
- **The participants total physical activity state** in this study was measured by adding of the participants given yes answer for work, transport and recreational related activities, and then ultimately categorizing them (active=1), as well as those given no answers for the above referenced type of activities and categorize them as (inactive=0).
- For the calculation of the categorical indicator on the recommended amount of physical activity for health, the total time spent in physical activity during a typical week and the intensity of the physical activity are taken into account. **As per the WHO recommendation on PA for health**, throughout a week, including activity for work, during transport and leisure time, adults should do at least: the percentage 150 minutes of moderate-intensity physical activity OR 75 minutes of vigorous-intensity physical activity OR An equivalent combination of moderate- and vigorous-intensity physical activity achieving at least 600 MET-minutes.
- For comparison purposes, the cut-offs from former recommendations are also included in GPAQ data analysis. The percentage of respondents classified into three categories of total physical activity according to former recommendations as **high, moderate, and low physical activity (PA)**. High physical activity was defined whenever a person reaching any of the following criteria: classified in the category of vigorous-intensity activity on at least 3 days achieving a minimum of at least 1,500 MET-minutes/week or-7 or more days of any combination of walking, moderate- or

vigorous-intensity activities achieving a minimum of at least 3,000 MET-minutes per week. Moderate activity was defined when a person not meeting the criteria for the "high" category, but meeting any of the following criteria are classified in this category 3 or more days of vigorous-intensity activity of at least 20 minutes per day or- 5 or more days of moderate-intensity activity or walking of at least 30 minutes per day or- 5 or more days of any combination of walking, moderate- or vigorous-intensity activities achieving a minimum of at least 600 MET-minutes per week. Low activity was defined while a person not meeting any of the above-mentioned criteria falls in this category.*(For more information, see Annex 3 the description and instrument questions of behavioral factors table attached)* (150).

4.7.3. Sociocultural contexts

Sociocultural contexts in this study perspectives refer to any cultural, personal, familial, social, environmental, structural or organizational, economic, historical, political, ethnic, religious, and other factors that either promote or hinder individual behaviors of knowledge, attitude, and practices (KAP) associated with MS risk prevention and control of long-term complications(23).

i. . The knowledge, attitude, and practice

Definitions were adopted from previous literature (25, 26), and adapted in the current study contexts, and used in the qualitative section of the study.

- **Knowledge:** Knowledge was defined as adequate if one knew MS at all, and/or knew at least three of its components or knew the risk factors and the basic methods for prevention and control of MS or either of the components of the syndrome, mainly of diet, exercise and other lifestyle-associated practices (smoking and alcohol use). Conversely, knowledge was defined as inadequate if one had heard of MS or either of its components but was not clear what it was or about methods of prevention and control.
- **Attitudes:** was defined as favorable if the knowledge, regardless of its extent leads to actions/behaviors or practices intended to prevent or control either of the components of the syndrome. It conversely was defined as unfavorable if, regardless of the level of knowledge about MS and risk factors, no efforts were made to determine the personal status or initiate practices to prevent MS, and monitor, or control it.

- **Practices:** practices were defined as adequate if, regardless of the level of knowledge and attitude about MS risks, one ate fresh fruits and vegetables > 3 days /week and exercised intentionally at least 3 days /week, and abstained from any other bad lifestyle associated behavior (i.e. such as smoking and alcohol use). In turn, it was defined inadequate if, regardless of the level of knowledge and attitude about MS, fresh fruits and vegetables eaten, as well as engaged in intentional physical exercise fewer than 3 days/week, and in general engaged in unhealthy practices such as bad feeding habit, running residential life, tobacco smoking and drinking of Alcohol.

4.8. Data quality assurance

Paper I and II

Typical data quality control procedures were implemented in each critical stage of the study. It started at the very beginning during the design of the data collection instrument and translation to the local language, pre-testing, training of data collector and supervisors, the physical handling of the tool and data, to the final data entry and analysis. The tools were translated into local languages (Amharic) and then translated back to English. The designed questionnaire was pre-tested at the field level with similar clients at a location that has not been selected for the actual survey. Based on the pre-test results, the questionnaires were further reviewed and finalized.

Trained nurses working in the chronic HIV care follow up clinics were involved in the collection of socio-demographic, behavioral, clinical, and physical characteristics from the patients. To ensure that all data collectors are aware of their duties, detailed to-do lists were prepared with day to day schedules. The checklist was also prepared for data collectors to check their performance against the time allocated. The proper functioning of instruments, laboratory reagents, and technical performance was checked by using quality control samples. Standard operating procedures (SOPs) were followed starting from sample collection up to result reporting. All laboratory procedures were handled by laboratory technologists.

Intensive monitoring and follow-up during each phase of data collection were undertaken by immediate supervisors. The principal investigator carried out monitoring in the field and provided technical and logistical support to data collection teams throughout the data collection process. During monitoring, the principal investigator randomly selects 5% of completed tools and rechecks them with the responses of the client checks ID variables, and check that questions are being properly understood and completed. Corrections and clarifications were carefully discussed and explained to the data collector and supervisors.

The quality of data was further ascertained during the data entry and analysis phases. Double data entering procedure using Epidata Version 3.03 was done with the help of two data clerks; eventually, validation of data against the original data was performed. Ranges and necessary rules for variables were set during template preparation, so that unlikely values were rejected and skipping patterns were maintained, during the data entering procedure using that software. In the analysis phase, the quality of the data was also maintained through use of the missing at random (MAR) assumptions and an expectation and prior knowledge analysis method to handle the corresponding missing of interval/ratio and categorical variables.

Paper III

The trustworthiness of the data was ensured through doing the following actions as follows: pretesting the FGDs guide; prior establishment of trust among the research team and the participants before the discussion; by triangulating the data found from different sources,(FGDs and interview), attaining of data saturation, allowing member verification during data collection and or at the end of the study through sending of report, by inspecting the codes and code categories after discussion; making of comparison of codes, categories, and the main theme with the interview data; by arranging a peer debriefing at the end of each data collection with research members to ensure frequent revision of the concepts and classifications developed from the data by the members on the degree of fitness until a consensus was reached; spending of much time with the data on reading it back and forth; and vivid outlining of the context and analytical steps. Besides, it was maintained through fine-tuning of the categories and quotations from the interviews and the results by different public health professional editors.

4.9. Ethical considerations

All the ethical guidelines and principles placed in the Declaration of Helsinki and others, necessary to address the ethical consent of the research initiated in humans were taken into account. Based on this, authorization was secured from different legitimate organizations. Initially, ethical clearance was sought after the proposal was submitted to Addis Ababa University (AAU) College of Health Sciences School of public health Research and Ethics Committee (REC) and then to the College of health science Institutional Review Board (IRB) (Meeting No.001/2017 and protocol No.0069/16/SPH). Subsequently, the official letter granted from the School of public health was submitted to the Southern Nations Nationalities Regional health bureaus (SNNPRs), and then to the Gedeo zone health bureau. Also, permission letters obtained from the Gedeo zone health bureau were distributed to the respective district and town administrative Health Office, and then to all of the institutions chosen to conduct the study.

Participants were engaged in the studies voluntarily after they have been provided with the detailed explanations on the possible benefits and risks in participating in the study. It was ensured through taking of ethical oral consent followed by written consent.

Confidentiality of the study participants' data was collected unlinked anonymously using codes during data processing without naming of the study participants. Physical measurement was done at an ART clinic room that has been screened off to maintain the individual's privacy. The participants were assured that the original data will be locked in cabinets after the data analysis was carried out and the information that it will not be used for any purpose, other than what the participants consented for. Besides, they are guaranteed that the qualitative data will be preserved in the lead author's side for some time and destroyed, as per Addis Ababa University, IRB schedule for its confidentiality concern.

The participants were assured that the research project does not have any kind of physical harm, social discrimination, psychological trauma, and economic loss risks. Also, study participants were informed that the research process has a form of inducement, but has no coercion and not bring any risks that incur compensation. Maximum efforts were made to increase the beneficence

aspect of the study participants during data collection. All biochemical analysis was performed free of charge, and results were provided to the clinicians for further investigation and possible management. At the end of each interview, patients received advice to improve lifestyle associated behaviors. Patients found sick during the data collection period were urged to seek care in the existed health facility. Also, in areas where there were health problems, health workers and supervisors were communicated with the assigned specialized physician to take actions to reverse the problem.

4.10. Summary table of study objectives and methods

The table below describes the study objectives and the methods of the dissertation (Table 8).

Table 7; Summary table of study objectives and methods, among PLHIVs, Gedeo-Zone, Sothorn Ethiopia, 2020

S N	Study Objective	Desig n	Subj ects	Sample size	Data collection	Analysis
1	To estimate and compare the magnitude of overall metabolic syndrome, among HIV infected patients exposed for antiretroviral therapy and ART naïve using the ATP III criteria, in Gedeo-zone, Southern Ethiopia (Paper I)	Comparative cross-sectional	Among people living with HIV	n=687 (n1=229 for ART naïve and n2=458 for ART exposed)	Interviewing, physical examination, and laboratory blood analysis result using WHO ^d steep tools	Descriptive statistics like proportion, mean and standard deviation, and analytical, statistics like binary logistic regression, and P-value
2	To determine the predictors of metabolic syndrome, among people living with HIV, in Gedeo Zone, Contr	Unmatched Case-Control	Among people living with HIV	633(139 metabolic syndromes diagnosed	Interviewing, physical examination, and	Descriptive statistics, proportion & cross-tabulation, Bivariable and

	Southern Ethiopia(Paper-II)	ol	livin g with HIV	cases 494 controls)	and	laboratory blood analysis result using WHO steep tools	multivariable logistic regressions, Hosmer–Lemeshow goodness-of-fit tests, multicollinearity checked by VIF ^e
3	To understand the role of sociocultural contexts in forming adult HIV- patients' behavior towards metabolic syndrome and its lifestyle risks (Paper III)	A dedac tive Descr iptive pheno meno logica l study	Peop le livin g with HIV	32 PLHIVs ^f (3 0 involved in the FGDs and 2 involved in the in- depth interview)		FGDs and in-depth interview guide grounded with PEN- 3 model construct & KAP as a CFW	Thematic analysis, using the PEN-3 ^h model constructs as a theoretical basis and KAP as a conceptual framework

a-HIV: Human immunodeficiency virus
d-WHO: World Health organization
f-PLHIVs: People living with HIV

b-ART: Antiretroviral Therapy
e –VIF: Variance Inflation Factors
g-FGDs: Focus Group discussions

C-naïve: unexposed
g-PEN-3: PEN three model

5. Results

5.1. Paper I results

5.1.1. The socio-demographic characteristics

Out of the 687 (229 ART naïve and 458 ART-exposed) required study samples, a total of 633 adult people living with HIV (n=422 on ART and n=211 ART-naïve) were involved, with an overall response rate of 92.1%. While, the highest proportion, 41.2% (87) of ART naïve participants' age were categorized under the middle age range (35-44 years), 56.2 % (237) of ART exposed individuals were grouped under the young age ($\leq$ 34years), with the mean age of (37.18 (+7.43) ART naïve Vs. 36.04+9.21 ART exposed) years old participants. More than half of ((52.6 %(111) and 54.5 %(115)) ART naïve vs. (62.8% (265) and 69.0% (291)) ART exposed) participants were women in their sex and urban residents, respectively (Table 8).

Table 8; proportions of respondent's characteristics, aggregated by ART status, PLHIV, in the Gedeo-zone, southern-Ethiopia, 2019

socio-demographic characteristics	ART Status ^a			
	ART-naïve ^b		ART exposed	
	No	%	No	%
Sex				
Women	111	52.6	265	62.8
Men	100	47.4	100	37.2
Place of residents				
Urban	115	54.5	291	69.0
Rural	96	45.5	131	31.0
Age Groups in years				
$\leq$ 34	78	37.0	237	56.2
35-44	87	41.2	116	27.5
$\geq$ 45	46	21.8	69	16.4

Total duration since diagnosed with HIV				
< 1 year	82	51.9	6	2.8
1-4 Years	76	48.1	144	67.9
5-9 Years	0	0	54	25.5
>= 10 Years	0	0	8	3.8
Marital status				
Single	47	34.1	69	26.1
Married	31	22.5	76	28.8
Separated	29	21.0	48	18.2
Widowed	31	22.5	71	26.9
Educational status				
No formal schooling	69	32.7	94	22.3
Less than 1 ⁰ school	36	17.1	87	20.6
1 ⁰ school completed	54	25.6	157	37.2
2 nd school completed	31	14.7	53	12.6
High school Completed	14	6.6	20	4.7
University/college completed	7	3.3	11	2.6
Occupation				
Government employed	33	15.6	51	12.1
NGO-employed	2	.9	25	5.9
Self-employed	98	46.4	230	54.5
Student	8	3.8	7	1.7
Homemaker	54	25.6	61	14.5
Able to work	16	7.6	48	11.4
Wealth index in quintile				
Lowest	18	13.0	12	4.5
Second	55	39.9	90	34.1
Middle	15	10.9	52	19.7
Fourth	45	32.6	102	38.6
Highest	5	3.6	8	3.0

a-Antiretroviral therapy b-ART naïve: ART unexposed

Moreover, out of the 370 of the respondents who were able to remember their duration of living with the virus after diagnosis, a higher proportion, 51.9% (82) of ART naïve individuals were reported to have stayed less than a year, and 67.9% (144) of ART exposed participants were found within 1-4 years; with a mean duration of (0.94±0.75 ART naïve Vs. 3.70±2.77 ART exposed) years old (Table 8).

5.1.2. Physical and biochemical measurements

The mean and standard deviation for each of the physical and biochemical criterion measurements were computed , and the table below summarized it as follows (Table 9).

Table 9; the mean values of physical and biochemical measurements, by ART status, PLHIVs, in the Gedeo zone, Southern-Ethiopia, 2019

Factor	ART status				Total	
	ART ^a		ART			
	naïve ^b (n=211)		exposed(n=422)			
	Mean	SD	Mean	SD	Mean	SD
Waist circumference (WC)	83.7	8.2	83.5	7.7	83.6	7.9
Body Mass Index (BMI)	22.2	4.4	22.2	4.5	22.2	4.5
Systolic blood pressure (SBP)	126.9	7.8	126.9	11.5	126.9	10.4
Diastolic(DBP)	82.8	5.1	83.3	6.3	83.1	5.9
High-density lipoprotein (HDL_c)	52.8	23.3	58.9	23.8	56.8	23.8
Triglycerides (TGL)	133.5	30.2	145.9	32.3	141.8	32.1
Fasting plasma glucose (FPG)	102.2	30.1	112.6	39.1	109.1	36.7
Total cholesterol (TC_c)	168.9	41.0	181.5	45.2	177.3	44.2
Low-density lipoprotein (LDL_c)	138.4	32.7	146.6	31.9	143.9	32.4

**SD: Standard deviation a-ART: Antiretroviral therapy b-naïve: unexposed*

Furthermore, with regards to the magnitude of each physical and biochemical markers associated measurement, the table below explains more (Table 10).

Table 10; magnitudes of physical, biochemical measures, by ART status, using ATP III criteria, in PLHIVs, Gedeo-zone, southern Ethiopia, 2019

Factors	Magnitude (%) as per ART status				Total		P-Value
	ART naïve		ART				
	(n=211)		exposed(n=422)				
	%	95% CI	%	95% CI	%	95% CI	
Blood pressure (SBP/DBP>=130/85 mmHg ^a)	54.0	47.4-60.2	56.4	52.1-61.1	55.6	51.8-59.6	0.57
Body mass index (BMI>=30kg/M ^{2b})	7.6	4.3-10.9	10.9	8.1-13.7	9.8	7.6-12.2	0.19
Waist circumferences (WC>Women 88 or men >=102 cm)	17.1	12.3-22.7	24.2	20.4-28.4	21.8	18.5-25.3	0.04*
Fasting plasma glucose (FPG>=110 mg/dl ^c)	16.6	11.8-21.3	31.3	26.8-35.3	26.4	23.2-29.9	<0.01**
Triglycerides (TGL_c>=150mg/dl or treated)	25.6	19.9-31.3	42.9	37.9-47.4	37.1	33.0-40.8	<0.01**
Low HDL cholesterol(<40 mg/dl (M),<50 mg/dl (F), or Treated)	41.2	34.6-47.4	30.8	26.3-35.5	34.3	30.6-38.1	0.01**

a-mmHg: millimeter of mercury b-Kg/M²: Kilogram per square meter c-mg/dl: milligram per deciliter

**significant at P<0.01 **Significant at P<0.01*

5.1.3. The magnitude of overall Metabolic syndrome

Based on the clinical examination results and blood chemistry measures, the magnitude of overall MS was estimated using the ATP III criterion, and exactly, 22% (95% CI: 19.0-25.4, by ATP III) of participants living with HIV had MS(Table 11 and Figure 6).

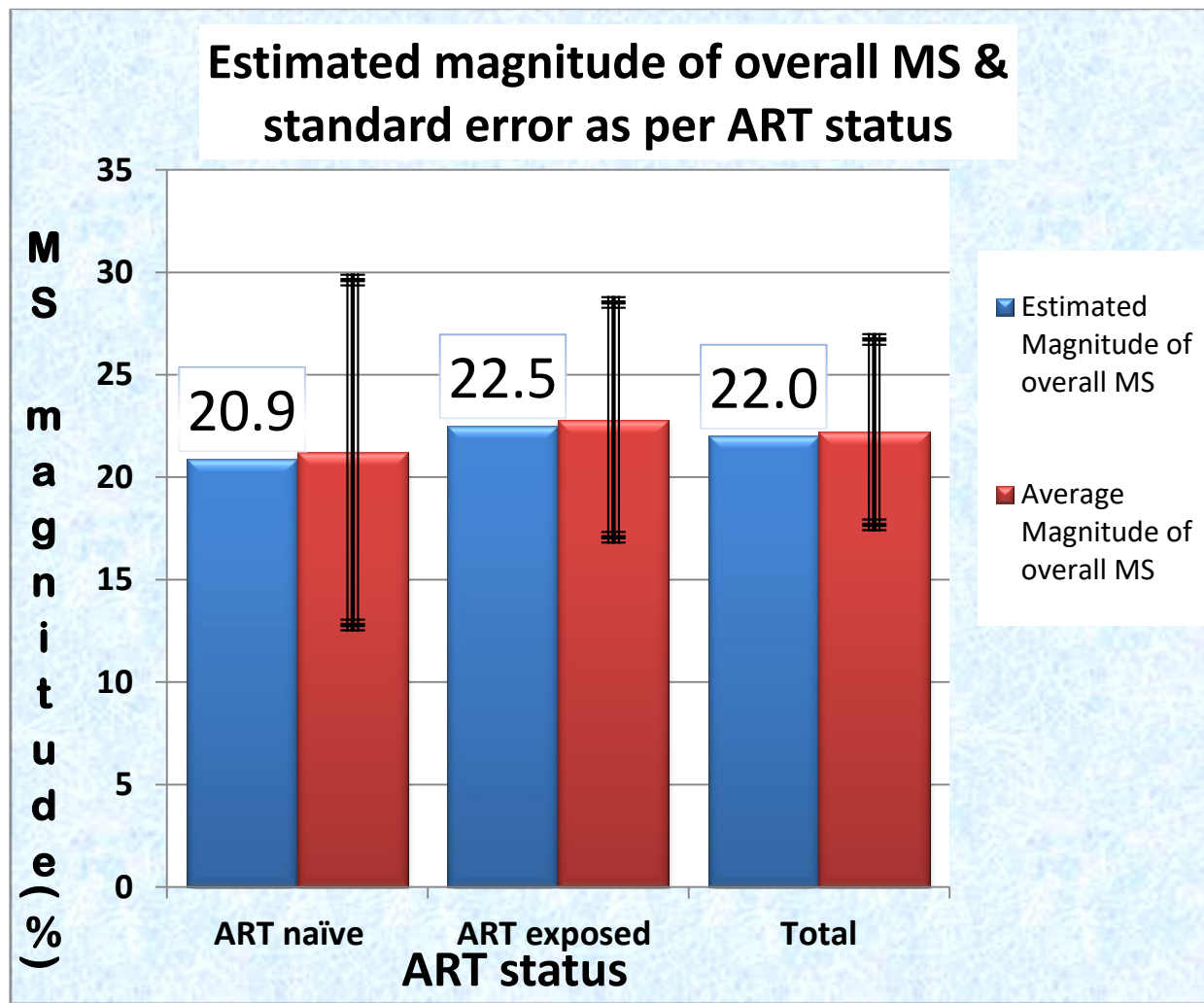


Figure 6; the magnitude of overall metabolic syndrome (MS), along with a standard error by ART status in PLHIVs, Gedeo zone, Ethiopia, 2019

The result prevails relatively higher magnitude in the ART exposed (22.5%, 95% CI: 18.7-26.8, by ATP III) than ART naïve (20.9 %, 95% CI: 15.2-27.1, by ATP III) groups, however, the observed difference was not statistically significant ($P>0.05$)(Table 11)(Figure 6).

Table 11; Magnitude of metabolic syndrome, by ART status in PLHIVs, in Gedeo-zone, southern-Ethiopia, 2019

Factors	n	The magnitude of overall metabolic syndrome	
		%(95% CI) ^b	COR(95%CI ^c
ART status			
ART naïve	211	20.9(15.6-27.0)	1
ART exposed	422	22.5(18.7-26.3)	0.91(0.61-1.36)

a-%MS: Magnitude of Metabolic syndrome

b-%(95% CI): Proportion and its 95 percent confidence intervals

c-OR(95%CI): Odd ratio and 95 percent confidence intervals

5.2. Paper-II results

5.2.1. Socio-economic and demographic characteristics

A total of 633 people living with HIV (PLHIVs) (139 cases and 494 controls) were included in the analysis. More than half, 62.2% (87) the cases were women and 67.6% (94) of them were urban area residents. The result from the bivariable analysis identified age, marital status, education, and occupation as significant factors associated with MS (Table 12).

Table 12; Bivariable analysis, socio-economic and demographic factors and MS, cases, and controls, PLHIVs, Gedeo-Zone, southern Ethiopia, 2019

Predictors	Metabolic syndrome		COR (95% CI)	P-value
	Cases	Controls(n=494)		
	(n=139)			
	Number	Number		
Age Groups in year				
≤ 34	42	273	1	
35-44	52	151	2.24(1.42-3.52)*	<0.01**
≥45	45	70	4.18(2.55-6.86)	<0.01**
Marital status				

Single	22	123	1	
Married	42	147	1.60(0.91-2.82)	0.11
Separated	29	106	1.53(0.83-2.82)	0.17
Widowed	46	118	2.18(1.24-3.84)	<0.01**
Educational status				
No formal schooling	39	124	1	
Less than 1 ⁰ school	24	99	0.77(0.44-1.37)	0.09***
1 ⁰ school completed	45	166	0.86(0.53-1.40)	0.25
2 nd school completed	16	68	0.75(0.39-1.44)	0.08***
High school completed	15	37	1.15(0.49-2.66)	0.60
Occupation				
Government employed	24	60	1	
NGO-employed	7	20	2.44(1.05-5.71)	0.18
Self-employed	67	261	2.14(0.70-6.51)	0.24
Student	12	67	1.57(0.74-3.34)	0.57
Homemaker	29	86	1.53(0.36-6.50)	0.08***
Wealth index in quintile				
Lowest	12	18	1	
second	31	114	0.41(0.18-0.94)	0.04*
middle	8	59	0.20(0.07-0.58)	0.01**
Fourth	28	119	0.35(0.15-0.82)	0.02*
Sex				
Men	52	205	1	
Women	87	289	1.19(0.81-1.75)	0.39
Place of residence				
Urban	94	312	1	
Rural	45	182	1.22(0.82-1.82)	0.33

Notes: *significant at P<0.05

**Significant at P<0.01

***Significant at P<0.1

Predictors: Age groups in the year, Educational status, Ethnicity, Marital status, Occupation, Wealth index in quintile, sex, place of residence

Outcome: cases with Metabolic Syndrome (MS), control without MS

Abbreviations: MS, metabolic syndrome; PLHIVs, people living with HIV; 1⁰, primary; 2nd, secondary; COR, crude odd ratio; AOR, Adjusted odd ratio

5.2.2. HIV/AIDS-related factors

Sixty-eight point three percent of the cases and 66.7 %(327) of the controls were antiretroviral therapy (ART) exposed; of which higher proportion (63.3%(88) of the cases and 65.6%(324) of the control) was on the 1st line regimen. Nearly, two-third of the participants (71.2 %(99) cases and 78.9 %(390) controls) had been found below three WHO staging levels. The mean viral RNA levels were 3501.7 copies per ml (+2379.3) for the cases and 1408.25 copies per ml (+1249.4) for the control (Table 13).

Table 13; Bivariable analysis, in the HIV/AIDS-associated factors and MS, cases, and controls PLHIVs, Gedeo-Zone, southern Ethiopia, 2019

Predictors	Metabolic syndrome		COR (95% CI)	P- value
	Cases (n=139)	Controls(n=494)		
	Number	Number		
ART status				
ART-naive	44	167	1	
ART exposed	95	327	0.91(0.61-1.36)	0.06*
Type of ART regimen				
Non-in ether of the two Therapy [#]	44	167	1	
1st line	88	324	1.03(0.69-1.55)	0.90
2nd line	7	3	8.86(2.20-35.65)	0.02*
1 st line ART regimen				
AZT-3TC-NVP	12	67	1.65(0.609-4.50)	0.14
AZT-3TC-EFV	8	27	1.37(0.68-2.73)	0.98
TDF-3TC-EFV	47	193	3.19(1.40-7.27)	0.37
TDF + 3TC+ NVP	20	35	1.91(1.01-3.58)	0.05***
ABC + 3TC + EFV	1	2	1.69(0.84-3.34)	0.93
NA /Not applicable [@]	51	170	1	1
2 nd line ART regimen				

AZT-3TC-LPV/r	4	1	14.88(0.65-134.24)	0.32
TDF-3TC- LPV/r	0	1	NC	NC
TDF-3TC-ATV/r	2	0	NC	NC
ABC + 3TC + LPV	1	1	3.72(0.23-59.87)	0.35
NA /Not applicable	132	491	1	
Duration since diagnosed with HIV				
< 1 year	19	69	1	
1-4 Years	47	173	0.99(0.54-1.80)	0.96
5-9 Years	11	51	0.78(0.34-1.79)	0.56
Duration since on ART				
1-4 Years	13	48	1	
5-9 Years	27	71	1.40(0.66-3.00)	0.38
Functional status				
Ambulatory	49	123	1	
Working	90	371	1.14(1.00-1.75)	0.02*
WHO staging				
< III stage	99	390	1	
≥ III stage	37	97	1.50(0 .97-2.33)	0.07***
OI other than TB				
No	110	429	1	
Yes	29	65	0.58(0.35-0.93)	0.03*
Recent TB status				
No	117	424	1	
Yes	22	70	1.14(0.68-1.92)	0.62
CD4-levels cells mm3				
<350	18	69	1	
350-500	38	110	1.32(0.70-2.50)	0.39

≥500	83	315	1.01(0.57-1.79)	0.97
Viral RNA levels >=				
1500 copies/ml				
No	130	480	1	
Yes	9	14	2.37(1.00-5.61)	0.05***

Notes: *significant at P<0.05 ***Significant at P<0.1 # Non-in either of the two Therapy: implies those diagnosed as a case /control but without ART exposure
@- NA /Not applicable; implicates the increasing Number observation due to the No of case/control from ART naïve and missing of # 2 observed data from ART exposed.

Predictors: ART status, Type of ART regimen, 1st line ART regimen, OI other than TB, Functional status, WHO staging, Viral RNA levels >= 1500 copies per ml, CD4-levels cells mm³, Duration since on ART, Duration since diagnosed with HIV

Outcome: cases with Metabolic Syndrome (MS), control without MS

Abbreviations: MS, metabolic syndrome; Rx –Therapy; HIV, human immunodeficiency virus; PLHIVs, people living with HIV, ART, antiretroviral therapy; 1st, First; 2nd, second; OI, opportunistic infections; TB, tuberculosis; WHO, world health organizations; RNA, Ribonucleic Acid; ml, milliliter; mm³, cubic millimeter; COR, crude odds ratio; AOR, Adjusted odd ratio

Exactly, 6%(9) of the cases and 2.8% (14) of the controls had more than 1500 copies per ml.

The result from a bivariable analysis has shown that ART status, duration since diagnosed with HIV, opportunistic infections other than tuberculosis, type of ART regimen, use of 1st line and 2nd line ART regimens were significantly associated with MS occurrence (Table 13).

5.2.3. Behavioral risk factors

The result with this regard revealed that 29.5%(41) of the cases 23.9% of the controls were smokers of (current and or past smokers) of all tobacco products. The mean age of smoking started for the corresponding groups were (27.4 years (± 7.5) vs 24.2 years (± 5.0)), and the duration were (5.5 years (± 2.1) vs 4.4 years (± 1.8)), respectively. Nearly, 52 % (73) of the cases and 46 % (227) of the controls were alcohol user; greater proportion, 37.4% (52) of the cases and 29.8% (147) of the controls consumed during the past 12 months, with the mean frequency of at least one standard alcoholic drink of (2.87 $\pm$ (1.89) for cases and 3.12 $\pm$ (1.69) for control). Also, 28.8% (40) of the cases and 19.6% (97) of the controls were found to be current drinkers (i.e. in the past 30 days). The mean number of alcoholic drinking occasions and mean number of standard drinks per drinking occasion in the past 30 days were (6.80 $\pm$ (3.20) and 7.00 $\pm$ (3.37) for cases Vs. (5.37 $\pm$ (3.32) (6.10 $\pm$ (4.17) for control), respectively. The average number of days per week on which fruit and vegetables consumed for the cases was 2.7 (± 1.3) and for the control was 2.8 (± 1.2). More than half (71.2% (99)) of the cases and nearly 67% (331) of the control were consumed less than five servings of fruit and/or vegetables on average per day (Table 14).

Adding to that, total physical activity per day was recorded using the total time spent on work-related, transport-related and recreation-related activities in to account. The mean minutes of

total physical activity on average per day was (55.8 (+72.3) for the cases and was 61.1(+70.1)) for the controls minutes per day. More than 3/4th , 80.6% (112) of the cases and 83.3 %(413) of the controls were physically active; having with the highest percentage contribution obtained from transportation (i.e. either from cycling or walking) for both groups (73.4% (102) for cases and 76.1%(376) for controls). By considering the situation on a typical day, the study besides assessed the participants' sedentary lifestyle state; with the mean time spent to run sedentary life for the cases was 189.8 minutes (+144.7) and the controls was 153.6 minutes (+90.0). Of which, 66.9 %(93) of the cases and 75.5%(373) of the controls were determined as they run such life style (Table 14). Moreover, the result from binary logistic regression analysis revealed that smoking state, alcohol consumption status, all alcoholic consumer, the average frequency of serving fruit/vegetables/ day, type of oil, total physical activity state, physical activity levels, running sedentary life, and daily chew Khat status as a factor associated with MS (Table 14).

Table 14; Bivariable analysis, in the behavioral risk factors and MS, cases and controls, PLHIVs, in the Gedeo-Zone, southern Ethiopia, 2019

Predictors	Metabolic syndrome		COR (95% CI)	P-value
	Cases	Controls(n=494)		
	(n=139)			
	Number	Number		
Smoking state				
Non-smoker	98	376	1	
All smoker	41	118	1.33(0.88-2.03)	0.18
All smoker				
Past smoker	23	72	1	
Current smoker	18	46	0.82(0.4-1.67)	0.58
Alcohol consumption status				
Lifetime abstainer	66	267	1	
Consumer	73	227	1.30(0.89-1.90)	0.17
Current alcoholic drinker(past 30 days)				

No	99	397	1	
Yes	40	97	1.65(1.08-2.54)	0.02*
Past alcoholic drinker (drank in the past 12 months)				
No	87	347	1	
Yes	52	147	1.41(0.95-2.09)	0.29
The average frequency of serving fruit/vegetables/ day				
< 5 servings	16	96	1	
≥5 servings	123	398	1.85(1.05-3.27)	0.03*
Type of oil				
Vegetable oil	10	32	1	
Butter	33	51	2.07(0.90-4.77)	0.09***
Margarine	20	142	0.45(0.19-1.06)	0.07***
Solid fats	67	218	0.98(0.46-2.11)	0.97
Don't know	9	51	0.57(0.21-1.54)	0.26
Self-reported consumption of salt			1	
Far too much	56	197	1.28(0.50-3.25)	0.61
Too much	58	198	1.32(0.52-3.35)	0.56
Just the right amount	19	72	1.19(0.43-3.29)	0.74
The total physical activity state				
Inactive	27	81	1	
Active	112	413	0.81(0.50-1.32)	0.09***
High levels of physical activity among physically active				
No	91	280	1	
Yes	48	214	0.69(0.47-1.02)	0.16
Moderate physical activity				
No	107	365	1	

Yes	32	129	0.85(0.54-1.32)	0.46
Low levels of physical activity				
No	22	105	1	
Yes	117	389	1.44(0.87-2.38)	0.06***
Composited total physical activity from work				
No	97	335	1	
Yes	42	159	0.91(0.60-1.38)	0.66
Composited total physical activity from transport				
No	22	105	1	
Yes	102	376	0.87(0.56-1.33)	0.51
Composited total physical activity from recreation				
No	124	433	1	
Yes	15	61	0.86(0.47-1.56)	0.62
Meeting the WHO GROPAFH				
No	128	451	1	
Yes	11	43	0.90(0.45-1.80)	0.77
Running sedentary life				
No	46	121	1	
Yes	93	373	0.95(0.65-1.38)	0.04*
Daily Khat chew state				
No	105	424	1	
Yes	34	70	1.96(1.24-3.11)	0.01**

Notes: *significant at P<0.05

**Significant at P<0.01

***Significant at P<0.1

Predictors: Smoking state, all smoker, Alcohol consumption status, All alcoholic consumer, Average frequency of serving fruit/vegetables/ day, Type of oil, Total physical activity state, Physical activity levels, High levels physical activity among physically active, Moderate physical activity, Low levels physical activity, Running sedentary life, Composited total physical activity from work, Composited total physical activity from transport, Composited total physical activity from recreation

Outcome: cases with Metabolic Syndrome (MS), control without MS

Abbreviations: MS, metabolic syndrome; PLHIVs, people living with HIV; WHO, world health organizations; COR, crude odds ratio; AOR, Adjusted odds ratio; GROPAFA, the global recommendation of physical activity for health

5.2.4. Predictor of metabolic syndrome

The overall model fitness check statistics were made and presented as follows: ($X^2(df=30) = 84.83$, $p < 0.001$, $-2 \text{ Log likelihood} = 314.151$, Nagalkerke $R^2 = 0.303$ and Overall Percentage predicted 81.6%, and the Hosmer and Lemeshow Test of significant $P = 0.905$). The result implicated the workability of the model for further interpretation the finding. The multi variable analysis result revealed that age (AOR=1.09, 95%CI(1.05-1.12)); educational status being completed secondary school (AOR=0.22, CI(0.02-0.42)); occupational status being of a students (AOR=0.11, 95%CI (0.24-0.51); wealth index being in the middle quintile (AOR=0.22, $P=0.02$, 95%CI (0.06-0.79)); ART status being exposed to ART (AOR=3.07, 95%CI (1.37-6.89)); total physical activity state being physically active (AOR=0.36 95%CI (0.16-0.79)), and engaged in low levels physical activity(AOR=3.83,95%CI(1.46-10.05)) were a significant predictors of MS development (Table 15).

Table 15; Multivariable analysis, in between all predictor variables and MS, cases and controls, PLHIVs, Gedeo-Zone, southern-Ethiopia, 2019

Predictors	Metabolic syndrome	
	AOR(95%CI)	P-value
Age	1.09 (1.05-1.12)	0.01**
Educational status		
No formal schooling	1	
Less than 1 ⁰ school	0.76 (0.32-1.82)	0.53
1 ⁰ school completed	0.63 (0.27-1.39)	0.28
2 nd school completed	0.22 (0.06-0.79)	0.02**
High school completed	0.61 (0.14-2.58)	0.50
Marital status		
Single	1	
Married	1.14(0.46-2.83)	0.77
Separated	0.89 (0.34-2.32)	0.82
Widowed	1.63 (0.69-3.89)	0.26

Occupation		
Government employed	1	
NGO-employed	0.39 (0.07-2.31)	0.30
Self-employed	0.36 (0.12-1.03)	0.06
Student	0.11 (0.24-0.51)	0.01*
Homemaker	0.42 (0.13-1.32)	0.14
Wealth index in quintile		
Lowest	1	
second	0.43 (0.16-1.14)	0.09
middle	0.22 (0.06-0.79)	0.02*
Fourth	0.43 (0.15-1.21)	0.11
ART status		
ART-naive	1	
ART exposed	3.07 (1.37-6.89)	0.01*
OI's other than TB		
No	1	
Yes	0.76 (0.30-1.98)	0.58
Functional status		
Ambulatory	1	
Working	1.42 (0.73-2.76)	0.30
WHO staging		
< III stage	1	
≥III stage	1.93 (0.85-4.39)	0.12
Viral RNA levels >= 1500 copies/ml		
No	1	
Yes	1.98 (0.39-9.92)	0.40
Current alcoholic drinker (past 30 days)		
No	1	
Yes	1.87 (0.91-3.82)	0.09

The average frequency of serving fruit/vegetables/ day		
< 5 servings	1	
≥5 servings	1.48 (0.48-4.58)	0.40
Type of oil		
Vegetable oil	1	
Butter	1.08 (0.32-3.63)	0.90
Margarine	0.40 (0.12-1.29)	0.13
Solid fats	1.18 (0.41-3.37)	0.76
Don't know	0.48 (0.10-2.40)	0.37
Total physical activity state		
Inactive	1	
Active	0.36 (0.16-0.79)	0.01**
Low levels of physical activity among physically active		
No	1	
Yes	3.83 (1.46-10.05)	0.01*
Running sedentary life		
No	1	
Yes	2.05 (0.88-4.78)	0.10
Daily Khat chew state		
No	1	
Yes	1.47 (0.59-3.65)	0.40

Notes: *significant at P<0.05

**Significant at P<0.01

Predictors: Age in the year, Educational status, Ethnicity, Marital status, Occupation, Wealth index in quintile, ART status, OI other than TB, Functional status, WHO staging, Viral RNA levels >= 1500 copies per ml, Alcohol consumption status, Average frequency of serving fruit/vegetables/ day, Type of oil, Total physical activity state, low level of physical activity, Running sedentary life, Daily chew Khat

Outcome: cases with Metabolic Syndrome (MS), control without MS

Abbreviations: MS, metabolic syndrome; PLHIVs, people living with HIV; ART, antiretroviral therapy; OI, opportunistic infections; TB, tuberculosis; WHO, world health organizations; AOR, Adjusted odd ratio, 1^o, primary; 2nd, secondary

5.3. Paper III results

5.3.1. The socio-demographic characteristics

A total of 32 (n=15 male and n=17 female) respondents were involved in the discussion. More than half, 68.8 % (22) of the subjects were found within the age range of (35-44) years, with a

mean age of 36.96 (+8. 94) years old. Of which, 40.6%(13) of them were found to be on antiretroviral therapy for about (1-3)years, with a mean duration of 5.2 ($\pm$ 3.16) years (Table 16).

Table 16; the socio-demographic characteristics of the participants, in the Gedeo zone, Sothern Ethiopia, 2018

Characteristics	No	%
Type of data collection method		
In-depth interview	2	33.3
Focus group	4	66.7
Number of participants per study location		
Dilla university referral hospital	18	56.3
Wonago health centers	14	43.8
Occupation		
A counselor	6	18.8
Carpenter	1	3.1
Day labor	7	21.9
Farmer	6	18.8
Housewife	9	28.1
Prisoner	2	6.3
Private worker	1	3.1
Religion		
Muslim	2	6.3
No religion	2	6.3
Orthodox	16	50.0
Protestant	12	37.5
Marital status		
Married	22	68.8
Single	1	3.1
Widowed	9	28.1
Educational status	No	%

Illiterate	8	25
Grade 1 st to 6 th	7	21.9
Grade 7 th to 12 th	16	50
Diploma and above	1	3.13
Area of residence	No	%
Rural	13	40.6
Urban	19	59.4
Age of the respondents in the year		
<=25	5	15.6
26-34	5	15.6
35-44	22	68.8
Duration on ART in year		
1-3	13	40.6
4-6	10	31.3
7-9	2	6.3
>=10 years	7	21.9

5.3.2. The qualitative results

All the discussions focused on the origin, development, and socio culturally worth health behavior. In the analysis of the transcripts, themes were established using the PEN-3 model constructs to push the conclusions toward the conceptual framework of knowledge, attitude, and practices (KAP). All the quotations are verbatim without rectifications. Using the thematic data coding strategies, 27 codes, 9 categories and 3 themes were formed from the discussion.

i. The knowledge associated health behavior

In the cultural identity of the health behavior domain, how subjects acquire health information about behavior was explored. What role did extended family play in the course? How did structures and institutions found in the community played a role to gain knowledge of health behavior is the last part of this section. Indeed, special care was taken to recognize how did persons individually attained information on metabolic syndrome and its associated risks

while using this domain (23, 25, 26, 105).

Based on this, a typical response to the question of "the long-term effects of aging with HIV?" was failed to indicate colloquial word for "metabolic syndrome." Approval for this concept may be found in this response: "So far, I was not sick...even, I know people who have taken the tablet for many years...but I have never seen them facing any health problem...As to me, I don't believe it may cause any problem"(W7_FGD1). Even after the probing of the participants by calling the term "metabolic syndrome" they reacted as "they didn't have any know-how and perceived it as hardly had any connection with their health conditions. An echo of the thickener concept can be comprehended in the following statements. "I don't believe that taking the medicine continuously will have negative side"(MP_Ind2). Instead, they itemized other kinds of health complications that have no link with the theme under study. With this regard, the second woman participant in the focus group discussion three sat quietly responded with: I have experienced health problems, which I didn't have earlier after I started the medicine. "My eyesight is blurred...Taking the medicine for a long; therefore, causes eye problem. Further by using checking questions about each component of metabolic syndrome for the subjects' mostly accepted conversational term for it was "hypertension and diabetes mellitus." A common theme that emerged was "blood pressure and sugar disease." A few brief quotes on the issue "I think...the diseases (blood pressure and sugar diseases) that demand extreme attention and priority"(M6_FGD2). "Like any disease, sugar diseases have medication"(W3_FGD).

Also, the exact response to the question of "the risk factors of MS and its components?" For the participants, the common conventionally spoken word emerged were not engaged on "physical exercise" and or "inappropriate feeding (mal feeding)" as the risk factors of the elevated magnitude of the syndrome. Participants shared the following: "Not performing of physical exercise is the first and foremost...Because if the body gets fatter, the more it faces various diseases."(W7_FGD1). "Inappropriate feeding (mal-feeding) may cause these problems (diabetics and hypertension).To echo the preceding sentiments, a male participant in the second discussion explained "These diseases (blood pressure and diabetics) are problems which occur as a result of feeding disorders...For example if we often eat meat-related food item it causes such kinds of diseases...It's in this way I understand" (M8_FGD2). Further adding to this, the quotes from the focus groups represent: "A diabetic's disease is an illness caused by eating many sweet

item... The existence of one presupposes the other"(W8_FGD1).

Some brief quotes on the long-term outcomes for metabolic syndrome. "Though I haven't faced any health problem owing to taking the tablet, using it for long cause's changes on the body. This, in turn, predisposes us to different health matters, entails blood pressure (hypertension), heart failure, and diabetics.

Many of the involved participants had lacked basic knowledge about MS risk factors and its long-term effects. Nonetheless, for whatever reason, there appeared to be an overriding view of the personal malpractices indicated by the participants as it was associated with the non-performance of physical exercise and having inappropriate feeding habits, as possibly the risk factors of MS.

Person: Interviewee response regarding how they educated about MS and its corresponding risks. A conjoint issue that emerged was "the personal serious disease tragedies were the colloquial words found as their source of health education."

The under designated participant response informed the various efforts of the infectious and non-infectious disease events role to learn: "In 1999 E.C, I was sick...and I was given a drug for pneumonia after diagnosis. As I began taking the drug, allergy (which is called 'Shifitah' in Amharic) appeared on my whole face"(W6_FGD3). "In the beginning, I got diarrhea...Then, my face was getting swollen...and all my situation got strange...I was completely indulged in a strange situation"(W7_FGD3). Echoing this concern, very few numbers of snippets from participants described chronic diseases related tragedies role to educate: "My experience to see people died of the sudden situation made me know about the dangerousness of these diseases(metabolic traits)" (W7_FGD1). "I came to know more about these health problems; after I saw my neighbor fell into sick and took insulin"(W7_FGD1).

Besides, suggestions are given about mass-media particularly "the use of radio and television" were found words as primary sources of health information. The following participant response revealed: "Like everyone else, I get information through listening to a radio and watching television"(M6_FGD2). A few brief quotes on the efforts of the "peer discussion" arranged in the health institutions are described. "There is a group or peer discussion in the hospital every morning...So; we get health education through these sessions. We mostly discuss our health situation, and about the problem, we faced in association with it.

In addition to, about the precautions or measures, we should take...We never discussed regarding metabolic problem”(W1_FGD1). A consistent trend in most of the participant transcriptions focused on any disease tragedies encountered by individuals; the various mass-media sources as well as the peer discussions were the primary ways in which the people living with HIV gained information about the syndrome at the individual level.

Extended Family: A classic response to the issues rose about "for the first event that encourages the respondents who bothered for their health?" was "The spontaneous blood HIV tests that they had undergone subsequent with the spouses' acquaintance to the virus" was the first event that encourages the participant to bother about their health. Although family members' disease tragedies provide the origin of education about health, its particular focus was based on the virus they live-in. Confirmation for this concept may be found in this response:" I came to know about my health because of my spouse...When my wife was fallen into sick, she had a test in a health facility...and as she was found to have the virus, I was requested to have the test...Then, both of us were informed that we have the virus in us, too"(M4_FGD2). "I came to know it because my husband died of HIV...That is all"(W4_FGD3). A few brief quotes about the chronic disease: "I came to know about diabetic's disease pretty well because of my friend... She was infected by this disease...She had been told that she was a diabetic, and she ought to have taken the drug properly...She quitted taking the drug and died; failing to act following the health practitioner's advice"(W3_FGD1). "I came to know more about these health problems; because my mother got a disease called blood pressure"(W4_FGD1).The diseases experience especially "hypertension and diabetics" by one of the family members, mainly by mothers and intimate friends were found as a primary source of health information. Further, this section will use little snippets from the participant replies to provide a general overview of the apparent role family played. "My husband highly supports me. For example, he advised me not to eat and drink which is not fresh. But we never discussed other related health problems...our awareness is also diminutive"(FP_Ind1). "My families highly support me...Especially, my children give me the drug; saying: "Drug taking time is up." In this regard, they help me a lot...If God hadn't given them to me, what the hell would have been to me? (Wagging his index fingers unto the sky)"(M8_FGD2). "Unquestionably, my family (my brothers and sisters) support me to have awareness"(W4_FGD1). "Concerning keeping health and preventing disease, we, among our

families, discuss and teach each other”(M1_FGD4).

From the responses, all seemed to have gained information on their condition. Individual diseases experience by one of the family members, mainly by mothers and intimate friends provide the beginning of the teaching of some participants about health education, particularly regarding diabetes and hypertension. Through family support, the spouse (wife or husband), children, brother, and sisters looking out for each other the knowledge of MS risks and methods of prevention was spread. Also, there were some found no family support.

Neighborhood: The formal and the informal systems that existed in the area were found to be central to most participants' attainment of health knowledge. Of which, the formal systems far outweighed the impact of informal systems mainly associated with the government agencies that emerged as sources of personal health knowledge acquisition. One of which is the mass media described. Even though it is not a specific suggestion of assisting to teach the public on the issue of discussion, a respondent noted, “We watch a program called “your health at your home” known in Amharic as ‘Tenawo Be-Betwo’ transmitted through television...Most of the advice delivered is in connection with our health (HIV/AIDS). Hence, I wish they (government agents) would do that. That might help the community more”(W2_FGD1). Echoing the situation, a participant voiced this idea: “I get more health information from other media, television, and radio...Though it is not about such problem as you heard in recent weeks, we heard health-related information from these media”(W7_FGD1). Other participants spoke of the main role of the health care organization played. "On top of that, health institutions are delivering information on various types of health problems in the outpatient department before issuing cards”(W1_FGD1).

One respondent saw things from this perspective. "They (the government agencies) discuss and teach only about HIV...This is because, I think, the policy the government holds...It's all about HIV...Even on this issue, it's not as such done...Individuals drawn from sector offices are assigned to share information about HIV on 21st of the month...every year...No one ever thought of other related health problem"(W2_FGD3). Although it is obvious that some feel the government is doing its job to teach and give supports to the community overall on HIV/AIDS, there remains the question of how the growing occurrence of chronic disease and metabolic syndrome will claim that policy assigned for infectious disease be

readdressed to teach the PLHIVs and provide some form of better access to routine screening and management for those at higher risk to develop the syndrome.

Another characteristic participant described as an important primary source of health teaching was about the informal systemic structures. A common subject that emerged was “the churches.” While few of the participants advocated the role played by the church without specifying the exact name, as is stipulated in the replies: “The church also gives us a lesson to protect ourselves and not transmit to others with negligent and not to commit sine...but they never give us other health-related lessons.” Other participant described the specific religious organizational roles by specifically indicating the name of the institutions, as follow. “Religious institutions (Churches); for example, St. Marry and St. John churches teach us about HIV during the preaching of Gospel. They (the churches); especially, focus on how to keep healthy, to stick to one partner, and not to commit adultery. “As for the diseases that would occur through time; let alone for they to teach us, we have just heard of about MS risks from you”(M3_FGD2). Furthermore, the other ideas emerged as participants described their perception focused in on “the social call,” which is known in Amharic as “Idir,” as a prime player of personal knowledge about health education. This issue can be conferred with the replies: “Besides, in social gatherings, such as “Idir”, we, carry out peer discussion on the health-related problem”(W6_FGD1). “With regards to this, I dare to say that members of ‘Idir’ are organizing a discussion forum for health education; especially on HIV...And, I'd like to recommend such a discussion forum should sustainably organize”(W1_FGD1).

All participants described that the getting hold of MS risks and outcome knowledge on the individual level encompasses the use of the mass-media (Television and radio); the peer discussion; volunteers' education; the neighbor's disease tragedies, and others. Family, in particular, the spouses (the husband at large and the wife), children, sisters, and brothers have been demonstrated to be the primary source of education on MS risks. Few educated from individual tragedies in the diseases and death of family members. Government structure, mainly the health care systems; the religious organization, the social calls ‘Idir’, employed numerous means to get the message out concerning the reduction of MS risk factors.

ii. Attitude associated health behavior

The current study used these constructs based on the assumption that the knowledge,

belief, and values of the person, family, and community that the participant communicated and holds of about MS risks, and preventive measures explain the practices they engaged about the theme under study (23). Out of these concepts, perceptions about health attitudes are made. Those perceptions are enabled and nurtured by well-meaning individuals from one's social circle(23, 25, 26, 105). Indeed, this may not exactly look to fit well with the attitudes facet of the conceptual framework. Nonetheless, how a person perceives the surroundings and those who enable or nurture different behaviors that are reflected acceptable gives foundational supports for the attitudes individual holds about the contexts under investigation(108, 151, 152). The sections below will first explore the perceptions relative to MS risks, and outcomes and prevention believed by the members. Later, the enabling factors that encourage holding onto certain attitudes and the occasions or individuals that nurture those attitudes will be revised.

Perception; the perceptions participants hold of about MS risks, outcomes, and preventive measures explain the practices they made with chronic disease prevention. Having taken this into account, "a distinctive reaction for the question of "who is responsible to maintain individuals own health?" was "the individual him/herself ought to be accountable to his/ her health," they said. The man in the fourth discussion was replied, "First and foremost, a man can exist if he can keep himself. I am responsible for my health...I must take care of myself...If I fail to do so, what on earth others do for me?"(M6_FGD4). The next is from subjects who have given thought to the question of "what is the feeling about acquiring MS problem?" The majority of the participants provided a reflection that highlighted that acquiring this problem is a simple health problem as compared to HIV." I say it should be for HIV due to attention is given. It's because...This disease has recently been recognized on us...it is terrible...These diseases (metabolic problems); however, existed long ago, and they (metabolic problems) exist now, too...They are not horrifying"(M4_FGD2).Further subjects feel like nothing if in case they can be a victim of metabolic disorders." These responses extended the idea with participants' assertion: " If I am told that I have diseases like...Blood pressure and diabetes(MS traits), I will feel nothing...because if I can able to live with the big one HIV...I might feel nothing beyond that...I think HIV is better than these diseases"(MP_Ind2).

A few brief quotes on the participants' beliefs. "They (metabolic problems) are serious health problem...It is so difficult, even to think...Because once you got these diseases(metabolic

disorders), death awaits at the door of your house at any time...It means that I have deserted my children as orphans...What would more a catastrophe come upon you?"(W7_FGD3). The majority of the involved participants described that developing the metabolic syndrome is a serious health threat that necessitates every one's attention. Though they reflected in that way, the contexts echoed how much horrified life experiences they spent with the virus and dictated as a major influencing factor for the current perceptions they hold about MS risks, without recognizing its future catastrophic health impacts.

Concerning actions to be in place, participants put forth: "We are abandoned to thinking about health," they said. "I also perceive it as others do...Poverty, unemployment, and the likes are here quite high...Due to this, people abandoned thinking about health...Everyone here runs to win their daily bread...As to me; therefore, I don't regard it as a problem...The real problem is a shortage of food"(M5_FGD4). Echoing this concept, "No disease is big (major) and no disease is small (minor)...Generally, every disease is harmful. Likewise, I think these health problems(metabolic diseases) need due attention...It's because...If these once happened to come, we will be forced to purchase more drugs and use...we will be obliged not to eat food item we have at hand...Instead, we will be obliged to select food item risks...And, this is unaffordable for us"(M3_FGD4). Overall, a subject was spoken of about the worth of acquiring the syndrome due to its extra demands of cost, the uptake of more drugs, and other the obligation linked with the diseases, like selection of diet, etc.

As to the prevention measure associated questions like "about diet, sports and harmful substance use habits?" raised for the participants; the overall accepted terms expressed as a limitations were "the lack of strengths", and "the absence of capacity to afford and secure protein-rich foods that they traditionally perceived as a full nutrition diet," and "working as a day laborer." The following participant quotations explain more: "Doing a sport is good...But I can't do it...For one thing, I work as a daily laborer, and I don't have the strength to do...as you all know, if we do sport, we need to get full nutrition food first; like 'raw meat' to eat...For this to happen, we need to have money...Therefore, owing to the limitation of my health and financial status, I can't"(M1_FGD4). Furthermore, the 4th man in the fourth discussion noted, "Most of the time we...No need to hide the fact...we often get irritated due to the disease...so, to forget the annoyance we may sometimes smoke a cigarette, and drink alcohol...We also know that it causes

another problem...Conversely, we repeatedly do it"(M4_FGD4). The response provided a reflection that meanwhile highlighted the habitual drinking of alcohol, as a means to overcome their anger as an experience where they perceived as bad to develop metabolic syndrome.

Generally, the finding revealed that the perceived severity of living with the virus grounded with, the social, economic and cultural values directives as factors associated with the dearth of contextual knowledge, which is contributed to form unfavorable perceptions about MS risks.

Enabler: are systematic, structural, societal, cultural forces, or influences that may encourage or hinders change such as the accessibility of resources, availability, government officials, managers, referrals, skills, and types of services (23, 25, 26, 105).

The response from the participants will represent; encouraging or obstacles to change. Little snippets from the participants' response voiced this concern: "I got full support from health institutions"(W1_FGD1). "Regarding our health problem (HIV/AIDS)...the government provides us with a supply of the tablet, but it doesn't provide us with any other support"(W5_FGD3). There was an apparent term of "the government", while the word "government" did not directly refer to any entities, the contexts dictate the health care organizations enhancing enabling role-played in the delivery of education and other supports to the PLHIVs. Following this bit of evidence, we inquired "were there any structural or system-level enhancing or hindering efforts made for the prevention of the syndrome?" The respondents continued and several others joined in. "As we know most often, there are many situations that the government endeavors with a great initiation to create awareness on issues of worth-noting among the community in any way available; as well as to implement"(M8_FGD2). Also, the report revealed some non-governmental organizational structures tremendous enabling role played on the perception of a person holding about the contexts under investigation. The female patient shared, "OSA organization is the other one that enables me to have awareness. This organization works only to matters related to HIV so it creates deep awareness to me"(FP_Ind1).

Briefly, the study suggested that the "governments, mainly of the health care institutions' and the NGO structural role played" were found as enhancing enabler of the current individual perception holds about the study theme.

In the contrary, concerning the hindering role made for the prevention of the syndrome?"

Some participants were shared the following: "The absence of having ample awareness and the absence of the required activities...due to little attention given by all concerned bodies, entails individuals, families, including government bodies...I guess this is a drawback "(M7_FGD2)."I think it's because of the absence of uniformity of solid activities concerning these and other health problems carried out by the government and non-government organizations"(M3_FGD4). Participant further disclosed the current abandoned role of the NGOs as discouraging the enabler of the study theme. This idea is reflected in the participant's replies below, as: "Currently, there is no organization engaged in providing health-related aids and awareness creation education in the area. In the previous time, there were some. There was an organization called the "Medan Act", for example...It went out a long time ago" (W2_FGD3).

Another provided answers that pointed, "If you are living with this disease (HIV/AIDS), you will especially be troubled not to work your job properly...and this will lead you to be a victim to several problem...to be reliant on someone...Thus...being live with HIV is so dreadful to me"(M6_FGD2). Furthermore, subjects in the discussion were felt that their socioeconomic context made a tremendous discouraging enabling role for educational attainment make in health in general and the study theme in particular. "I perceive our being dependent (needy); our being illiterate; our being daily laborers for winning our daily bread; as well as having a meager income, as a hindrance"(M3_FGD4). "As most of us live in avert poverty, we may fail to get daily bread; let alone select food items for this and other diseases"(W4_FGD3). "Even though there are schools, most youth go out to look for a daily labor job instead of going to the schools...Owing to this, they stay along with the asphalt all day long"(W3_FGD3). By emphasizing these concerns, other participants justified, "Due to the high population size, there is no ample farming land here...I guess that we couldn't feed ourselves and our families yielding more production"(W7_FGD3). "As is known, the population size is highly increased here...there is no ample farming land as compared to the population size in our Zone...Hence, our inability to producing other alternative food production to feed ourselves and our families"(M4_FGD4). "The absence of food aid here is the foremost problem that hinders us not to improve our feeding style"(M2_FGD4).

In short, the inadequate contextual knowledge, living with HIV/AIDS, the social health-seeking habit, socioeconomic problem implicated with lack of good governance, and the

systemic level unresponsiveness were the words identified as discouraging enabler of the current individual perception holds about the study theme.

Nurturer: refers anyone in the extended family, friends, and kin, peers who exert influence on "health beliefs, attitudes, and actions(23, 25, 26, 105). According to the recommendation of nurturers, PLHIVs will follow some form of directed health behavior.

Respondents shared, "I don't underestimate my families': my spouse's and my children's support...they often support me in many ways...Above all, they sometimes help me to have know-how on issues related to the virus as per their knowledge...I have told you that their support is high"(M1_FGD4). The quotations designate participants who have given thought to the encouraging roles of the family as nurture to live healthily. They also provided insight on some of the role of the children, mothers, and spouse carrying one back or even the struggle to teaching one of the health doctrines that can preserve their health. Other participants further shared, individual experience of diseases tragedies developed the energy for giving lesson that will advance their health to others. "I came to know about such diseases (chronic disease) because I have seen it on my mother...indeed she (my mother) is a diabetic patient...If she gets a minor wound, the wound never gets cured soon...She can't eat what she wants...I could understand that it is a big health problem"(W5_FGD3). Conversely, the following drawn-out suggestions perhaps shared the role of the family that hindered them to be benefited to restore or maintain their health situation, for various reasons like: "being lived far apart from the family," "being unwilling to disclose one's real health status," and "lack of interest to know about the health problem of family members. The above concepts reflected in the following quotations. "I merely say, my family didn't provide me with any support"(W6_FGD1). "No one from my family supported me to have knowhow about my health...because I hid my situation to them"(W7_FGD3)."My family lives far away from me...I have no support from them (family)"(W2_FGD1). Emphasizing this issue, one participant noted, "Let alone supporting me, my families do not want to know about my problem...I work for my livelihood...No one helps me anything"(M1_FGD4). One of the overarching themes emerged was about "the contextual understanding level of the family unit." "They (the family) didn't have any information about metabolic issues. Had they had; hopefully, they would have taught me"(W4_FGD1). The trend exhibited that their lack of knowledge and poor perception towards disclosing themselves hurts

their health status.

Besides, the subsequent response from participants perhaps best explains “community's experience illness tragedies” enhanced to nurture their current perceptions they hold about MS risks. “I came to know more about these health problems; after I saw my neighbor fell into sick and took insulin”(W2_FGD1). “My experience to see people died of the sudden situation made me know about the dangerousness of these diseases (metabolic problems)”(W7_FGD1). Further, a woman in the second discussion reacted uniquely as: “Every community varies...Some are educated, and some are uneducated...As compared to these,...The uneducated community rarely does so in such activities...To your surprise, we come across people who do not have any know-how about HIV...Imagine! How many years have gone out since HIV was introduced into our country? What does this indicate? It indicates that the activities being carried out are insufficient. Therefore, such a problem will not be solved unless the government works along with the community...Be it in educational institutions...Even on this issue, it's not as such done...No one ever thought of other related health problems”(W2_FGD3). She described that education plays a huge role in health effects. It was felt by a participant in the interview that his education made a tremendous difference between educated and those who were uneducated communities. The fact of the statement is understood in the variance educational level and knowledge gain and perception hold regarding MS risk reduction. In the reverse, one participant extended remark probably best describes the hindering nurturing role of the “community stigma and discrimination,” to have a proper health habit and the consequence upon the PLHIVs. “It is needless to talk about the community(Gesticulating)...What I have realized is that the community strongly detests using the cups we used...And, the community let alone supporting us; even after such all activities, they kept stigmatizing or discriminating us from any social interactions. (Expressing unintentional, deep sorrow on her face)... What surprises me (Pointing her fingers towards her...they are discriminating not only us but also our children...They don't allow their children to play with our children...The best example is, my child is under ART as I am...When my child plays with other children, the community often orders these children not to play with this boy...Knowing this fact, I also say to my child not to play with them... And, my kid, in turn, asks “me why they say like this?”....and “why you let me not to play with them?” That is why I don't let him do so... (Being in melancholy or low-spirit... as her eyes are full of

tears, her speech interrupts...wiping out her tears, all persons there fell in a sheer silence for minutes)... (After a while, she ended up her speech); the community is imposing discomfort on me..."(W4_FGD1). As is seen in the aforementioned response, the PLHIVs were forced to live under strong pressure due to the ill-advised discrimination imposed on them by the community; which, in turn, could aggravate the individual's health circumstances. Such practices of stigmatization were not only limited to the victim but also on the lives of their children who did not have any accountability on their parents' health status. From this, one can deduce that getting support from others is a sort of luxury life or is unthinkable for them under such a condition.

Still, the quotes from the discussion shared, "The doctors advise us...As for feeding, they say to us; "Before you eat the food whatever you cooked...Don't eat uncooked food"(M4_FGD2)." The health workers provide me high support...often inform us in advance as of administering the drugs...Besides, they give us the advice to quit our bad habit; such as smoking cigarettes and drinking alcohol...They also advise us concerning our way of feedings"(M3_FGD4). Oppositely, a woman in the third discussion proposed "The health practitioners working in the institution never tell us clearly that the cause of our illness is associated with the drug or not...They see us off providing the routine treatment...It would be better if they help us create desirable awareness; especially on metabolic diseases risks that you have told us right now...they never gave us pieces of advice"(W2_FGD3). Echoing these contexts, a woman in the interview explained: When we come to the health center, often the adherence counselors ask and give us advice regarding the virus and whatsoever problem we faced about the drugs"(M7_FGD2). All participants described some level of impact experienced through the pieces of advice given by the health workers, and adherence counselors in the health care institution, and asserted them as a nurturing role players for the correct knowledge gain about keeping their health. Nonetheless, the entire roles have no effect on knowledge gain and attitude develops about the contexts under investigation. Additionally, some other participant further noted, "The presence of health extension workers in our area...However, their focus area to teach and to nurse is only on issues of mother-childhood; as well as HIV and TB cases...Unquestionably, it's worth noting in its right...They didn't do the same on other health problem...So, I don't dare to say they helped us in areas of other health problem"(M5_FGD4). Given the efforts made by the health extension workers were not undermined, yet their area of

focus being restricted on another disease (i.e. other than NCDs) were sensed as a discouraging influence to nurture the perception that participants hold regarding MS-associated risk reduction.

In summary, while the nearby community's experience illness tragedies, and health workers and adherence councilor's role were intuited as enhancing influence; the social stigma or discrimination, the health extension workers restricted effort were found as a discouraging influence to nurture the current perception that participants hold regarding MS-risk reduction. Lastly, the sociocultural contexts (the surrounding enhancing or discouraging enebbling or nurturing factors) dictates the individual PLHIVs to have in adequate contextual knowledge or perceptions about MS risks, which eventually leads them to have developed unfeverable attitudes about dieting habits, physical activity, and other harmful substances use habits.

iii. Practice associated behavior

Litreatures suggested that the cultural empowerment domain of the PEN-3 model is intercepted with the conceptual framework of practices associated with health behavior. Studies asserted that the way of life is an obstacle or precursor to disease and it is well known. The result revealed there remains similarites between personal practices related to preserving and keeping health and individual knowledge. Positive behaviors are those rooted in personal beliefs and knowledge that are known to be beneficial to health. Existential behaviors are those based within the culture and are not necessarily negative or positive in its application. Negative behaviors are those practices that portend debilitating outcomes and disease for its adherents (23, 25, 26, 105). Based on this assumption, the paragraph below presented the participants replies on the positive, existential, and negative practices sub-domains of the model.

Positive practices: are those deep-rooted in individual beliefs and knowledge that are known to be valuable to health (23, 25, 26, 105). The PLHIVs were largely known that positive practices were based on diet and physical activity. Respondents shared the following: "I say: eating vegetables, fruits, and light food items which do not discomfort us; and improving our living style and feeding system...help us to keep ourselves from such health problems"(W8_FGD1). "I believe that our feeding style...like...Vegetables, Tomato, Sweet-Potato, Potato, Carrot, Tomato, and Pimento (locally called in Amharic as 'Daattaa' are sensible feeding habit to be safe from such health problem" (W5_FGD1). The third woman in the

discussion three furthered this idea by suggesting, "I consider refining feeding style, like reducing over-salted foods as one of the sensible practices"(W3_FGD3). In short, the responses on feeding practices were articulating the overall positive health impacts of vegetables and fruit consumption. Also, it highlighted the necessity of the refraining feeding lifestyle from over-salted foods as a sensible habit.

Another respondent' noted, "Regarding protecting and controlling health problems I take as a positive thing that I do exercises. Everybody should do exercise regularly to protect themselves from any sickness...If we sit idle, our leg will contract illness, which exposed us to other diseases, and that might cause a psychological disorder"(MP_Ind2). Echoing this situation, the third woman in the first discussion reacted, "I dare to say that walking a long distance, and working for many hours indoors; including cooking as discharging my responsibility helped me a lot...By doing so, I am benefited(W3_FGD1). They also focused on doing physical activity and feeling that doing regular exercise as a high-quality practice associated with them to maintain their health by reducing body weight. Yet, the response lacks terms that explains the explicit role of such behavior in the prevention of the MS risks and its long term effects, along with the compulsory rate and extent required in pursuing a healthy life. Generally, the discussion suggested that no difference was exhibited on the welfares of engaging in positive practices that improve MS risks.

Existential practice: are identified within the sociocultural perspective and are not essentially undesirable or helpful in its use (23, 25, 26, 105). It presented practices in a new context perhaps not ever well-thought-out already.

Accordingly, little snippets from the participants' response were identified "the long-lasting habitually eating of food item called in Amharic as 'Kochoo' and 'Bulla' prepared in the form of porridge and gruel were the catchphrases emerged under such feeding habits. These ingredients (i.e. 'Kochoo' and 'Bulla') are produced from a plant known in Amharic as 'Enset' (i.e. false Banana) that are extracted from the root section of the plant." These food items are organic, locally endemic, indoor prepared and culturally accepted food items with the highest social values. To repeat the preceding opinions, other subjects shared eating 'Injera' together with 'Wot', also seen as the other existential feeding practices identified in the responses of the PLHIVs. Additional participant sides included: Despite the frequent use of 'Injera' has a such

health impact...particularly...the use of 'Shiro-Wot'...together will have a better outcome (M1_FGD4). The term 'Injera' is an Amharic word refers to the name given to the cultural legend, well-known, and the most widely used food item in the country and in the study area for a long. It is commonly prepared with the cereal name called in Amharic as 'Teff'. It's often eaten by using an indoor stewed sauce called in Amharic as 'Wot', might be prepared using several ingredients called as 'Shiro'(i.e. prepared with the processed pea, bean, chickpea cereals). Overall, such feeding habits are culturally legend habits, not only in that locality but also all over the country of Ethiopia. However, still, there is no supportive evidence about the scientific nutritional values of 'Injera' in the promotion of health.

Another participant noted, "Since we are living with the virus...we never use alcoholic drinks that can intoxicate us...however, occasionally we use of 'kiineetoo'" (W1_FGD3). As is grasped in the aforementioned response, "the use of Coca-Cola like fermented drink called in Amharic as 'kiineetoo' appeared term that is grouped as existential practices. It is known as indoor fermented Coca-Cola like drinks that the society used occasionally. It is a unique, culturally based and socially accepted type of drinks used by all segments of the population, irrespective of their health state, age, sex, and religion status. Still, other participants noted, "As most of the communities, including me, are religious... mmm...That's to say, as we live with the Lord; let alone such kind of problem we are well-looked-after by God from another kind of health problem. Only by being in the Lord; what's more, as we are going to be well-kept-up unnecessary practices: like an addiction of alcohol, cigarette, and infidelity to women; no problem happens to us"(W3_FGD3). These statements illustrate essential aspects of being in the Lord to safeguard themselves from any evil practices that aggravates the MS occurrences.

Negative practice: relies on the undesirable practice related concepts with bad health outcomes (23, 25, 26, 105). Perhaps when we think of negative practice, there is a trend to shrink back from self-blame. Subsequently, few attempted to offer information in this respect. Their replies are concepts that were pronounced at different times all over the discussion. The practice revealed may be reflected in negative or harmful behaviors.

Subjects noted: "I perceive that the prevailing habit of feeding often "raw meat" (i.e. called in Amharic as 'Tire-Sigga') here as one practice"(M8_FGD2).Participants described recognizing that "eating raw meat" is the culturally preferred food type that habitually practiced

by the vast majority of the community in the country in general and the population in the study area in particular. Against of the prior views, one subject shared, “In my opinion...As she does...eating meat is regarded as a noble traditional feeding system in here...however, I don’t think it’s worthy”(W7_FGD1). Despite the cultural nobility, she advised one to abstain from “eating raw meat” as one action to improve health in general and the theme under study in particular. To echo the former opinions, the "fatty food item" idea can be realized in the next statements. "Most of the time, it is noticed that people often use fatty food items risks here"(M3_FGD2). In the reverse, another participant remarked: "I guess we shouldn't eat fat meat and fatty food items...Because food items cause diarrheal disease and other problems that affect people who live with the virus"(W1_FGD1). There was only one mention of the habit of the use of "the food item called in Amharic as 'Injera' with 'Wot' or “meat-sauce” (the sauce prepared using ingredient meat called in Amharic as ‘Sigga-Wot’), as contributors to chronic disease in general and metabolic syndrome in particular during the discussions. Confirmation of this concept is noted in the next quotation. “Our habit of eating sauce prepared using with meat as an ingredient (‘Injera with Sigga-Wot’) is a sensible food...You know why?...such food items are good for people like us (living with HIV-infection) to be free from any health problem including the kind of disease that you talk about now...and even to get strength"(W3_FGD3).

Participants were also aware that the negative practices were based on running sedentary life and engaged in other harmful substance use habits, like alcohol consumption and smoking cigarettes. This concept is affirmed in the following responses. "You know what? While you live with the virus(HIV)...this doesn't give you time, rather exposes you to various illnesses...this, let alone give you the chance to perform the exercise, rather it imposed you to fail to get your daily bread...Spend much of your time in bed"(M3_FGD4). "It is difficult to try to even to think...due to the inadequate power, we experienced...and the economic problem encountered succeeding with the disease we live in (HIV/AIDS)"(W7_FGD3). This insightful report demonstrates vital aspects of PLHIVs life experiences; the development of various opportunistic infections accounted for the HIV-infection deemed the PLHIVs to fall into bad health states that eventually leads these people to run a bedridden life. It also designates the socio-economic implication of the virus and the antiretroviral therapy that they regularly use as contributors to their habit relating to a sedentary lifestyle.

Still, participants notified, "The youth, as they are most addicted, uses the wage from daily labor for...especially, drinking 'Areke' 'Tella and 'Tejj to get drunk"(M2_FGD4). In my opinion, I believe we should abstain from drinking alcohol...It's because...We will be exposed to many problems as we can't control ourselves "(M7_FGD2). One participant reacted differently. "As has been known, the big problem of living with HIV is...You often get irritated due to the disease...So, we may sometimes smoke cigarette and drink alcohol to forget the annoyance. Health professionals most often advise us that it causes another health problem...Conversely, we keep using it covertly...by ignoring their advice...Hope, we better quit our bad practice."(W3_FGD3). Participants described the long term impact of the virus on the day to day life of the PLHIVs and its attached psychosocial problem as contributors to increase metabolic syndrome through leading harmful lifestyle habits. Furthermore, other participants shared: People usually sit idle throughout the day without doing anything, mostly on chewing 'Khat'...It is a common trend...Even, there are peoples who I know living with the virus and who habitually use this substance...I feel that may harm" (M2_FGD2). Conversely, the man in the fourth discussion revealed, "Having the initiation and exercising our effort...For example, we have to...abstaining ourselves from bad addiction, such as cigarette, "Khat", and alcohol"(M1_FGD4). He suggested that abstaining oneself from the use of 'Khat', cigarette and alcohol or any harmful substances as a whole as a positive practice to control MS risks; in the mean time, he also introduces a new risk factor "'Khat' use habit" with the occurrence of the syndrome. Generally, the discussion asserted that the consumption of different substances like a smoking cigarette, and 'Khat" were found expressions related to harmful substance use habits as contributors to advance metabolic syndrome.

In the empowerment of health behavior domain, the positive behaviors were certainly explained. The habit of eating vegetables and fruits, restricted harmful substances use, and intentional physical activity were notified as positive practices that the PLHIVs perceived measures to prevent MS risks. The long-lasting habitually eating of 'Kochoo', 'Bulla', 'Injera' together with 'Wot', and the use of Coca-Cola like fermented drink called in Amharic as 'kiineettoo' were emerging as an existential practices that are locally recognized as a noble habit, with no any scientific evidence on the progression of MS. Others acknowledged their habit of "eating raw meat", running sedentary lifestyle, the use of locally prepared alcohols, called in

Amharic as: ‘Areke’ ‘Tella and ‘Tejj, and smoking cigarettes were the practices that might lead the PLHIVs to advance a negative health outcome. Using a substance called in Amharic ‘Khat’ was also stated as a negative practice. From this paragraph we can deduce that the participants have inadequate practices towards MS risks.

iv. Summary of results for each research questions

Coding the responses of the interviewees based on the conceptual framework of knowledge, attitude and practices were undertaken after an extensive review of comments of the participants transcribed documents created from the focus group discussions and the interview. A representative replies was selected to alline with the knowledge of MS risk factors and its corresponding consequences that was adequate. Replies that were considered adequate revealed certain type of commitment to keeping a lifestyle intended to alleviate risks for MS. On the other hand, the inadequate responses consider a lack of knowledge about the contexts and/or non-vivid aspiration or requirements to undertake an obligation for individual health and struggle to reduce risks for MS. Fortunately, the larger proportion of the responses for knowledge was dropped into this group. Similarly, practices were considered as adequate, if and only if the responses were fitted with the actions that they involved in diminishing risks for and controlling MS comprised of the nutritional and exercising habits; and/or smoking and alcohol cessation, or the lifestyle modification in general. Whereas, practices were considered inadequate, if and only if actions were aggravating the situations; and/ or there were no significant struggles made for stopping, decreasing, and or controlling MS. The majority of responses to practices were considered inadequate. Individual attitudes were determined as favorable or unfavorable. The higher numbers of the responses were grouped in to unfavorable, even if certain shown that there were quiet efforts in assuming or keeping an attitude that would lead to the improvement of practices that were intended to prevent, diminish risks for, or control of MS. In light of these, overall the sociocultural contexts dictate the PLHIVs' to have inadequate knowledge concerning risk factors and methods for preventing MS. And, this, in turn, contributed to form an unfavorable attitude and inadequate practices regarding feeding habits, physical activity, and other harmful substance use habits (Figure 7 & Table 17).

Table 17; connection of the research question, participant responses, CFW, favorability and adequacy, PLHIVs, Gedeo-Zone Southern Ethiopia, 2018

Question	Conceptual Framework	Adequate	Inadequate
How and in what ways does personal knowledge form the basis of personal attitudes toward MS and methods for preventing its long term effect?	Knowledge	"Individuals, among people who live with HIV and who are often enraged and ill-tempered, are likely to be exposed to metabolic problems; such as blood pressure." (M1_FGD4).	"I have never heard of the cause and general indication of such health problem." (W2_FGD3).
Question	Conceptual Framework	Favorable	Unfavorable
How and in what ways does personal knowledge form the basis of personal attitudes toward risk factors and methods for coping MS?	Attitude	"I believe that it is my responsibility to have knowledge about my health and to take care for myself because no health expert can control us to do or not to do so this is the individual's responsibility" (FP_Ind1)	"I say it should be for HIV due to the attention given. It's because... This disease has recently been recognized on us... It's terrible...These diseases; however, existed long ago, and they exist now, too...They are not horrifying (M3_FGD4).

Question	Conceptual Framework	Adequate	Inadequate
How does knowledge gained and attitude hold about MS and its risk factors influence eating habits, physical exercise, smoking, and alcohol intake practices?	Practice	“I say: eating vegetables, fruits, and light food items risks which do not discomfort us; as well as improving our living style and feeding system...help us to keep ourselves from such related health problems”(M8_FGD2).	Previously, I have heard that doing sports can enable us to keep from any kind of health problems risks... However, I didn't attempt to do it as I did not have the strength”(M4_FGD2).

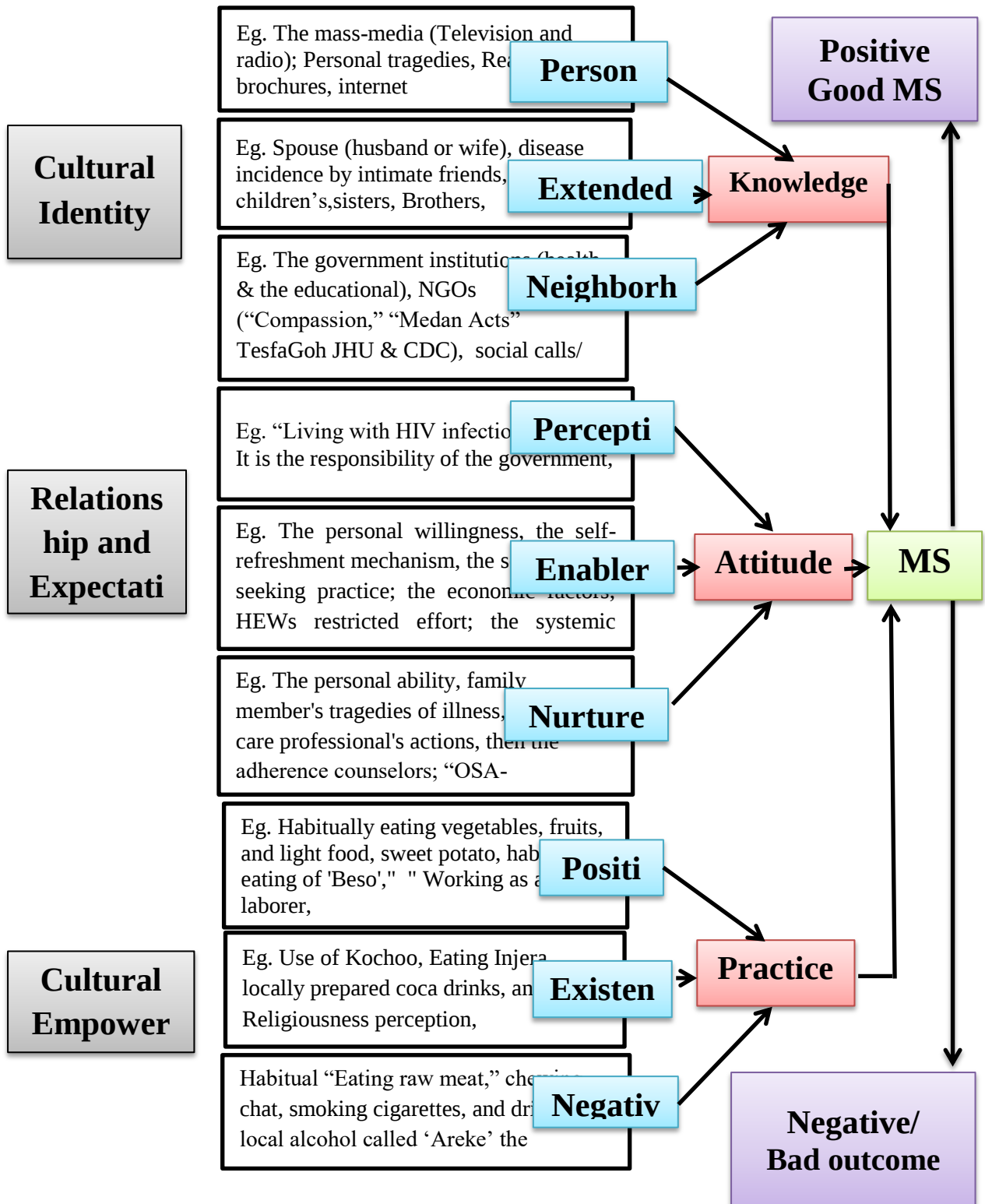


Figure 7; a schematic summary of PLHIVs comments from the interview discussions, the PEN-3 construct, the PLHIVs comments in the middle, and the conceptual framework of KAP

5.4. Summary of main findings by specific objectives

The table below summarizes the major findings of the dissertation.

Table 18; Summary of the findings of the dissertation, Gedeo zone southern Ethiopia, 2019

S. N	Papers	Major findings
1	To estimate and compare the magnitude of overall metabolic syndrome, among HIV infected patients exposed for antiretroviral therapy and ART naïve (Paper-I)	• Generally, the estimated magnitude of overall MS was diagnosed in (22.0%, 95% CI: 19.0-25.4) of PLHIVs in the zone. It was slightly higher in the ART-exposed (22.5%, 95% CI: 18.7-26.8, by ATP III) than ART naïve (20.9%, 95% CI: 15.2-27.1, by ATP III) groups. However, the observed difference was not statistically significant ($P>0.05$).
2	To determine the predictors of metabolic syndrome, among people living with HIV(Paper-II)	The leading factors significantly associated with MS were: • Age (AOR=1.09, 95% CI (1.05-1.12)) • Educational status being completed secondary school (AOR=0.22, 95% CI (0.02-0.42)) • Occupational status being of students (AOR=0.11,95% CI (0.24-0.51)) • The wealth index being in the middle quintile (AOR=0.22, 95%CI (0.06-0.79)) • ART status being exposed to ART (AOR=3.07, 95%CI(1.37-6.89)) • Total physical activity state being physically active (AOR=0.36, 95%CI (0.16-0.79)), • Engaged in low levels of physical activity (AOR=3.83, 95%CI(1.46-10.05))

3 To understand the role of sociocultural contexts in forming adult HIV-patients' behavior towards metabolic syndrome and its lifestyle related risks (Paper-III)	• The study concluded that getting hold of MS risk factors associated with health knowledge of a person encompasses multiple sources. Family, the spouse's, children, sisters, and brothers; the government structure, mainly the health care structures; the social systems, principally, the religious organization, the social calls 'Idir', were primary role player in educating the PLHIVs concerning MS risk factors. Individual, governmental, non-governmental, & social systems related contexts were found as enhancing/discouraging enabling and nurturing sociocultural contexts that influence the lifestyle-related perception of PLHIVs in any directions. • The sociocultural contexts impacted the PLHIVs to have inadequate knowledge concerning risk factors and methods for preventing MS. And, this leads to form an unfavorable attitude and inadequate practices. • The socio-cultural contexts have played a role to influence PLHIVs decision about the eating habits as positive (eg. Eating fruit & vegetable), existential (eg. eating 'Injera' & 'Kochoo'), and negative (eg. Eating raw-meat or 'Tire-Sigga' & highly fatty foods). The physical activity as positive (eg. Doing intentional physical exercise), existential (eg. the routine daily work as a day laborer), and negative (eg. Spent on bed & longtime sitting). The other harmful substances to use associated habits as positive (eg. Abstained from alcohol, cigarette and 'Khat' consumption), existential (eg. Being religious), and negative (eg. Daily consumption of Alcohols, cigarette and 'Khat').
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6. Discussion

6.1. The magnitude of overall metabolic syndrome (MS)

HIV infection is liable for MS and NCD risk within the general population (8, 12). Due to such reasoning, there's a growing concern that MS-associated with HIV and ART, which places these segments of the population in a high-risk category (8). Despite this, the precise magnitude of MS within the HIV-infected population and its differential contribution by ART status remains arguable (15, 16). Essentially, within the sub-Saharan African (SSA) region (8), and Ethiopia(18), in particular within which the matters isn't yet well known. In the study area, it is the first in its type. Therefore, this comparative cross-sectional study is intended to estimate and compare the magnitude of overall MS among ART-exposed and ART naïve PLHIVs within the Gedeo zone, southern Ethiopia. The study concluded that the estimated magnitude of MS was found to be higher among all PLHIVs residing in the zone. The magnitude was slightly higher within the ART-exposed (22.5%, 95% CI: 18.7-26.8) than ART naïve (20.9%, 95% CI: 15.2-27.1) individual PLHIVs in that zone; however, the observed difference wasn't statistically significant ($P>0.05$).

Correlating with our finding, studies from Portugal, 22-58.8%(39), India, 20-49.6%(58-60), Thailand, 22.2%(46) and Taiwan, 26.2%(61), SSA region,13%-58%(8, 16), and Ethiopia 21.1-24.3%(18, 40-42) were demonstrated comparable ranges of magnitudes among all PLHIVs, irrespective of the ART status and the criteria used to diagnose the syndrome. This signified that except the development seen within the quality of life, conferred by immune reconstitution, the HIV infection and antiretroviral therapy, together with the advances in age, might predispose the PLHIVs to won future risk of developing MS. On the other hand, studies from Brazil, 49.9%(17, 80, 85), and Uganda, 58%(74) were reported an extremely higher magnitude of overall MS among those subjects, inconsistent with our findings. Besides, a sensibly lower magnitude of the syndrome was reported among PLHIVs by studies from Switzerland, 20%(78), Spain, 15.8%(77), Cameroon, 15.6%(52, 75), and Cote d'Ivoire, 14.4%(76). The difference may be attributed to discrepancies related to the host, HIV infections, and/or its associated therapies, as suggested by some literature (8, 15, 18, 19, 42).

Additionally, our study highlighted the presence of slightly higher magnitude of overall MS within the ART exposed than ART naïve; however, the observed difference wasn't statistically significant, ($P>0.005$). A study conducted among 300 PLHIVs in Western Kenya revealed the presented insignificant difference of prevalence of MS among ART-experienced (16.9%) and naïve (15.2%) groups, consistent with our finding (19). Analogously, similar study from Northwest Nigeria by Muhamed. 2017 (153) and Southern India(154) by Sneha Deepak Mallya.2020 reveals statistically insignificant difference in MS prevalence between ART-treated and ART-naïve individuals, having with slightly higher magnitude seen in the former than the later groups. However, several studies worldwide have reported magnitude of MS to be significantly higher among patients on ART as compared to their ART-naïve counterparts. For instance, a meta-study done worldwide (on ART 18.4% vs. ART naïve 11.8%) (15), a study from USA (37% after 96 weeks of ART initiation vs. 20% at ART initiation) (45), Brazil (65.7% on ART Vs. 34.3%ART naïve)(17), Italy (19.4% on ART Vs. 13.8%ART naïve)(81), Thailand (24.9% on ART Vs. 15.9% ART naïve)(46), Nigeria, (19.3% on ART and 5.3%ART naïve), Nigeria (21.0% on ART and 9.0%ART naïve)(82), Ethiopia (18.1%-25% on ART Vs. 15.6%-22.5% ART naïve)(18); were reported to be statistically significant. This could be due to the reason that only 2.4 % of the ART group of in the current study received PI-based regimen that are recognized to be related with metabolic complications. In this study we fail to observe such relation as PI-based ART regimen was consumed among only 10 subjects, and thus, did not have sufficient power to identify this relationship. Moreover, the time variation, the number of study participants, the differences in study approaches, and also the socio-economic and cultural factors related to the host may well be partially credited for the above differences observed by the studies.

Adding to the justification given above, the asserted criteria employed by the studies may also be partly taken as an attribute of the above discrepancies seen (8). Within this regard, for example, a meta-study by Nguyen KA, et al.2016 was shown distinction of MS burden supported the different criteria used (ART-exposed, 19.6%, by IDF criteria vs. 21.6%, ATP III), and within the ART-naïve, (14.9%, by IDF vs. 19.9%, by ATP III)(15). Furthermore, a study from Ethiopia shown the presence of variations of MS magnitude within the corresponding comparative groups

(ART exposed, 25%, by IDF criteria vs. 18.1%, by ATP III and ART naïve, 22.6%, by IDF vs. 15.6%, by ATP III), respectively (18). Though there have been no reliable differences of MS estimates supported the IDF and ATP III criteria. However, the context underscored the presence of a higher estimate using the IDF criteria for both ART exposed and ART nave groups. This may well be attributed to the inconsistencies emanated from the cut of point employed by that criterion(8, 42). Yet, the finding suggested future study demand on the realm to determine culturally suitable criteria formed within the East African region countries contexts, then resolves the problem encountered related within the diagnosis of the syndrome, once for all.

6.2. Predictors of metabolic syndrome (MS)

In areas where the routine screening of PLHIVs for metabolic syndrome within the chronic HIV care clinics isn't regularly done, resources and evidence on HIV/AIDS comorbidities are constrained, the report from this study has public health and clinical implications that supplement the body of knowledge towards HIV positive individuals. Hence, the current study was intended to determine the predictors of overall metabolic syndrome (MS) occurrences and differentiated modifiable and non-modifiable risks among HIV-infected people in the Gedeo zone. Accordingly, the study revealed age as a non-modifiable independent risk of MS; however, education, occupation, wealth index, antiretroviral therapy status, total physical activity, and lower physical activity levels were identified as modifiable predictors of MS.

As the finding implicated that the odds of developing MS is 1.09 times higher with a unit increase age in a year. Similarly, a marked disturbance within the MS with aging has also been reported by several epidemiological studies done worldwide (15, 16, 18, 19, 99). The observed comparability among the studies can be because, irrespective of the difference within the target population, age is additionally a standard non-modifiable risk factor that equally likely predisposes all to such health mater. In copatablly, Bosho, et al. 2018 (40), Lívia D. Akl et al.2017 (80), Tesfaye et al. 2014 (18), and Kaduk et al 2012 (101), were reported that age isn't an independent predictor of MS. The differences across studies can be due to the variation within the studies approaches used, the differences within the standard criteria used and even the variation within the characteristics of the target population, and the time differences. Overall the

finding could be highlighted, succeeding with the advance of ART, the PLHIVs have prolonged lifetimes and increasing age that eventually leads them to be a victim to a chronic pathological state like MS, by inflicting equivalent effect on PLHIVs as it was done within the general population. This portrayed the danger of MS increases with the advance of age following the regression of intrinsic metabolic actions(10).

In line, the study implicated that the estimated odds of developing MS among PLHIVs completed secondary schooling is about 0.22 times less than individuals with no formal schooling. This was quite the same as a cross-sectional study from residents of Mizan-Aman town, South West Ethiopia, within which individuals with the academic status of below degree are up to 89% protective to develop MS (32). This finding correspondingly aligns with the studies from Kenya (by Kiama, 2018 and Kaduk, 2012) (44, 101). This confirms that education could be a key to open any locked secrets of life within the world that enable everybody to own an identical and healthy lifestyle by getting a behavioral change. Unlike with our findings, few studies from Ethiopia (by Ataro and Ashenafi, 2020(10), and Bosho, et al., 2018(40)) were informed not enrolled in formal education and lack of formal education as a protective factor of MS occurrences. Likewise, Kagaruki, 2015(94) study from Tanzania shared, MS was significantly higher with a better level of education. This can be an attribute of the differences within the measurement schemes implemented by the studies. All in all, the finding may be indicated the importance of the equitable distribution of education to the community to be accessed by all, no matter their health condition, as a distinct prevention measure.

The relation between occupation and the risk of MS is worth further discussion. Our result has shown that student PLHIVs have 0.11 times reduced odds of MS than those working as a government-employed. This corresponds with Mashinya, et al. 2015 (99) reports. In our view, the possible reason for the analogs report may not be out of the domains of variations on the income generated schemes in between the gov't employed, and not yet employed but worked as a student. This is often because, since students always earn no income that they're run their life not by themselves rather by letting them dependent to any relevant others that eventually leads these people to possess lower standards of lifestyle. This standards of life might contribute in

order they to possess less risk and save from such a high standards of lifestyle-related chronic diseases, including metabolic syndrome. Nonetheless, the planning of awareness creation action to all, irrespective of their occupational status may be played an essential role in the prevention of MS risks.

Our finding similarly asserted that the PLHIVs wealth index grouped under the middle quintile have 0.22 times reduced odds of MS compared to those within lowest quintile. The finding was contradicted with a crosssectional study done in St. Paula's Hospital, in Ethiopia(102). This might be resulted from the differences within the kind of study subjects involved within each studies, the variation within the study approaches, and also the method accustomed to measure income by each studies. This suggests, since we did not find validated evidence in the subject area, a future confirmatory study is needed to examine how wealth in quantiles affects the MS occurrences.

Notably, ART exposed individual PLHIVs have over 3.07 time odds of MS than ART-naïve individuals. Correlating with our findings, quite a lot of studies worldwide were revealed that exposure to ART is a predictor of MS, regardless of the effect of other factors(15, 18, 58, 92). Within this regard, for instance, a meta-analysis study across five continents showed that the MS prevalence within the ART exposed was significantly above within the ART-naïve (15). Correspondingly, a crosssectional study from the southern region of Ethiopia notified that HIV patients on ART have higher risks to acquire MS than ART-naïve subjects (18). Further studies from Italy,(81) Spain,(77) India,(58) Thailand,(46) Ghana,(92) Burkina Faso,(90), and Nigeria,(82) also suggested similar reports. This might result in the direct impacts of mitochondrial dysfunction, oxidative stress, altered abiogenesis, and differentiations that are mostly related to the event of each cluster of MS after exposure to a mix of treatment (49-51). The situations may accentuate the significances of awareness creation towards lifestyle-related risk factors like physical activity, diet, and other harmful substance use habits reduction. However, our finding worth a confirmatory study with a robust design to be initiated to differentiate the particular effects of every drug regimen with MS incidence in these PLHIVs.

In light of this, as it was displayed elsewhere, the finding in the first paper was a little bit contradicted with the finding of the second paper about ART status. This contradictory finding was due to the reason that the finding in the first paper was an unadjusted result, possibly confounded with multiples of factors. Whereas, the finding in the second paper, since it was an adjusted result by which the effect of other factors was controlled that may leads to show an apparent association existed in between the two variables.

Finally, our study revealed that the odds of developing MS among physically active PLHIVs were 0.36 times lower than physically inactive individuals. This corresponds with different epidemiological studies conducted worldwide (55, 99, 104). The exceeding energy expenditure resulted in the physically active than inactive individuals that protects subjects from the development of overweight and obesity, which are responsible for the pathogenesis of MS among these target groups may be the possible explanation. Similarly, our finding shown that the odds of MS 3.83 times higher in PLHIVs engaged in low levels of physical activity than individuals' not engaged in such activity. Against our report, several works of literature have stated the absence of association in between these two variables (18, 40, 84). This could be partly explained due to the lower number of people grouped under each category that may affect the analysis. Another possible justification could also be partly due to the character of the information relying on self-reporting data, which is prone to response bias.

6.3. The socio-cultural contexts

This descriptive phenomenological study intended to know the role of sociocultural contexts in shaping adult HIV-patients' behavior towards feeding habits, physical activity, and harmful substance use habits. We were fascinated by realizing how personal knowledge forms the basis of individual attitudes, and the way knowledge and attitude do gain influence eating habits, exercise, smoking, and alcohol intake practices. This delivers virtual intuition for health care executives; public health professionals, researchers, community, and PLHIVs. The study concluded that the sociocultural contexts impacted the PLHIVs to have inadequate knowledge concerning risk factors and methods for preventing MS. And, this leads to form an unfavorable attitude and inadequate practices.

As Airhihenbuwa asserts, an individual's connection to family, public, and neighborhood customs the means of acculturation to a typical idea of health teaching. The use of the PEN-3 model offers an avenue to method the responses to the study questions within the circumstance of the cultural identity of the individual. This enables the role of the family, community, and neighborhood informing persons who they were within the study (23, 25, 26, 105). The participants in our study correspondingly shared the assorted primary ways within which they gained information about the syndrome at the individual level. This resembles Airhihenbuwa(155), and Sheppard et al.2010(110) reports. Several participants in our study attributed individual diseases experience by one of the family members to provide the beginning of the teaching of some PLHIVs about health education, particularly regarding diabetics and hypertension. This finding aligns with Airhihenbuwa CO. 2014 (108), Mieh, 2013 (131), and Brown, 2010 (156) regarding the family unit as a crucial influencing role player that determine an individual behavior related to several public health concerns.

Similarly, participants in our study revealed that formal and informal systemic structures used numerous means to get the message out concerning MS risks. This supports Iwelunmor, 2015 (157) and Brown, 2010 (156) studies within which the role of the community system was found as a vital contributor to disclose seropositive status among PLHIVs and as a wonderful resource in assisting families tormented by HIV/AIDS, respectively. As Airhihenbuwa further suggests, replies given under questions from this dimension were seen to all or any shares to the growth of health knowledge (25, 26, 105). Our data compatibly conferred that several of the involved participants had inadequate basic knowledge about MS risks and its long-term effects. This shows that regardless of the kind and amount of information transmitted, the use of various sources are a key for the building of health knowledge.

Studies also suggested the expansion of individual development in society has its stake of perceptions, enablers, and nurturers of health behaviors that may or won't are suitable. All accepted behaviors are socio-culturally suitable and are positive, existential, or negative. Nevertheless, perceived health practices, and people who enabled and nurtured them, are all a part of the cultural background and can grip dominance within the attainment of knowledge of,

acceptance of attitudes to, and formation of health-associated behaviors (25, 105). Numerous PLHIVs were analogously noted throughout my data analysis as factors related to the dearth of contextual knowledge that contributed to forming unfavorable perceptions about the study concept. This finding supports the Ka'opua, 2016 (121), Airhihenbuwa, 2014(24), and Iwelunmor et al.2010(113) studies report. This means that living with HIV could be a serious public health matter stranded with multicultural and socioeconomic factors that may prompt the PLHIVs to make unfavorable perceptions or attitudes towards any health contexts, including the theme under study.

Enabler represents resources and institutional support or any social forces, which can be effective in the promotion of healthy behavior or creating challenges to revert its incidence as suggests by Airhihenbuwa, 2004(145). Our data consistently revealed inspiring and discouraging enabling factors related to the perception of PLHIVs about lifestyle practices. This corresponds with Ka'opua (121) during which "systemic factors" were found as an enhancing enabler of anal cancer screening promotion practice. Airhihenbuwa, 2014 (108) consistently shared encouraging enabling factors associated to different public health-related perceptions. On the opposite hand, Iwelunmor, et al.2010(117) further develops “disruptions in mother to daughter relationships” as an issue and as a hindering enabler related to disclosure of HIV status to mothers. Similarly, Iwelunmor et al.2010(113), Kannan et al.2010(112) and Iwelunmor(142) studies were moreover described different terms that represented as a negative enabling factor of the corresponding public health concerns.

Nurturer is referring to any relevant others who could be a family or community who are important to encourage or discourage a personality's health behavior decision, as likewise noted by Airhihenbuwa, 1989 (23). The study further evidenced that participant thought related contexts as inspiring or hindering nurturer role players for this perception they hold about the concept under investigation. Literature besides notified several phrases like: “the cultural norms”(121), "internal motivation and awareness about cervical cancer screening"(158), and “the contextual knowledge state” (159) as an enhancing nurturing role player of the various public health-related behavior. Conversely, "organizational stigma" was found by the Sofolahan(115) as

a hindering nurturing role player of PLHIVs care-related health behavior. This might implicate that the positive and also the negative pivotal enabling and nurturing roles that the sociocultural contexts play on influencing the PLHIVs current attitude hold towards diet, work up, and other healthy lifestyle practices. Thus, any future intervention actions designed in PLHIVs should take the above sociocultural contexts into account first, so as to push their attitude about the study concepts. Yet, the finding offers a start line that now inspires further investigation.

The cultural empowerment domain is important to identify the impact of sociocultural contexts of individual lifestyle practices, as suggested by Airhihenbuwa. It works with the idea that "the way of life could be a predecessor or obstacle to disease and it's well-known (23, 25, 105). Despite this, there remains a good gap amongst individual practices associated to stop and conserving health and individual knowledge in our findings. This may implicate the importance of further actions to be in situ to revert true by taking the sociocultural contexts surrounding their behavior under consideration. Airhihenbuwa proposed that the positive practices are those deep-rooted in individual beliefs and knowledge that are known to be valuable to health (25, 26, 105). Correlating with this study report, "my child will get well" was the phrases, found as a positive perception of kid malaria treatment-seeking behavioral decisions of woman suggested by Iwelunmor, et al.2010(117). Few other studies conducted worldwide were further established crucial sociocultural contexts that support this idea (110, 160).

Correspondingly, the existential practices are those founded within the sociocultural perspective and aren't essentially undesirable or helpful in its use, as asserted by Airhihenbuwa (25, 105). Analogous words that reflect existential practice associated perceptions with the neutral progression of MS risks were reported in our findings. The word "breastfeeding" was found as an existential practice of motherhood to divulge the HIV-status to the family suggested by Iwelunmor, et al.2010(117). Likewise, the "beliefs related to child teething" as existential practices related contexts linked with the perception of kid malaria treatment-seeking behavioral decisions of women reported by Iwelunmor et al.2010(113). This implicated that any of the positive and existential perceptions, enablers, and nurturing factors that will cause a positive health outcome must be promoted and recognized.

Airhihenbuwa similarly asserts negative practices are those practices that show devastating effects and disease for its followers(23, 105). The findings from our study as well pinpointed several terms associated with the substance use practices which may lead the PLHIVs to advance a negative health outcome. The “fear, stigma, and discrimination” are words that emerged as a negative individual behavior of PLHIVS related to the non- disclosure of seropositive status to significant others stated by. Airhihenbuwa CO. 2014 (108) The phrases," my child's illness isn't severe" were correspondingly found as negative factors related to the perception of kid malaria treatment-seeking behavioral decision of girls suggested by Iwelunmor et al.2010(113). The finding suggests, although the negative practices that the community tied up are a culturally preferred habit that much of them practiced, but it has to be resolved.

7. Validity and Generalizability

Assessing the quality of epidemiological studies is vital to use the finding for decision and policymaking. The quality should be evaluated both internally and externally(161). The internal validity refers to the ability of the study to measure variables correctly during the data collection process that often focused on "what is supposed to be measured" or (getting the truth-value).The external validity refers to whether we can generalize the results to different measures, persons, settings, and times(162). Moreover, an appropriate data analysis schemes were besides used to increase the validity of the results. This dissertation used different techniques to ascertain both the validity and generalizability of the evidence in all studies as follows(161).

7.1. Evidence of validity for the paper I and II

7.1.1. Internal validity

Internal validity is usually concerned about the study's ability to measure what is intended to measure. It is the extent to which systematic error is minimized during all stages of the data collection process, and is a base for the generalizability of the evidence (161). To enhance the internal validity of the current study, we ought to minimize the role of bias, confounding and chance, which are the potential threats of epidemiological studies or could be alternative explanations for the observed association between exposure and an outcome.

Bias is a systematic deviation of a study's result from a true value. It is introduced, typically in the design and implementation of an epidemiological study, and cannot be remedied later (161, 162). Bias arises from flawed information or subject selection so that a wrong association is found. Also, bias needs to be distinguished from random error, a deviation from a true value caused by statistical fluctuations (in either direction) in the measured data. Many possible sources of bias have been described. The two potential sources of biases that crippling the study outcome will be from enrolling of the subject and error in collecting data in the study. This means enrolling wrong study subjects in the study and collecting data or use the response from such persons might consequence to have a wrong or incorrect result. We find two simple categories helpful to be recalled in the epidemiological studies: information bias and selection

bias (161). The best way to handle both biases in the epidemiological study will be in the design stage, and often very little can be done in the analysis stage of data(161).

Information bias is a systematic error, arising from inaccurate measurement (or classification) of variables. There are many sources of information bias (i.e. measurement bias, interviewer/assessor bias, and respondent bias), which can be arisen from the choice of tools one uses to measure, the respondents' and the observers' attitude(161) It resulted from wrong collection or wrong measurement of data, which often occurs during the data collection process of the research and their effects are of varying importance(161).

In this study, to minimize bias related to measurements and verify the internal validity; a check list developed from reviewing of credible source of medical documents validated in the local context was used. In addition, the WHO steep tool was employed in the current study. It is a standardized tool that is freely flexible to investigate NCDs risks (like MS) of various countries in the world, including the countries in the sub-Saharan African region, including Ethiopia. This tool is planned to measure all components of the variables in question step by step to ensure high content validity and evaluate the reliability of measurement instruments. As a result, the chance of error that might be introduced in association with the measurement tool was less likely.

To minimize interviewer biases, well experienced health professionals with previous exposure to data collection were involved in the data collection as data collectors and supervisors respectively to maintain the data quality as they are close in profession to chronic HIV care health services. Additionally, to reduce the potential sources of measurement error associated with the understanding ability of the assessors to the questions and local terminologies, training was given to data collectors and supervisors on all measurement issues and interviewing techniques, supported with practical role plays going through question by question was conducted before the actual data collection period. There were also translation and pretesting of the tools, close field supervision, checkup of filled questionnaire for completeness and consistency; daily debriefing on the problems encountered and provision of feedback at the end of each data collection day especially until they become very familiar to the data collection tool.

Moreover, the use of standardized ATP III criteria to diagnose overall metabolic syndrome cases (the outcome of interest of paper one and two) and blinding of the interviewer about the study hypothesis and the criteria used to diagnose the outcome, together with the daily calibration of the physical and biochemical measurement instruments were a kind of action made to avoid observer bias and bias associated with measurement instruments respectively. Furthermore, the provision of detailed explanations about the study aim to the study participants' together with the employment of different techniques to assess for some sensitive variables during designing the questionnaire, and interviewing the respondents were similarly the early measures taken to minimize respondent's bias. So, since we can't fully address measurement bias, the interpretation of the current study result should take this in to account.

Recall bias likewise is systemic bias that affects the internal validity of epidemiological studies(161). In this study, few of the exposure variables such as age and lifestyle/ behavioral factors were assessed based on the recall ability of the respondents and reduced the period for past events to the recent memory. In addition, the WHO steep tool recommended show cards has been used as a supplementary method to enhance the recalling capacity of the subjects, mainly in assessing things related to their lifestyle /behavioral risks. Undeniably, recall bias is a form of measurement bias of particular importance in retrospective case control studies(162). This occurs when there is a differential recall of information by cases and controls; for instance, cases may be more likely to recall past exposure, especially if it is widely known to be associated with the disease under study. However, as the cases and control for the second study were determined at the end of all exposure and outcome data collection of the prior survey, the inclusion probability of subjects in the study was not associated with their exposure status and there was an equivalent degree of recall among cases and controls. Despite the actions made, it is advisable to interpret the current study result cautiously.

7.1.2. External validity

External validity or generalizability refers to the extent to which the inferences drawn from study findings can be generalize to a more universal population beyond the study population (162). Selection bias is the other form of a systematic error that can distort the estimation of an epidemiological measure. It is a systematic difference in characteristics between those who take

part in a study and those who do not. Which may relate with a missing data resulted from the non-selection of individuals in the study, which may be implicated with the missing of estimates(161). Selection bias often occurs during the design phase of the study(162).

None response (NR) bias is one of the selection biases occurs when some group of individuals invited to the study refuse or not able to participate in relation to specific characteristics to the outcome or risk factors. In this dissertation, to reduce the effect due to NR or incomplete questionnaire, 10% NR rate was added as compensation. In addition, since the response rate was very good (exceeding 92%), the role of selection bias has minimal effect.

As well, the samples in the current study were determined during the design phase of the study to represent all PLHIVs in the Gedeo zone. However, as the study was restricted only to public institutions, the finding may not typically be applied to PLHIVs found in the study zone. To overcome this challenge, the study health facilities with different level (hospital and health centers) with different number and qualification mix of chronic HIV care services delivery were considered in this dissertation to increase the sample representativeness. Correspondingly, as the recruitment of subjects was undergone through the use of a consecutive sampling technique; this might result the study to miss its randomness and lead one to conclude that the participants fail to represent cases of MS occurred in the Gedeo zone. But, we believe that the populations are homogenous and the selection bias is minimal and generalization is possible.

Notably, the selection bias may be introduced in case-control studies if the probability of including cases or controls is associated with exposure (161). In our study, controls and exposures were explicitly defined in the method section of this study. Also, since the exposure and outcome data of the case and the control in the current study were gathered simultaneously from the databases formed from the prior survey, the chance of inclusion of subjects based on their exposure status was less likely. Besides, the use of disease registers may introduce selection bias: if a possible relationship between an exposure and a disease is known, cases may be more likely to be submitted to a register if they have been exposed to the suspected causative agent (161). Nevertheless, since the databases formed for the study was made blindly, without the

knowledge of association of the exposure with metabolic syndrome; as well, the outcome of interest of MS is a rare outcome; the role of selection bias has negligible effect. On top of that, using of secondary data for most HIV/AIDS exposure factors could be the cause for missing of important variables, however, as the probability was equal for both the cases and the controls, the chance of occurrence of selection bias has an insignificant effect. Having taken these all actions into account; the finding is externally valid and can be generalized to those PLHIVs found in another area.

Confounding literally means confusion of effects. A study might seem to show either an association or no association between an exposure and the risk of disease. In reality, the seeming association or lack of association is due to another factor that determines the occurrence of the disease but that is also associated with the exposure. The other factor is called the confounding factor or confounder, which can be given as another possible explanation for any estimates seen in the epidemiological studies. Confounding thus gives a wrong assessment of the potential 'causal' association of an exposure. Restriction, randomization, and matching in the designing phases, as well as stratification and multivariable regression in the analysis stage, can control confounders (161). Likewise, to control the confounding effect in the current study, a statistical modeling method using a multivariable logistic regression analysis was employed to control the potential confounding variables in the analysis stage of current studies. It was chosen because of the large number of determinant factors considered in the study. Therefore, the effect of confounders on the current study is minimized, and thus; the findings can be generalized to a similar population elsewhere.

In epidemiological studies, the chance is another potential source of error for crippling study results(162). It has a role in explaining the observed association and should be assessed before making an inference, which affects the results observed because of random variation from the sample to the sample. Thus, the role of chance needs to be kept in mind in designing any study and in interpreting the data, since its threats may lead to a small sample size and ultimately to inaccurate estimates (161). Similarly, the probability of chance as an alternative explanation for the observed results of the current study was evaluated using the statistical significance test using

the suggested P-value less than 0.05 (objective I and II) or not crossing one (null value for Odds Ratio) (objective I and II) or zero (null value for regression coefficients) (objective I-II) at 95% confidence level. In the current study, a large sample size estimate using a scientific sample size determination method was used to increase the generalizability of the finding in the first paper and also to reduce the possibility of the associations between the outcome of interest (MS) and predictor variables due to chance in the second paper. The confidence interval for most of the variables used in the current study was not wide enough and suggesting the adequacy of the sample size in both studies. Moreover, the performance of appropriate statistical methods, like a binary logistic regression to estimate the crude and adjusted odds ratio were consistently used to quantify the role of chance in the current study. Therefore, these all approaches have the potential to increase the validity of the study result and the findings can be generalized to a similar population elsewhere.

7.2. Evidence of validity and trustworthiness for paper III

The study PLHIVs had a prior chance to contact the research teams before the discussion that there was a chance to be introduced each other and created a slight bond between me (the main author) and other research team members. During the focus group discussion (FGDs), restating the question to see if a identical answer was gained or restating the response and validating its accuracy with the respondents was made to verify that correctness of the response to the query might be assured. The questions in the FGDs covered the three domains of the PEN-3 model. Through questioning about PLHIVs' KAP across each domain, a saturation of idea was achieved during the discussion as it gave similar answers for original questions across the domains. Thus, these all actions, together with the prior youtube assisted serious of tutorial self-training uptake in the use of Atlas.ti 7.5.5, enhanced the credibility of the study result. In addition, the place where this study was conducted in the Gedeo zone, which is home to several people with different ethnic backgrounds. What may be strong-minded is that the local socio-cultural contexts may be the most principal impact, regardless of the ethnic background. Therefore, the data presented narratively from the focus group perspectives allowed for the development of a personal point of view and decisions about MS risks within the model construct. Wide-ranging use of respondent

descriptions enables readers to gain perspectives on how persons of other cultures view and work with MS risks. These approaches have the potential to increase the credibility of the study.

The delivery of definite facts of the method process of the focus group selection procedure, respondents, data collection, and analysis procedures, the transferability of the research is enriched. The study was phenomenological and wanted to describe observed behavior among the respondents. Considerably smaller size for the FGDs was enough for the growth of important themes rather than integration or comparing data. Despite this, more than the expected numbers of (32 members) of the interviewee was involved in this study. The primary data created from the participants have created a chance for a detailed description of the phenomenon. The delivery of detailed, rich reports provide others enough aspects for contrasting study. The transferability of the research is improved and an overall background from which other interested researchers can do some decisions that may not be unfounded regarding the direction of future research.

This study run in a room designated for study purposes by Dilla University College of Medicine and health science and Wonago health center. Subjects were turned off or silenced their cell phones during the discussion. Hence, overall there were no surprises during research discussion sessions. These ensure the dependability of the findings.

To the degree that other researchers could confirm the results, one could decide on the confirmability of this research. The frequent playing of recording devices was the actions used to aid the correct transcription of recordings. The audio files were reviewed as the transcripts were read to verify transcript accuracy. Primarily, codes and themes were investigated manually using codebook, followed by Atlas.ti7. The entire uploaded transcripts were reviewed and color-coded to identify the knowledge, attitude, and practice codes. The codes were compared with initial coding done manually. Further, a review of the conceptual frameworks revealed a pattern that was not seen prior to analysis. Using the revealed connections between the frameworks and the data flows within them, it was decided to constrain the themes along the lines of the theoretical framework and then the conceptual framework. Use of this method made the lines of connection between the theoretical and conceptual frameworks more direct and clearer. This method was

chosen because the research was grounded in theory and allowed for the extension of the theory into new areas of understanding. Constraining the data to fit pre-existing theory may be considered a form of bias. The purpose of theory is to provide a framework for explaining or understanding observed or recorded phenomena. In the case of this research, theory was used within this context so any bias can be directly attributable to the theory or its application to the data. Coding the data along the major domains of the theory and then by sub-domain assisted in determining relationships of the sub domains through the major domains to the conceptual domain.

8. Strengths and limitations

8.1. Strengths

- The use of standardized WHO three-step tools could enhance to reduce potential biases associated with measurement and increase the internal validity of the estimate.
- The supplementation of clinical measurements with biochemical analysis might augment the reliability/accuracy of the estimate or diagnosis of MS.
- The consideration of selection of individual PLHIVs from more than one health institutions with different service delivery levels (referral hospital and primary care) drawing of representative sample group to generalize the result.
- The consideration of a relatively larger sample size than ever used by the previously conducted studies in the SSA region in general and in the study country, in particular that has a direct impact on increasing the external validity through reducing the role of chance.
- The establishment of the different data collector and supervisor clinical teams deployed with the prior provision of training along with the detailed what-to-do lists and schedules, that reduce bias resulted from the assessor's perspective.
- The use of one centralized clinical laboratory biochemistry unit, operated with a single trained laboratory technologist working on the MENDRAY BS-200E Clinical Chemistry Analyzer machine that might contribute to handling measurement variation resulting from the use of the different individuals and using different analyzing instruments.
- The use of comprehensive data handling and management processes with help of two data encoders supplemented with Epidata V.3.03 software that enhances to ensure the quality and validity of data entered by correcting the errors against the original tools.
- The application of a standardized criterion to diagnose the outcome of interest (MS), which enhances to reduce measurement bias.
- The data collectors, supervisors, and the researcher being blinded for the threshold levels for each physical and biochemical risk markers, determined by the ATP III standard criterion would contribute to reduce information bias.

- The use of a database formed from the prior survey arranged with the simultaneous collection of the exposure and outcome data as a source to identify the cases and the controls that might eliminate the selection biases encountered in case-control study study.
- The exceptional nature of the study approaches employed to explore the sociocultural contexts embedded with the behavior of MS risks, characterized by multicultural natures, using formative ways of assessing the individual basis from the collective viewpoint, among vulnerable segments of the population, in Southern Ethiopia, in the Gedeo Zone.
- The consideration of the PEN-3 cultural model as a theoretical framework and as a socio-cultural tool to look for an understanding of knowledge, beliefs, values and or any cultural foundations detected or described customs, associated with MS risk prevention and the means to control its impact.
- The use of an intentional technique of a conceptual framework of knowledge, attitude, and practice (KAP), to concentrate the model on the three situations that generate or alleviate the syndrome's risks, helps to explore deeply and understand the contexts and relationships between different themes.
- An integrated closed and open coding analysis scheme used for coding of transcripts data, sorting, and theme formation or synthesis data.

8.2. Limitation

- The fundamental limitation raised from the use of an observational study that inherently fails to determine causality.
- As the study was restricted only to public hospitals, the finding may not typically be applied to patients found at the other health institutions of the study zone.
- The use of consecutive sampling technique to recruit the study population that might fail to represent cases of metabolic syndrome occurred in the Gedeo zone.
- The use of secondary data for most HIV/AIDS related exposure factors that could be the cause for missing of important confounding variables.
- The delayed analysis of the sample serum, which was collected in other study sites; due to distance from the centralized clinical chemistry laboratory location, might affect the results on the fasting glucose levels.

- As the pre-existing chronic disease status of the PLHIVs' was utilized as a criterion to verify the outcome of interest; instead of using them as an exclusion criterion that might potentially contribute to confounding the findings.
- The problem associated with the qualitative studies in general and the phenomenological study design in particular, which are often responsible for the subjectivity of the evidence following consideration of the individual perspectives as a collective view might impact the external validity of the study.
- The inherent nature of the use of the model that blinds the researcher to overtly look for any newly emerging themes and see only from the model constructs. This might have an implication on the confirmability of the report from the study.
- The challenges encountered in association with the launching of the biochemical analysis program in the centralized biochemistry units in Dilla university referral and teaching hospital, which requires a high level of cost for training of laboratory technologists, the calibration of the biochemistry analyzing machine, and procurement of reagents.
- The challenges encountered in relation to the expensive nature of conducting such laboratory based studies; using health professionals working in such a high privacy demanding health care clinics as a data collector and supervisors, whom required a high rate of payment, and the resource intensive nature of the laboratory materials, equipment, and lab-reagents.

9. Conclusion

- The estimated magnitude of overall MS was found to be higher among PLHIVs residing in the Gedeo zone. The magnitude of overall MS was slightly higher in the ART-exposed than ART naïve individual PLHIVs living in the zone. However, the observed differences were not statistically significant($P>0.05$).
- Education, occupation, wealth index, antiretroviral therapy status, total physical activity, and lower physical activity levels were concluded by the study as modifiable predictors of metabolic syndrome, while age was found as a non-modifiable independent risk of metabolic syndrome(MS).
- The study concluded that getting hold of MS risk factors associated with the health knowledge of a person encompasses multiple sources. Family, the spouse's, children, sisters, and brothers; the government structure, mainly the health care structures; the social systems, principally, the religious organization, the social calls 'Idir', were primary role player in educating the PLHIVs concerning MS risk factors. Individual, governmental, non-governmental, and social systems-related contexts were found as enhancing and or discouraging enabling or nurturing sociocultural contexts that influence the lifestyle-related perception of PLHIVs in any direction.
- The sociocultural contexts impacted the PLHIVs to have inadequate knowledge concerning risk factors and methods for preventing MS. And, this leads to form an unfavorable attitude. The PLHIVs' inadequate knowledge and unfavorable attitude regarding the risk factors and methods for preventing MS leads to form inadequate practices. Furthermore, the contexts have been played a role to influence PLHIVs decisions about eating habits, the physical activity habits and the substances use habits as positive, existential, and negative.

10.Recommendations

Policymakers

- Federal Ministry of Health, National, Regional and zonal Agency for the Control of HIV/AIDS, and the management of the Gedeo zone Health Bureau should use the result.
- The regional health bureau and government bodies of Dilla University College of medicine and health science, the Gedeo zone health desk should give high attention and make the structure responsive to the contexts of MS risk prevention. This will eliminate or reduce extra medical costs caused by hospitalization as a result of NCDs, thereby improving the overall health and quality of life of this target population. Moreover, loss of wages through reduced productivity as a result of ill health will likewise be diminished.
- Revise and implement the existing guideline for chronic HIV care and management strategy to address the routine screening of PLHIVs for MS, especially for those individuals exposed to ART with the advance of age is mandatory.
- Policy actions aimed at improving better access to formal education for PLHIVs at least to the level of secondary schooling are mandatory.

Program manager

- Re-orientate the primary health care system towards realizing an integrated care plan that addresses both the routine care given to PLHIVs and regular MS screening and prevention actions to be underway to optimize its prevention and management.
- The Gedeo zone administration unit and other NGO should further enhance the local communities to maintain their social assets (eg. 'Idir' and 'the peer education), and even planning and implementing actions that modernize and expand that assets to the extents that it to be used in the provision of awareness creation actions about MS risk prevention and control of its impacts among those PLHIVs.
- The Gedeo zone, the southern region, and the country at large should employ the model constructs as a tool to plan and implement a health education program towards the study theme among the PLHIVs.

- Consider all personal, familial, and structural based sociocultural perspectives for the creation of awareness regarding lifestyle-associated health knowledge gain and promote the attitude and practices.

Health workers

- Efforts geared towards disease prevention should focus more attention on the physical and biochemical measurements. This is because early detection and management can go a long way in preventing NCDs, thereby preventing more disease and financial loss on this group of population.
- Determine the BMI, even though weight is routinely measured during ART clinic visits and height taken only at enrolment. Also, include the waist circumference and lipid profile tests as part of the routine tests made to enable assessment of the central obesity and lipid profile of PLHIVs while on ART.
- Input effort to investigate and act patients on ART based regimen with complications of MS and its components to be switch over to another regime if no contraindications exist.
- Consider risk factors based on evidences while caring for patients in this population to use and support the initiation of and regular screening for MS in HIV patients on ART especially when they are getting older and that will help to prevent the occurrence of MS. By reducing the prevalence of MS, the risk for NCDs such as CVDs, type two diabetic complications will be significantly eliminated.
- It is relevant to inform that MS and the risk factors are modifiable. Hence, behavior/lifestyle change management programs are advisable for HIV patients on ART.
- Plan a consistent health education or advice program to all PLHIVs to increase knowledge of the risk factors for MS.
- Encourage the PLHIVs to commence the positive practices, recognize and encouraged the existential practices, and discourage the negative practices.

Researchers

- Given the limitations of this study, and being the first study of this nature in Gedeo zone, southern Ethiopia, a community-based large scale study is mandatory by using a large number of the study population in estimating the extent of MS to confirm these results.
- Initiation of three-arm prospective cohort studies among ART naïve, ART exposed and HIV-negative individuals to confirm the explicit effect of HIV-infection and ART.
- Planning of wide-ranging scale studies using a multi-center representative sample of HIV infected subjects are essential to assess predictors of MS occurrence.
- Plan research that evaluates the cost benefits of an integrated care plan that addresses both the routine care given to PLHIVs, and regular metabolic traits early screening, and or the provisions of routine health education program.
- There is the need for additional studies to confirm the effects of predicting factors such education, occupation, wealth index, antiretroviral therapy status, total physical activity, lower physical activity, and age that appeared to confer risk differently in PLHIVs.
- Design a mixed study using the PEN-3 model and KAP as a framework to affirm its workability using similar approaches among those PLHIVs for the planning and implementation of health education programs regarding the study concept.

The local religious organizations

- The orthodox and protestant churches should maintain and enhance their supports on the building of health knowledge dissemination to all communities, and extending their effort on the methods to promote their lifestyle.
- The religious organization should work to eradicate 'any stigma or discrimination' related actions practiced in the community through enhancing a moral education.

The local community

- Enhanced to maintain their culturally honorable social integration or social systems, such as 'Idir', as a great opportunity to mobilize all, including PLHIVs, to plan and implement any health behavior change interventions.

The people living with HIV

- Should maintain the positive practices that promote positive outcome on the prevention of MS risks and longtime complications such as eating " fruits, light food, sweet potato, potato, cereals and vegetables like cabbage", and refrained from the uptake of more salt-containing, raw meat, and other fat-containing food items.
- Recognized eating Kocho, the routine job they tied up to run their livelihood daily, and a habitual walking a long distance on, as well as the longtime spending of indoor activities, and maintains their habit of worshipping GOD for its no harm it imposed to increase the risk of MS.
- Avoid "eating raw meat," refrain from running off a long time residential lifestyle practices, chewing chat, smoking cigarettes, and drinking local alcohol called 'Areke,' and 'Tej.'

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12. Appendices

Annex 1: Published Original papers and manuscripts

Paper I



Contents lists available at ScienceDirect

Diabetes & Metabolic Syndrome: Clinical Research & Reviews



journal homepage: www.elsevier.com/locate/dsx

Original Article

The global magnitude of metabolic syndrome among antiretroviral therapy (ART) exposed and ART-naïve adult HIV-infected patients in Gedeo-zone, southern Ethiopia: Comparative cross-sectional study, using the Adult Treatment Panel III criteria



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abstract

Aim: The global operation of antiretroviral therapy (ART) has averted 30 million new infections and nearly 8 million deaths; however, it has an impact on metabolic syndrome (MS) acquisition. As a result, there is growing concern about MS; but strangely the magnitude of MS in HIV-infected cohort, and its differential contribution ART status in Ethiopia has yet to be abundantly studied. Hence, the aim of this study was to estimate and evaluate the difference of the overall magnitude of MS among ART exposed and ART naïve people living with HIV (PLWH).

Materials and methods: An institution based cross-sectional study was conducted at the randomly chosen two hospitals and health centers, in Gedeo zone, southern Ethiopia between December 29th, 2017 and January 22nd, 2019. Data were collected using the WHO three step tools. The collected data were fed into Epidata version 3.1 and exported to SPSS version 22 for analysis. The mean, standard deviations and proportions were used as a descriptive summary. Categorical data and the proportion of MS in the two groups were compared using binary logistic regression, and results were reported statistically significant with p-value is less than 5%.

Result: A total of 633 (n = 422 ART and n = 211 ART naïve) PLWH was involved, with the response rate of 92.1%. Of whom, 22.0% (95% CI: 19.0-25.4) of PLWH had MS. It was slightly higher in the ART-exposed (22.5%, 95% CI: 18.7-26.8) than ART naïve (20.9%, 95% CI: 15.2-27.1) group. However, the observed difference was not statistically significant.

Conclusion: The global magnitude of MS in the ART-exposed was relatively higher than ART naïve groups. This dictates the existence of HIV associated MS that necessitates immediate prevention and management strategies.

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1. Introduction

Above three-quarters of the non-communicable diseases (NCDs) deaths, 30.7 million occurred in low and middle-income countries (LMIC) with about 48% of deaths in these countries occurring before the age of 70, in 2015 [1e3]. In the Sub-Saharan Africa (SSA) region, over the next two decades, it is expected to escalate substantially [2]. In Ethiopia, NCD is estimated to account for 30% of total deaths [3]. The HIV infection environment presents a typical illustration of

the interaction between infectious diseases and NCDs [2,4e7]. The worldwide implementation of antiretroviral therapy (ART) for HIV infection has averted 30 million new infections and nearly 8 million Acquired Immune Deficiency Syndrome (AIDS)-related deaths [2,7], and increase in life expectancy of people living with HIV (PLWH). However, it has an impact on the aging population of PLWH living longer on that therapy (ART), to developing the metabolic syndrome (MS), which is the risk markers of Non-communicable disease NCD [2,7e13]. As cumulative evidence reveals, an adult with this problem will have a twofold as likely to die from and are three times as likely to have cardiovascular diseases (CVDs) and a five-fold greater risk of developing type 2 diabetes (T2DM) [2,4,10,14,15].

Metabolic syndrome (MS) is usually diagnosed based on the

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following medical conditions: central obesity, elevated blood pressure/hypertension, elevated fasting plasma glucose/DM, dyslipidemia/elevated triglycerides (TGL_c), and low high-density lipoprotein (HDL_c) cholesterol levels [7,14,16e18]. Globally, an estimated 8e35%, in the SSA 0e50% or higher, and in Ethiopia, about 40% of adult peoples above the age of 20 years are expected to be living with the syndrome [10,19]. However, the precise global magnitude of MS in the HIV-infected population is still arguable; but the available data on it can be regarded as high, ranging from 11.2% up to 45.4% [6,7], and was also assumed to be reached up to 13% to 58% in Africa [2,16]. Surprisingly, in the sub-Saharan Africa (SSA), primary data on this situation is not yet well established [7,20].

On top of that, there was no crystal clear knowledge of whether HIV infection alone has an explicit effect to develop a higher prevalence of MS remains unclear [7,14]. Nevertheless, some re-searchers suggested the presence of higher magnitude of MS among PLWH (10% to over 50%) [7,14], while others argued as it has comparable rates with the in general population (11e26%) [7,8,16]. In this regards, for instance, Kiama et al.(2018) study revealed that the magnitude was higher and was nearly 60.6%, with 8.4% increment at 48 weeks initiated on ART [10]. On the contrary, NGyuen et al. (2016) study beside stated, despite the notified elevated percentage of MS in those targeted group with or without treatment (17e47%), but it was within the acceptable ranges of reported to the general population [16]. In short, the cumulative evidence supported the presence of elevated proportion MS in the HIV infected patients, and the consequence of HIV infection by itself and antiretroviral treatments perhaps contributes to this increased MS, with the prevalence's ranges in the ART-exposed (18.4e21.6%) than the ART naïve (11.8e19.9%) [7,14,16,20,21].

In this backdrop and its higher attendant economic and health system implications of the identification and monitoring of co-morbid health risks of HIV and ART [2,22], MS at present is a global public health issue [2], prominently in the SSA region and Ethiopia, the epicenter of HIV infection [2,4]. In spite of these facts, much of the reports on the magnitude of the problem in HIV-infected cohort and its differential contribution, if any, of ART status is produced from resource rich nations, while little outputs exist in SSA [7,16,23,24].

Therefore, the main intent of this comparative cross-sectional study was to estimate and evaluate the difference of the overall magnitude of MS among ART-exposed and ART naïve PLWH in a resource-restricted setting. The findings from this study are believed to have significance for public health practice and to establish baseline information for policy and program development.

2. Materials and Methods

2.1. Setting and participants

This study was conducted in Gedeo zone, which is located in the Southern Nations, Nationalities, and Peoples (SNNP) region, 360 km to the south of Addis Ababa, the capital City of Ethiopia, and 86 km to the south of Hawassa, the capital city of the SNNP region. An institution-based cross-sectional study was conducted in the randomly chosen two hospitals and health centers (HC) ART clinics found in the zone, namely: Dilla University referral and teaching hospital (DURH), Yirga-Cheffe primary hospital, Wenago HC and Dilla town HC; between December 29th,2017 and January 22nd,2019. As per the national guideline for HIV prevention, Care and Treatment protocol, not all people living with HIV are eligible for ART and have got access to ART immediately. Enrolment in care provides an opportunity for early assessment of eligibility for ART

and timely initiation. Many care interventions are relevant across the full continuum of care for people living with HIV before initiation and during ART [25]. Once the decision to start ART has been made, in our context, we have few options of drugs 1st line, 2nd line, and 3rd line regimens. Adult 1st line regimens comprises: 1a(30) ¼ d4t(30)-3TC-NVP, 1a(40) ¼ d4t(40)-3TC-NVP, 1b(30) ¼ d4t(30)-3TC-EFV, 1b(40) ¼ d4t(40)-3TC-EFV, 1c ¼ AZT-3TC-NVP, 1d ¼ AZT-3TC-EFV, 1e ¼ TDF-3TC-EFV, 1f ¼ TDF þ 3TC þ NVP, 1g ¼ ABC þ 3TC þ EFV, and 1h ¼ ABC þ 3TC þ NVP. As well, adult 2nd line regimens include: 2a ¼ ABC-ddI-LPV/R, 2b ¼ ABC þ ddI-NFV, 2c ¼ TDF-ddI-LPV/R, 2e ¼ AZT-3TC-LPV/r, 2g ¼ TDF-3TC-LPV/r, 2h ¼ TDF-3TC-ATV/r and 2i ¼ ABC þ 3TC þ LPV. The 3rd line adult regimens are: 3a ¼ DRV/r þ DTG þ AZT/3TC and 3b ¼ DRV/r þ DTG þ TDF/3TC. All of those regimens are based on the nucleoside reverse transcriptase inhibitors (NRTI), none nucleoside reverse transcriptase inhibitor (NNRTI) and a boosted Protease Inhibitor (PI) [25]. HIV positive patients less than 18 years of age, less than 95% adherence rate, pregnant women and who switched ART combination regimen for any reason were excluded from the study.

During the study period, as the Gedeo zone ART case team Health management Information system (HMIS) report reveals, they're a total 3597 adult PLWH (629 ART naïve (370 female, 259 male) and 2968 current on ART (1813 female, 1155 male)) were existed. Of whom, while (135 ART naïve and 537 ART exposed) were enrolled in the ART clinics of health centers, 412 and 2395 corresponding groups were served under the ART clinics of the hospitals. Among those PLWH on ART (2922 in the first line regimen (1790 female, 1132 male), and 453, 168, 1991, 308 and 1 were receiving (1c ¼ AZT-3TC-NVP), (1d ¼ AZT-3TC-EFV), (1e ¼ TDF-3TC-EFV), (1f ¼ TDF þ 3TC þ NVP), as well as (1g ¼ ABC þ 3TC þ EFV) regimens correspondingly. Similarly, 46 (23 female, 23 male) in the second line regimen and 10, 24, 6, 3, and 3 were on (2e ¼ AZT-3TC-LPV/r), (2g ¼ TDF-3TC-LPV/r), (2h ¼ TDF-3TC-ATV/r), (2i ¼ ABC þ 3TC þ LPV/r), and OTHER therapy, in the order presented.

The sample size estimation was made using openEpi version 3.03 software and by taking the following assumptions in to account: the two population proportion identified from the previous study done in Hawassa university specialized Hospital, Sothorn Ethiopia (P1 ¼ 15.6% for ART naïve and P2 ¼ 18.1% for ART-exposed) [23], with 1:2 ratio of the ART naïve and ART-exposed groups, 95% confidence interval, 5% level of significance, and with the power of 80% and 90, the calculated sample size for the first group became (n1 ¼ 3378) and (n1 ¼ 4521), respectively. However, due to the constraints of resources, we made different assumptions for our sample size estimation (Table 1 supplementary file S1 word doc.). Accordingly, using all of the above assumptions, the final sample size required for ART-naïve group, with power 90% to detect an increment of 13.2% of the proportion of MS in the ART group from the baseline (i.e. 15.6%) became 208. By adding 10% non-response, overall 687 (n1 ¼ 229 and n2 ¼ 458) HIV positive patients were proposed for the study.

To select participants, first stratification of the health care institutions of the zone according to the health care delivery levels as hospital and primary health care unit (PHCU)/health center was made. Subsequently, a simple random sampling technique of a random table method was employed, and two hospitals (i.e. Dilla University referral hospital (DURH) and Yirga/Cheffe primary hospital (Y/CHP)), as well as two health centers (Dilla Town and Wonago Health centers) were chosen for the study. Once the chronic HIV clinics were specified, so as to choose participants from the study population, a survey supplemented with the data logs at the data clerk of the ART clinics of each health facility was arranged for a month to evaluate the daily/weekly/monthly patient flow.

Using the compiled assessment monthly result, the proportional allocation of sample size (PPS) to ART-exposed and ART naïve cases required for each health institution for the study period was determined. Accordingly, the resultant estimated average monthly ART naïve and ART-exposed patients flown of each health in-stitutions became (14 and 132 for DURH, 7 and 43 YHP, 6 and 18 for WHC, and 3 and 12 for DHC). And, the total population computed for the study period and the population proportionally allocated sample size (PPS) estimated to the former and the later compara-tive group to DURH, YHP, WHC, and DHC were found to be (168 and 106 vs. 1584 and 282; 84 and 50 vs. 516 and 92; 72 and 43 vs. 216 and 38, as well as 36 and 19 vs. 144 and 25), respectively. Finally, by using a consecutive sampling technique, daily recruitment and selection of subjects, in accordance with the eligibility criteria's set to each comparisons group was carried on, until the estimated sample size to each study sites was obtained (Fig. 1).

2.2. Data collection

The data collection was accomplished using the validated WHO STEPS instrument version 3.2 [26], developed to chronic disease

risk factor assessment in developing countries, with modifications to the context of the Ethiopian community. It covers three different levels or 'steps' of risk factor assessment: Step 1 (questionnaire), Step 2 (physical measurements) and Step 3 (biochemical measurements).

Step 1: was used to gather demographic and behavioral characteristics of the PLWH from a representative sample.

Step 2: was employed to build on the core data in step 1 and to determine the proportion of the study population with raised blood pressure, overweight and obesity. The body weight and height were measured by wearing light clothing using the 220 SECA Scale placed on a firm, flat surface. BMI is calculated according to the formula ($BMI = \frac{\text{Body weight (kg)}}{\text{Body height}^2 (\text{m}^2)}$), which is a ratio of body weight in kilograms to the square of body height in meters. Waist and hip circumferences were measured by a constant tension tape meter with millimeter precision. Waist circumference (WC) was measured by placing a tape measure around the abdomen at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest of the hip bone, with the bare or light clothing, at the end

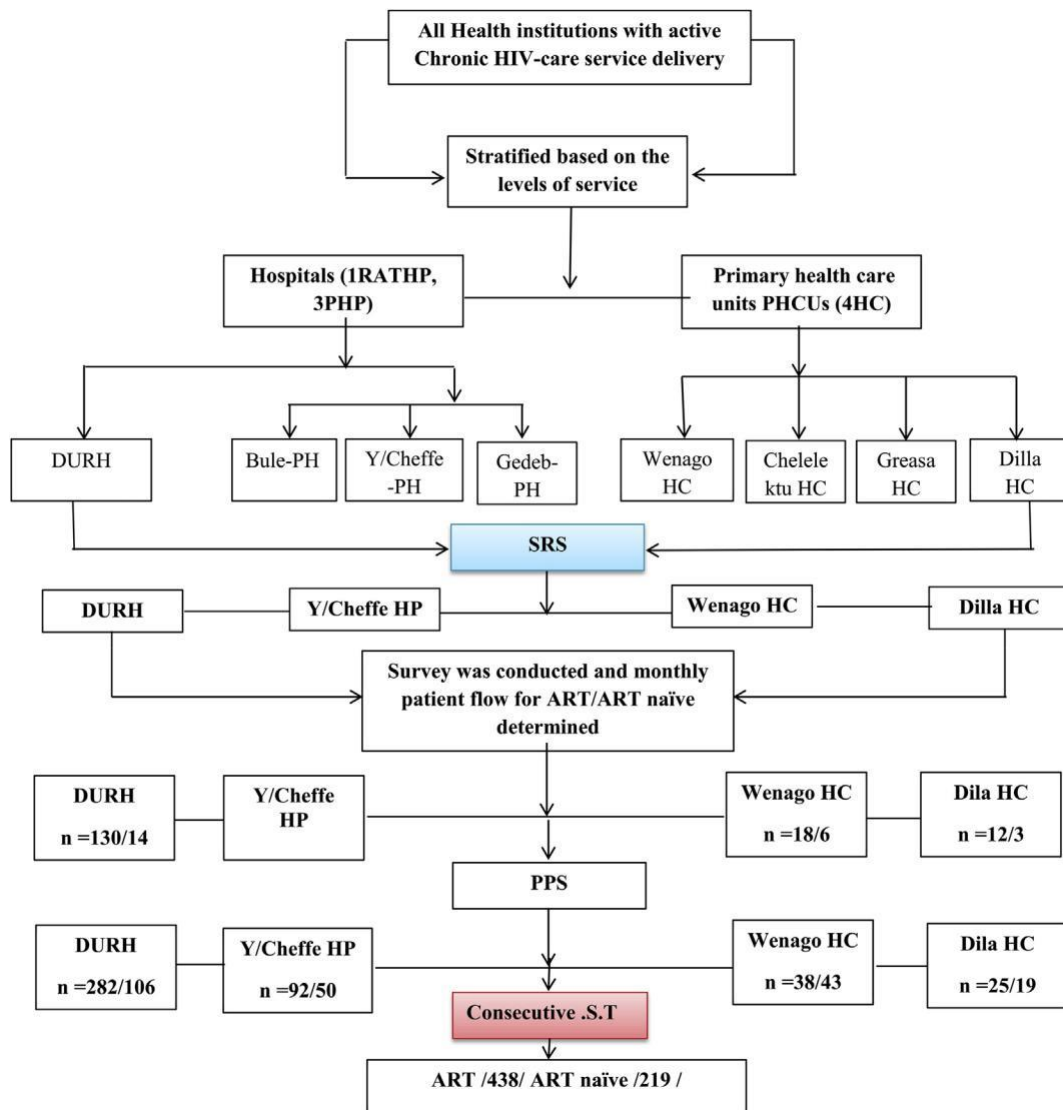


Fig. 1. Title the schematic representation of the study procedure, among PLWH, Gedeo zone, South Ethiopia, 2017e2019

of a normal expiration. Hip circumference was measured by placing a tape measure around the hip at the maximum circumference over the buttocks or around the greater trochanter of the femoral bone. Blood pressure measurements were taken three times on the left arm of the survey participants in a sitting position, using The NUTEC BP09 Arm-type Fully Automatic Digital Blood Pressure Monitor with cuff Circumference (Approx.135 (W) 485(L) mm (medium Cuff; Fits arm Circumference 22-36Cm)). The measurements were taken after the participant had rested for 15 min, and each with 3 min of rest between the measurements. Ultimately, the mean of the three measurements was taken for analysis.

Step 3: was important to build on the core data in step 1 and step 2 and measure the proportion of the study population with diabetes, impaired fasting plasma glucose and abnormal lipid level. Laboratory tests were performed the next day or sometime after completion of STEPS 1 and 2 of the data collection process, with 8e12 h overnight fast by drawing of 3e5 mL Venus blood. The blood samples were collected into dry vacutainer tubes and centrifuged with 5000 (rpm) for 5e10 min, using a centrifuge machine in order to separate the serum from the whole blood. Subsequently, the serum stored into refrigerator at 2e8 C or 20 C, until analysis. The biochemical analyses were done to all serum transported from other study sites and for those samples collected at Dilla University referral and teaching hospital (DURH) clinical Diagnostic Laboratory (i.e. the centralized unit for the whole biochemistry analyses). It was made for fasting plasma glucose level and lipid profile (Total cholesterol (TC), High-density lipoprotein cholesterol (HDL-c), Low-density lipoprotein cholesterol (LDL-c) and Triglyceride cholesterol (TGL-c)) measurement, using BS-200E Clinical Chemistry Analyzer. Enzymatic colorimetric assay method was used for the measurement of TC (CHOD-PAP method) and triglyceride (GPO-PAP method), HDL-c and LDL-c measurements were done by utilizing direct homogeneous enzymatic colorimetric assay technique. Glucose level was measured by the glucose oxidase method (GOD-PAP). All the reagents, used for the glucose and lipid profile testing, were from Human Gesellschaft für Bio-chemica und Diagnostica mBH (Germany). Often, the quality control samples were run before running patient samples and along with patient samples in order to check the correct functioning of instruments, laboratory reagents, and technical performances. All laboratory performances were done by lab technologists by using standard operating procedures (SOPs) from sample collection to result in releasing. Finally, values of the analyzed clinical and biochemical measures got complied with the revised Adult treatment panel III standard criteria set for Europe countries.

2.3. Definition of metabolic syndrome(MS)

The presence of MS was diagnosed according to the 2005 revised National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATPIII) criteria [6]. Based on this criteria, the cholesterol (HDL-c) < 40 mg/dL (male), <50 mg/dL (female)); Blood pressure (BP) systolic/diastolic(SBP/DBP) 130/85 mmHg or anti-hypertensive medication and Fasting plasma glucose 6.1 mmol/L (>= 110 mg/dl)). Or previous diagnosis of type 2 diabetes mellitus or anti-diabetic treatment.

2.4. Data processing and analysis

Every day, after completion of each step of the data, the completeness of these tools was checked by the immediate supervisor and the main author. The completed tools entered in to template formed using Epidata version3.1 software by two data clerk; eventually validation was performed using the original data as references. Subsequently, data was transformed in to Statistical Package for Social Sciences (SPSS) Version 22 for analysis. Statistical analysis was performed by the principal investigator in consultation with the primary and secondary supervisory, using appropriate methods for the complex sample design of the study. Charts were produced using Microsoft® Excel 2007. The prevalence of each component and overall metabolic syndrome were estimated and differences between groups (ART status, age, and sex groups) were calculated with a 95% CI. Sampling error,

which could potentially affect the accuracy of the results of the current study, was measured by the standard error of variables. A margin of error in prevalence is represented by numeric values for the lower and upper limits of a 95% CI.

2.5. Ethical clearance

All the principles of ethics laid down in the Declaration of Hel-sinki (and its successive amendments) were considered. Accordingly, ethical clearance was obtained first from Addis Ababa University (AAU) College of Health Sciences school of public health Research and Ethics Committee (REC) (Ref.No.SPH257/09) then from College of health science Institutional Review Board (IRB)(-Meeting No.001/2017 and protocol No.0069/16/SPH). Furthermore, the official letter was produced and delivered by the author to the respective Southern Nations Nationalities Regional health bureaus, Gedeo zone and Woreda health bureaus and all of the institutions selected to conduct the study. Data were collected unlinked anonymously, without any personal identifiers. Each individual was enrolled entirely voluntarily after written consent was obtained. Any information obtained during the study was retained with the greatest confidentiality. Physical measurement was done by performing measurements at an ART clinic room that has been screened off to maintain the individual's privacy. All biochemical analysis was performed free of charge, and results were provided to the clinicians for further investigation, and possible management.

3. Result

3.1. Socio-demographic characteristics

Out of the 687 (219 ART naïve and 438 ART-exposed) proposed samples, a total of 633 adult people living with HIV (n = 422 on ART and n = 211 ART-naïve) were involved, with an overall response rate of 92.1%. The mean age of the study population was 36.4 ± 8.7 years (ART naïve men, 36.4 ± 6.9 years versus women, 37.9 ± 7.8 years). This is consistent across all age groups through the highest proportion of ART-exposed women 76.1% (137) belonged to the younger age group (Age <= 34) compared with men 74.1% (100) (Table 2 supplementary file S2 word doc.).

As the result further reveals, out of the 302 respondents who were able to remember their stay of living with the virus since diagnosis, greater number, 278(43.9%)(123(58.3%) ART naïve and 155(36.7%) ART-exposed)) of them were below a year, with the mean reported duration of 5.31 ± 3.99 months. Besides, among those who were able to react for the time spent since ART initiation, 98 of the ART-exposed respondents were able to estimate the duration; of which 53 (8.4%) (18(7.0%) of men and 35(9.3%) of women) were exposed for less than 6 months, with reported average exposure time of 5.69 ± 3.00 months (6.27 ± 3.09 months for men and 5.31 ± 2.90 months for women). The therapeutic schemes were based on the 1st line, 2nd line, and 3rd line regimen. All of those regimens are based on the nucleoside reverse transcriptase inhibitors (NRTI), none nucleoside reverse transcriptase inhibitor (NNRTI) and a boosted Protease Inhibitor (PI). Accordingly, overall 226 (53.5%) women and 196(46.5%) men were on both types of regimens (Table 3 supplementary file S3 word doc.).

3.2. Physical measurements

The mean and standard deviation (SD) associated with physical measurements are summarized in Table 1.

The magnitude of hypertension was found to be 56.9% (95%CI: 53.1e60.5); where 55.6% was diagnosed from elevated systolic and diastolic blood pressure (SBP 130 and/or DBP 85 mmHg). The ART naïve groups, had shown slightly greater proportion 57.3%(95%CI: 50.7e64.5) than ART-exposed 56.6% (95%CI: 51.7e61.4). (Fig. 2 supplementary file S1pdf. Document). The result further indicates, nearly 28%(28.9%, 95%CI: 25.3e32.7) of study population had central or abdominal obesity; higher proportion was seen among ART exposed 32.0% (95%CI: 27.7e37.0) than ART naïve 22.7% (95%CI: 17.1e28.4) groups. Of which, 21.8% of PLWH were diagnosed with elevated WC (>102 cm for men and >88 cm women), and 9.8% of them were diagnosed with elevated body mass index (BMI > 30 kg/M2), (Fig. 3 supplementary file S2 pdf. Doc.).

3.3. Biochemical measurements

In line, the study further measured the mean and standard deviation (SD) associated with the biochemical measurements and summarized in Table 2.

Thirty one point three percent (32.9%, 95%CI: 28.4e37.4 ART group compared to 28.0% ART naïve 95%CI: 21.8e34.2) of PLWH had diabetes (Fig. 4). Of whom, 26.4% (95%CI: 23.2e29.9) of participants were found to have impaired fasting plasma glucose, and the rest had history of type two DM or anti-diabetes treatment (Fig. 4 supplementary file S3 pdf. Document). Furthermore, the result indicates, generally 59.2% (95% CI: 55.5e62.7) of the study respondent were diagnosed with dyslipidemia; prominently higher magnitude, 60.4% (95% CI: 55.9e64.9) noticed in the ART exposed than ART naïve groups, which is 56.9% (95% CI: 50.2e64.0). Of which, nearly 37% (95% CI: 33.0e40.8) of them had elevated TGL_c level of 150 mg/dl and 34.3% (95% CI: 30.6e38.1) of them had low HDL_c level (<50 mg/dl for women and <40 mg/dl for men) (Fig. 5 supplementary file S3 pdf. Document).

As the study result pinpointed, the overall proportion of MS was found to be 22.0%; (22.5%, 95% CI: 18.7e26.8 in the ART-exposed and 20.9%, 95% CI: 15.2e27.1 in ART naïve group); which was found to be slightly higher in the former group than the later (Table 3) (Fig. 2). A significant differences on the prevalence estimates was observed across sexes and age groups, with a notable increase in the proportion of MS in the corresponding groups of women (23.1% 95% CI: 18.9e27.4) than men (20.2%, 95% CI: 15.6e26.1), as well as older age group than young age (Table 3) (Fig. 2).

3.4. The overall magnitude of the metabolic syndrome

The percentage contribution of each of the four components in the diagnosis of the overall magnitude of MS was further evaluated, and comparably higher contribution was made by dyslipidemia (20.5%) and hypertension (20.4%); followed by Diabetes mellitus (15.6%) and central obesity (12.5%). Shortly, the contribution from ART-exposed than ART naïve groups was higher to all traits of MS, except for the case of hypertension (Fig. 7 supplementary file S5 pdf. Document). In line, the result further revealed the percent-age contributions made by each of the physical and the biochemical measurement to diagnose the overall magnitude of MS (Table 7 supplementary file S4 word document). Table 1

4. Discussion

Human immune deficiency virus (HIV) infection is responsible for MS and NCD risk in the general population [6,7]. Due to such reasoning, there is growing concern that MS associated with HIV and ART, place this population in a high-risk category [7]. However, the precise magnitude of MS in the HIV-infected population and its differential contribution by ART status is still arguably [2,6,7,16]. Essentially, in sub-Saharan Africa (SSA) region in general and in Ethiopia, in particular, the situation is not yet well-known [23]. Therefore, the intent of this comparative cross-sectional study was to estimate and compare the global magnitude of MS among ART-exposed and ART naïve people living with HIV (PLWH) in Gedeo zone, southern Ethiopia. Overall, the study concluded that the global magnitude of MS among PLWH was notified as higher, with a slight difference observed in the ART-exposed than ART naïve group. As well, the contribution of dyslipidemia was found to be higher, followed by hypertension, diabetes, and central obesity that all of these traits were relatively greater in the ART-exposed than ART naïve, except for the case of hypertension.

The current study finding on the overall prevalence of MS to be higher than the study done on apparently healthy peoples in Addis Ababa, Ethiopia [27]. On top of that a lower percentage of MS was besides identified in the present study than studies by Husain et al. (2017) [2] review finding in Africa (13%e58%), Dr.J.Balachandrudu et al. (2018) (40%) [28], Nguyen KA, (2016) (24.6e31.3%) [16], Tesfaye et al. (2014) (25%) [23] and Hirgo et al. (2016) [20] (24.3%) [20,23]. Inconsistently lower than our report, a number of studies done among HIV- infected patients worldwide point out magnitude's ranging from 15.0 to 20.0% [16,20,23,29e31].

Mean (SD) of physical measurements, among PLWH, Gedeo zone, South Ethiopia, 2017e2019.

ART status	Age groups in years	n	The mean (SD) of WC in Both Sex		The mean (SD) of BMI in Both Sex		The mean (SD) of SBP in Both Sex		The mean (SD) of DBP in Both Sex	
			Mean	SD	Mean	SD	mean	SD	mean	SD
ART naïve	<1/434	78	81.5	8.0	22.39	4.92	126.7	7.9	81.9	4.9
ART-exposed		237	82.1	8.0	21.78	4.06	125.0	11.5	83.0	6.3
ART naïve	35e44	87	84.7	7.4	21.75	4.13	127.2	8.4	83.4	5.2
ART-exposed		116	85.2	7.6	22.41	4.88	128.5	11.6	83.6	6.1
ART naïve	>1/445	46	85.7	9.4	22.81	3.70	126.5	6.3	83.2	5.0
ART-exposed		69	85.4	7.5	23.16	5.38	130.9	10.5	83.9	6.3
ART naïve	All age	211	83.7	8.2	22.22	4.36	126.9	7.8	82.8	5.1
ART-exposed		422	83.5	7.7	22.18	4.54	126.9	11.5	83.3	6.3
Total		633	83.6	7.9	22.19	4.48	126.9	10.4	83.1	5.9

*WC: Waist circumference *SBP: Systolic Blood Pressure.

*BMI: Body mass index *DBP: Diastolic Blood Pressure.

Table 2
The mean and (SD) of biochemical measurements, among PLWH, Gedeo zone, Southern Ethiopia, 2017e2019.

ART status	Age groups in years	n	The mean (SD) of HDL_c in Both Sex		The mean (SD) of TGL_c in Both Sex		The mean (SD) of FpGL in Both Sex		The mean (SD) of TC in Both Sex		The mean (SD) of LDL_c in Both Sex	
			Mean	SD	Mean	SD	mean	SD	mean	SD	mean	SD
ART naïve	</¼34	78	53.1	23.2	133.3	29.9	96.19	26.4	168.7	40.8	138.7	32.2
ART-exposed		237	59.8	24.3	144.2	31.4	111.2	38.4	179.8	42.0	145.4	30.5
ART naïve	35e44	87	55.2	24.8	131.1	31.5	102.0	22.0	175.9	42.4	139.4	33.4
ART-exposed		116	59.9	24.2	147.2	30.8	112.8	39.0	182.7	51.4	148.6	33.3
ART naïve	>/¼45	46	47.3	19.7	138.4	28.0	102.0	22.0	156.3	35.8	136.0	32.6
ART-exposed		69	54.0	20.7	149.5	37.6	116.9	42.3	185.4	44.9	147.2	34.5
ART naïve	All age	211	52.8	23.3	133.5	30.2	102.2	30.1	168.9	41.0	138.4	32.7
ART-exposed		422	58.9	23.8	145.9	32.3	112.6	39.1	181.5	45.2	146.6	31.9
Total		633	56.8	23.8	141.8	32.1	109.1	36.7	177.3	44.2	143.9	32.4

* TGL_c: Triglyceride cholesterol * HDL_c: High density lipoprotein cholesterol.

*SD: Standard deviation * LDL_c: High density lipoprotein cholesterol * FpGL: fasting plasma glucose.

Table 3
Magnitude of Metabolic syndrome (%MS), by ART status, age, and sex, among PLWH, Gedeo zone, Southern Ethiopia, 2017e2019.

	The magnitude of Metabolic syndrome (%MS)							Both Sex		
ART status	Age groups in years	Sex								
		Men			Women					
		n	% MS	95% CI	n	% MS	95% CI	n	% MS	95% CI
ART naïve	</¼34	35	8.6	0.0e17.1	43	14.0	4.7e25.6	78	11.5	3.8e19.2
ART exposed		100	13.0	7.0e20.0	137	14.6	8.8e20.4	237	13.9	9.7e18.6
ART naïve	35e44	47	17.0	6.4e27.7	40	30.0	15.0e45.0	87	23.0	14.8e33.3
ART-exposed		39	35.9	20.5e51.3	77	23.4	14.3e33.8	116	27.6	18.8e35.5
ART naïve	>/¼45	18	33.3	11.1e55.6	28	32.1	14.3e50.0	46	32.6	19.6e47.8
ART-exposed		18	44.4	21.4e66.7	51	43.1	29.4e56.9	69	43.5	31.9e55.1
ART naïve	All age	100	17.0	9.0e25.0	111	24.3	16.2e32.4	211	20.9	15.2e27.1
ART-exposed		157	22.3	15.9e29.3	265	22.6	17.7e27.9	422	22.5	18.7e26.8
Total		257	20.2	15.6e26.1	376	23.1	18.9e27.4	633	22.0	19.0e25.4

As well, the study report from Nigeria also shown the extremely lower magnitude of MS (12.7%) than the current study finding [32]. Besides, nearly correlating with the current study result, a meta-analysis study done in the SSA by Todowede et al. (2019) [7] (21.5% 95% CI 15.09e26.86), a cross-sectional study conducted in HIV-1 infected Thai adults by Jantarapakde J et al. (2014) [33] (22.2%), and Berhane T et al. (2012) cross-sectional study done in South West Ethiopia (21.1%) [34]. The observed inconsistencies on the magnitude of MS could be attributed to the overlapping of range of factors such as host, HIV and/or its associated therapies, as it has been suggested by literature [7,14,16,20,21]. Apart from these, the different standard criteria employed by the studies to diagnose the overall MS, along with the diverse approaches used by the studies may be taken as a justification. This, in turn, dictates, regardless of the improvement in the quality of life conferred by immune reconstitution, the HIV infection and ART bringing the PLWH into the future risk of developing NCDs, subsequent with the acquisition of MS.

As well, in this study, we found that a slightly higher proportion of overall MS diagnosed in the ART-exposed than ART naïve counter group. Correlating with Nguyen KA, (2016) study (18.4% vs. 11.8%, $p = 0.001$) [16], and D.Y. Tesfaye et al. (2014) (18.1% versus 15.6%, respectively, $p = 0.52$) [23]; however, all are below the reported magnitude to each groups indicated by the active study result. Besides, the finding demonstrated consistency with the study re-reported by Jantarapakde J et al. (2014) in HIV-1 infected Thai adults (24.9% ART-exposed vs. ART naïve 15.9%) [33], and D.Y. Tesfaye et al. (2014) (25% on ART compared to 22.6% in ART-naïve group; $p = 0.58$ by IDF) [23]. In the reverse, a study report by Ngatchou W et al. (2013) [35] done in Cameroon was notified lower rate of MS (21%) in the ART-exposed and extremely higher magnitude (47%) among the ART naïve

group. The observed differences on the magnitude of MS among the two comparative groups may be attributed to the study approaches used, the standard criteria employed, the number of individuals involved, as well as the socio-economic and cultural dissimilarities associated with the host. Besides, not surprisingly, even if both the HIV-infection and ART have an independent role in the acquisition of MS complication, but the ART together with the virus might have a synergetic effect on the disease progression by aggravating the impaired metabolic processes to be underway.

Furthermore, there was also a notable increase in the prevalence of MS in the corresponding groups of women than men PLWH. Analogues with our finding, a comparative cross-sectional study by Hirigoet al. (2016), in the southern Ethiopia [20], a meta-study by Nguyen KA, (2016) [16], Tesfaye, et al. (2014) [23], Mbunkah, et al. (2014) [31], Jantarapakde, et al. (2014) [33], Ayodele, et al. (2012) [32], Berhane, et al. (2012) [34], and Zannou et al. (2009) [36] studies notified comparable finding. Consistency of difference of proportion across sexes, with a higher magnitude of MS seen among women than men were also reported by Abda et al. (2016) [37] study done among non HIV-infected outpatients in Jimma southwest Ethiopia. On top of that, there was also an observed

variation on the reported magnitude in between the current study report and the studies of Nguyen KA, (2016) (women 26.7%, 95%CI: 20.8e33.0 than men 23.7%, 95%CI: 19.0e28.7) [16]; Mbunkah et al. (2014) [31] (18.3% in women vs. 4.3% in men, $p = 0.003$), Zannou, et al. (2009) [36] (19.2% in women vs. 3.1% in men; $P = 0.043$), and Nguyen KA, (2016) (women 17.5%, 95%CI: 14.0e21.2 and men 14.6%, 95%CI: 11.5e18.1) [16].

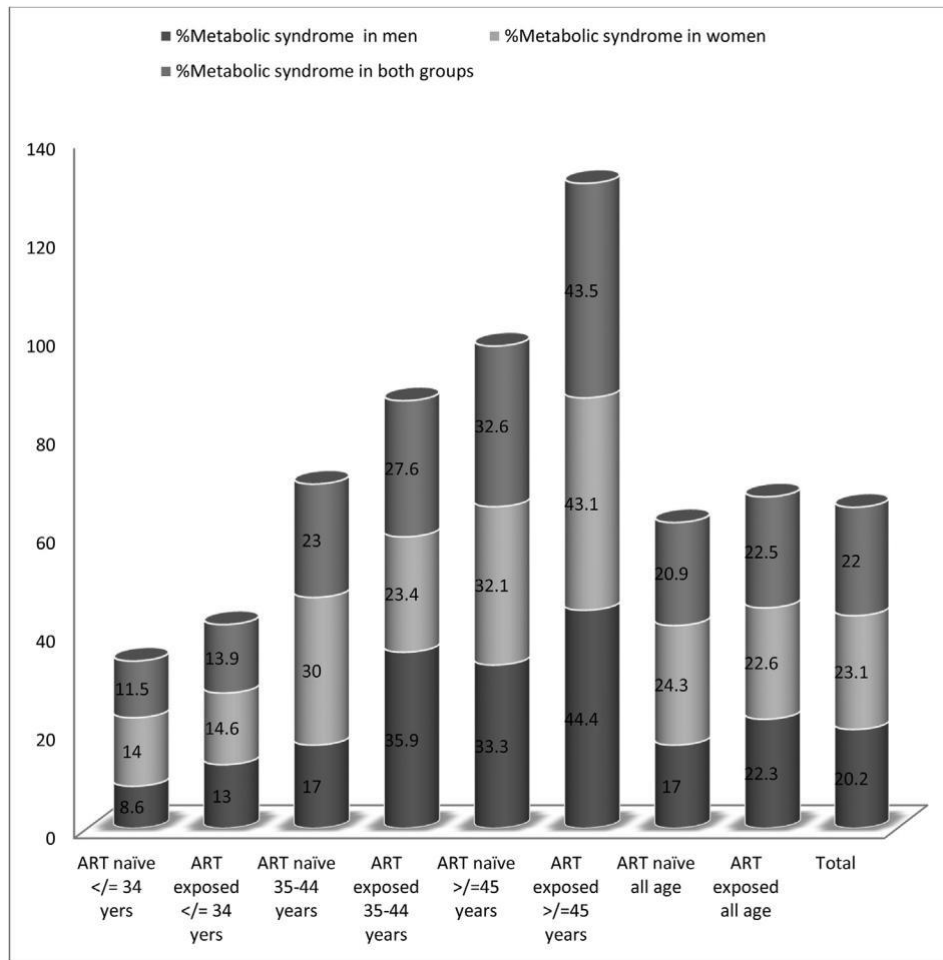


Fig. 2. Title Magnitude of Metabolic syndrome (%MS), by ART status, age and sex, among PLWH, Gedeo zone, South Ethiopia, 2017e2019.

The observed differences in magnitude among the two groups could be partly attributed to the biological and physiological differences inherited from being of male and female. Besides, central obesity precipitated with pregnancy and childbirth, any pregnancy induced chronic disease such as pregnancy-induced hypertension and gestational diabetes might also favor the women to have greater MS than men. In addition, as it has been suggested by Kiama et al. study [10] done in Kenya, hormonal and environmental factors that are thought to be contributing to the occurrence of metabolic syndrome in women.

Also, the prevalence of MS in the current study reveals increased noticeably with aging, aside from it was realized higher in the older age than in the younger age. This marked disturbance in the MS with aging has also been reported by several other studies of Tesfaye et al. (2014) [23], Jantarapakde, et al. (2014) [33], by Mashinya et al. (2015) [38], and by Dr.G.Madhavi et al. (2018) [28]. This may be partly due to the inevitable degeneration of organ experienced by any person following with the increase in age has a consequence on the pathological organ function and that might provoke the genesis of impaired metabolic actions, and ultimately to develop MS.

Besides, the current study was also pinpointed that the contribution of dyslipidemia was found to be higher, followed by hypertension, diabetes mellitus and central obesity. The magnitude of each of the above traits was relatively greater in the ART-exposed than ART naïve, except for the case of hypertension. In spite of the variation seen on the magnitude of each trait, a cross-sectional study done in the South-West region of Cameroon using 173

treated and untreated HIV-infected out-patients by Mbunkah et al. (2014) demonstrated that dyslipidemia diagnosed from low HDL_c (43%), and hypertriglyceridemia (12.1%), followed by Hypertension (24.7%), central obesity (36.8%), and hyperglycemia (26.5%) was the most frequent traits of MS [31]. As same, Husain et al. (2017) review [2] also notified that the magnitude of each component in HIV population in Africa was estimated to range from (2.1%e26.5%) for diabetes and (20.2%e43.5%) for pre-diabetes and (13%e70%) for dyslipidemia. Another study conducted among 100 HIV patients on ART and HIV negative controls revealed that the magnitude of serum triglyceride levels are higher in HIV patients than in controls (60% vs 32), followed by hypertension (52% vs 27), fasting blood sugars (45% vs 33%), and Central obesity (33% vs 27%) in the corresponding comparative groups. However, HDL_c was reported to be low in HIV patients than controls (69%vs 32%). This may be partly associated with the development of the peripheral lipodystrophy with loss of subcutaneous fat following the use of ART is a harbinger of underlying dyslipidemia, insulin resistance, and ultimately acquiring of diabetes. On top of that as it has been suggested by Willig AL et al. (2016) [21], [21] review report, the HIV infection as well likely induces changes in mitochondrial function, adipose tissue, and inflammatory pathways independent of ART and have increased the probable chance of occurrence of the above consequences among these subjects.

The limitations of this study mainly emerged from the observational nature and cross-sectional design of the study; therefore, we cannot establish a cause and effect relationship. In addition, the inherent problems raised by the institution based studies that might be failed to reflect the true prevalence estimates of the target population.

5. Conclusion

The study concluded that the global magnitude of MS among PLWH was notified as higher, with a slight difference of magnitude observed in the ART-exposed and ART naïve groups. This signifies the existence of HIV associated MS that necessitates immediate prevention and management strategies in such resource restricted area. As well, the contribution to estimate the global proportion of dyslipidemia was found to be higher, followed by hypertension, diabetes mellitus and central obesity. The magnitude of each of the above traits was relatively greater in the ART-exposed than ART naïve, except for the case of hypertension. Which implicates, in the time of entire test and treat course of action among HIV infected patient, routine follow-up of MS and its traits encompassed through the whole management system is indispensable.

Consent for publication

Not applicable.

Availability of data and materials

All data generated or analyzed during this study are included in this published article [and its supplementary information files].

Conflicts of interest

I confirm that there is no competing of interests in this research work.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.dsx.2019.07.051>.

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Predictors of Metabolic Syndrome Among People Living with HIV in Gedeo-Zone, Southern-Ethiopia: A Case–Control Study

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Background: Intensive access to antiretroviral therapy improved the prognosis of HIV. As a result, a non-communicable disease risk marker known as metabolic syndrome (MS) has emerged. It is a public health issue in sub-Saharan Africa including Ethiopia. However, there is little literature on predictors of MS among

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people living with HIV (PLHIVs) in the study area context.

Purpose: To identify predictors of metabolic syndrome among PLHIVs, Gedeo Zone, Southern-Ethiopia.

Methods: Health institutions-based unmatched case–control study was conducted. All HIV-infected adult persons who are receiving routine care in the randomly selected two hospitals and two health centers of the Gedeo zone, southern Ethiopia were involved in the study, conducted from December 29th, 2017, to January 22nd, 2019. PLHIVs diagnosed with MS using ATP III criteria were considered as a case, and subjects free of MS in the survey were enrolled as controls. Binary logistic regression was employed to identify predictors of MS.

Results: A total of 633 (139 cases and 494 controls) PLHIVs were included in the study. The multivariable analysis result found that age (AOR=1.09, 95% CI (1.05–1.12)); educational status being completed secondary school (AOR=0.22, 95% CI (0.02–0.42)); occupational status being of students (AOR=0.11, 95% CI (0.24–0.51)); wealth index being in the middle quintile (AOR=0.22, 95% CI (0.06–0.79)); ART status exposed to ART (AOR=3.07, 95% CI (1.37–6.89)); total physical activity state being physically active (AOR=0.36, 95% CI (0.16–0.79)), and engaged in low levels physical activity (AOR=3.83, 95% CI (1.46–10.05)) were the factors significantly associated with MS.

Conclusion: While education, occupation, wealth index, antiretroviral therapy status, total physical activity, and lower physical activity levels were concluded by the study as modifiable predictors of metabolic syndrome, age was found as a non-modifiable independent risk of metabolic syndrome. There is a need for an ongoing effort to realize an integrated care plan that addresses both the routine care and regular screening programs to reduce the risks associated with MS and its traits in these subjects.

Keywords: predictors, risk factors, metabolic syndrome, Gedeo zone, southern-Ethiopia

Introduction

Globally, there were 38.0 million [36.2 million adults] people living with HIV (PLHIVs), and 690 000 died from AIDS-related illnesses at the end of 2019.¹ East and Southern Africa is the region hardest hit by HIV, in which there were nearly 20.6 million people infected, and around 310,000 people died of AIDS-related illnesses in 2018.² Sub-Saharan Africa carries the highest-burden with an estimated

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71% of the global total. In Ethiopia, an estimated 715 404 people were living with HIV in 2015 and this increased to 722 248 in 2017.³

Despite the continuing severity of the epidemic, as of the end of 2019, 25.4 million people were accessing antiretroviral therapy (ART) in the globe.¹ In East and Southern Africa, 85% of 79% of PLHIVs were on treatment in 2018.² In Ethiopia, 71% of PLHIVs are current on ART in 2016.⁴ With such expanding global access to the treatment, the prognosis of HIV/AIDS is improved.^{5–8}

As a result, the worldwide morbidity and mortality from infectious diseases have occupied a backseat;⁹ instead, non-HIV-related chronic conditions, non-communicable diseases (NCDs) are increasingly emerging.^{9–11} The PLHIVs have high rates of NCDs^{5,12} due to the acquisition of non-AIDS-related comorbidities, like metabolic syndrome (MS).⁵

Metabolic syndrome (MS) is commonly defined as a constellation of interconnected complex diseases, like abdominal fat, high blood pressure, dyslipidemia, elevated blood sugar.^{7,13,14} There have been diverse standardized definitions used to measure overall MS,¹⁴ each with criteria that influence its diagnosis and complexity.⁹ Of which, the revised National Cholesterol Education Program (NCEP) Adult Treatment Panel III (ATP III) was the most widely employed criteria in Africa,^{11,15,16} which is also used to ascertain the outcome in the current study.^{15,17}

MS has a higher attendant economic and health system burden, resulted from the cost for identification and monitoring of it among PLHIVs, together with the routine care.^{13,18} It has a substantial undesirable impact on the treatment and the long-term prognosis of HIV patients due to NCDs.⁵

The significance of the MS is that it is a dominant predictor of future NCDs, primarily cardiovascular disease (CVDs) and type two diabetes mellitus (T2DM).¹⁴ NCDs are a major public health and medical challenges of the globe. It is rising disproportionately across countries. In 2016, over 3/4th of NCD deaths, 31.3 million deaths happenings in low- and middle-income countries.¹⁹ In Ethiopia, 52% of the total mortality in 2016 was reported to be an attribute of NCDs. The disease has a dramatic impact on out-of-pocket expenditures (OOP), accounts for 23% of total OOP expenditures.²⁰

For this reason, there is a growing concern about what predicts MS among HIV-infected populations, yet little is known about this context. A recent crosssectional study in Ethiopia Ataro and Ashenafiin, 2020 reported Age, education, and type of ART as predictors of MS.⁴ Another narrative review in people living with HIV in Africa Husain et al

notified the following factors: female sex, age, time post-infection, exposure to ART, type of ART regimens, CD4 count, smoking, family history of diabetes, overweight, lipodystrophy, and total cholesterol as predictors of MS.¹³ This implies that the PLHIVs in Africa, including in the SSA share many common risk factors of NCDs, which are likely to be very large,¹² encompass a combination of modifiable and non-modifiable individual-based factors.^{5,12}

Additionally, a meta-analysis of 65 crosssectional studies across five continents, including Africa documented that nevertheless, lifestyle or behavioral risks factors contribute to these conditions, additional influences unique to HIV-infected populations further rise their vulnerability to MS. Notably, disease severity indicator like the level of CD4 +counts, the duration of diagnosed HIV infection, and exposure to ART was found as risk factors of MS. Furthermore, the study described that the use of ART is related to body fat redistribution and metabolic traits such as dyslipidemia, hypertension, insulin resistance, and dysglycaemia. The HIV infection itself through chronic inflammation and immune dysfunction condition is presumed to be essential predictors of dyslipidemia, atherosclerosis and type two diabetes mellitus.¹⁴

Evidence related to MS among HIV-infected individuals are compulsory to notify several HIV/AIDS programs and indicate the need for preventive and management strategies, and facilitates healthcare services design. However, there found few primary data on the predictors of MS in PLHIV in resource-limited settings.⁴

Unambiguously, in Ethiopia, even if there were few primary studies conducted crosssectional on the study theme; there is no sufficient evidence on the predictors of MS among HIV-infected patients, using such a relatively stronger study approach. The study is perhaps vital to recognize and differentiate those, which are modifiable factors certain to reduce MS and its long-term complications (NCDs) in these subjects.

Therefore, this study sought to identify predictors of MS among PLHIVs, in the Gedeo Zone, Southern Ethiopia, and plug the gap in the existing literature.

Methods and Materials

Study Site

This study was conducted in the Gedeo zone, which is located in the Southern Nations, Nationalities, and Peoples (SNNP) region; 360km to the south of Addis Ababa, Ethiopia. It was made in the randomly chosen

two hospitals (H) and two health centers (HC), namely: Dilla University referral and teaching hospital (DURH), Yirga-Cheffe primary hospital, Wonago HC, and Dilla town HC. During the study period, as the Gedeo zone ART case team Health Management Information system report reveals, there were 3597 adult PLHIVs (629 ART-naïve (370 female) and 2968 current on ART (1813 female)). Of whom, while (n=135 ART naïve and n=537 ART exposed) were enrolled in the ART clinics of all public health centers, 412 and 2395 corresponding groups took services under the ART clinics of the public hospitals.

Study Design and Period

The unmatched case-control study design was conducted in between December 29th –2017 and January 22nd –2019.

Source and Study Population

Confirmed HIV-positive individuals; either previously enrolled in the randomly selected chronic HIV care clinics of the public health institutions found in the Gedeo zone, who revisited the clinics currently to take their routine care or enrolled in those clinics for the first time and participated in the prior survey arranged for one year were considered as a source population. The cases and the controls with or without the outcome of interest determined as per the criteria stipulated below were used as study populations.

Outcome Ascertainment

Metabolic Syndrome (MS)

Defined using the revised National Cholesterol Education Program (NCEP)-Adult Treatment Panel three (ATP III) criteria. Based on this criteria, the presence of three of the following criteria was employed to diagnose cases with the outcome of interest (MS): elevated waist circumferences (WC ≥ 102 cm or 40 inches (men), ≥ 88 cm or 35 inches (women)) or raised Body Mass Index (BMI ≥ 30 kg/m²); raised triglycerides: (triglyceride ≥ 1.7 (≥ 150 mg/dl) or treated; high-density lipoprotein cholesterol (HDL ≤ 40 mg/dL (Male), ≤ 50 mg/dL (Female)) or Treated; elevated blood pressure (systolic/diastolic BP $\geq 130/85$ mmHg or treated with antihypertensive medication, and raised fasting plasma glucose (FpGl ≥ 110 mg/dl) or previously diagnosed with type 2 diabetes mellitus or anti-diabetic treatment).¹¹

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Case Finding

Cases were identified when they came into those randomly chosen public health institutions' chronic HIV care clinics for their routine care and participated and eventually enumerated as a case (ie, with the outcome of interest) in the prior survey. The detail is described elsewhere.²¹

Eligibility Criteria for the Cases

Inclusion Criteria

Confirmed HIV-positive adults with or without antiretroviral therapy, who enrolled in the chronic HIV-care clinics of the public health institutions for the unrestricted period or for the first time and was recorded a case ascertained as per the revised ATP III criterion, whose age was ≥ 18 years and below 70 years old were included in the study. The underline reason to take that age limit is due to the associate of age range more than or equal to 70 years old with metabolic dysfunction in most adults, after controlling for various factors, as suggested by various studies.^{4,13}

Exclusion Criteria

Individual PLHIVs with the following conditions such as mental disorders, communication barriers, pregnant women, severely ill subjects, and have restrictions impede their participation were excluded from the study.

Control Selection Method

The control selection was accomplished using a cumulative case-control design. Accordingly, the control groups were sampled from among those who did not become cases (free of MS) or with lower than two numbers of ATP III criteria established to ascertain the outcome of interest in the prior survey.

Sample Size and Sampling Procedure

As this study is unmatched case-control, different sample sizes were calculated using Open Epi Version 3.03 with the assumption of power (% chance of detecting) of 80%, two-sided confidence level (1-alpha) of 95%, the case-control ratio of 1:3 hypothetical proportion of controls to be 19.1% and hypothetical proportion of cases with exposure to be 32.0%; estimated from a systematic review and meta-analysis study done in the globe by taking duration with HIV infection as one of the main exposure variables for MS that provide the maximum sample size.¹⁴ Accordingly, that yields a minimum sample size of 126 cases and 376 controls. Adding a 10% non-response rate,

the final sample size required for the study were cases 139 and controls 414. To increase the power of the study, all cases observed during a year along with the corresponding three controls were included in the study. Concerning the sampling procedures, the detail is described elsewhere.²¹

Data Collection Methods and Materials

An interviewer assisted data collection method was used to accomplish the data collection procedure. Four teams were formed in each of the selected health institutions; each with six people (a supervisor and five data collectors, ie, 3 ART nurses and two laboratory technologists). On the day of data collection, the ART nurses delivered information verbally on the survey and assess their eligibility. This was followed by securing written consent for each volunteer. After securing consent, the data collection process starting to be accomplished using a checklist and the WHO/NCD STEPS instrument version 3.2.²² The checklist was developed following reviewing the different medical records and employed to collect data from Pre ART/ART log-books. It consists of questions regarding HIV/AIDS-related factors. The STEPS instrument was supplemented with the WHO step tool recommended show cards. In the first step: a questionnaire tool was used to gather data on respondent's demographic and socioeconomic status; tobacco use; alcohol consumption; diet, including fruit and vegetable consumption, etc. in step 2: a physical data tool was used to build on the core data in step 1 and to determine the proportion of the study subjects with elevated blood pressure, and obesity. In step 3: a biochemical tool was used to build on the core data in step 1 and step 2 and measure the proportion of subjects with diabetes, raised blood glucose, and abnormal lipid level. The Laboratory tests were performed with 8–12 hour overnight fast by drawing of 3–5 mL Venous blood. The detail is also presented in another place.²¹

Data Processing

The completed tools entered into a template formed using Epidata version 3.1 software and then transformed into Statistical Package for Social Sciences (SPSS) Version 22 for further analysis.

Data Analysis

The proportion, mean, and standard deviation measures were statistical techniques used to estimate the physical and biochemical associated risk factors. The dependent out-come variable was dichotomized as having metabolic

syndrome (MS), and not having MS. Bivariable logistic regression was performed to see the crude association between the exposure and the outcome variable. All variables significant at the $p < 0.1$ level in the bivariable analysis were moved to multivariable analysis to control the effects of confounding and to identify predictors of metabolic syndrome. All socio-economic and demographic, HIV/AIDS, and lifestyle factors with $p < 0.1$ in the bivariable analysis were entered once in the multivariable analysis, using an enter method, and those significant variables at ($p < 0.05$) were determined as predictors. For each predictor, the adjusted odds ratio (AOR) with 95% CI was estimated to assess the presence and strength of associations. All statistical tests were two-sided and considered statistically significant at a P -value of < 0.05 . Moreover, the goodness of fit of the model was checked using the Omnibus test of significance, model summary, Hosmer-Lemeshow goodness of fit test, and the classification table, before interpretation of the finding. Besides, multicollinearity between all the significant variables was checked using variance inflation factors (VIF), and no potential multicollinearity between independent variables was seen ($VIF < 10$). The quantitative exposures variables were grouped into several ordered categories in the analysis. We defined some of the essential explanatory variables.

Variables and Criteria Used to Operationalize

Socio-Economic and Demographic Characteristics

Age in year categorized in to (≤ 34 , 35–44, and ≥ 45); educational status grouped in to (no formal schooling, less than primary school, the primary school completed, the secondary school completed, the high school completed), and occupation considered in to (government employed, NGO-employed, self-employed, student, homemaker). Wealth index was estimated by principal component analysis based on eleven household variables measured household assets which are divided into quintiles to represent overall levels of household wealth: as quintiles, 1-lowest, quintiles 2-second, quintiles 3-middle, quintiles 4-fourth, and quintiles 5-highest, constructed as per the EDHS report (25).

HIV/AIDS-Related Factors

Antiretroviral therapy state categorized in to (ART exposed and ART naïve), and the WHO staging categorized in to ($< \text{stage III}$ and $\geq \text{stage III}$ stage).

Lifestyle/Behavioral Risk Factors

The total physical activity per day was recorded and analyzed using a continuous indicator (ie, time spent in participating in work-related, transport-related, and recreation-related activities), and then lastly grouped as (active=1, inactive=0). The percentage of respondents classified into three categories of total physical activity according to former recommendations as high, moderate, and low physical activity (PA). High physical activity was defined whenever a person reaching any of the following criteria: classified in the category of vigorous-intensity activity on at least 3 days achieving a minimum of at least 1500 MET-minutes/week or-7 or more days of any combination of walking, moderate- or vigorous-intensity activities achieving a minimum of at least 3000 MET-minutes per week. Moderate activity was defined when a person not meeting the criteria for the “high” category, but meeting any of the following criteria are classified in this category 3 or more days of vigorous-intensity activity of at least 20 minutes per day or- 5 or more days of moderate-intensity activity or walking of at least 30 minutes per day or- 5 or more days of any combination of walking, moderate- or vigorous-intensity activities achieving a minimum of at least 600 MET-minutes per week. Low activity was defined while a person not meeting any of the above-mentioned criteria falls in this category (133). Overall, an expectation and prior knowledge analysis procedures were used to handle missing interval/ratio and categorical variables, respectively, by taking the missing at random (MAR) assumptions into account. However, there were no methods used to examine subgroup analysis.

Data Quality Control

Typical data quality control procedures were implemented in each critical stage of the study. It started at the very beginning of the design stage of the study. The data collectors and supervisors were given two days of onsite training to standardize methods and ensure consistency of data collection. The tools were pre-tested in the non-considered health institutions to verify its appropriateness. The proper functioning of instruments, laboratory reagents, and technical performance was checked by using quality control samples. Standard operating procedures (SOPs) were followed starting from sample collection up to result reporting. All laboratory procedures were handled by laboratory technologists. Intensive monitoring and follow-up during each phase of data collection were undertaken by immediate supervisors. The principal

investigator carried out monitoring in the study sites. A detailed explanation was found somewhere else.²¹

Research Ethics and Consent

All the ethical guidelines and principles placed in the Declaration of Helsinki and others, necessary to address the ethical aspects of the research initiated in humans were taken into account. Based on that, the proposal submitted to Addis Ababa University (AAU) College of Health Sciences School of public health (SPH) Research and Ethics Committee (REC) and then to the College of health science Institutional Review Board (IRB) (Meeting No.001/2017 and protocol No.0069/16/SPH) to obtain ethical clearance. Subsequently, the official letter granted from the SPH by citing the above ethical approval reference number was distributed to the respective Southern Nations Nationalities Regional health bureaus, Gedeo zone, and Woreda health bureaus, including to all of the institutions selected to conduct the study. Data were collected unlinked anonymously, without any personal identifiers. Each individual was enrolled entirely voluntarily after written consent was obtained. Any information obtained during the study was retained with the greatest confidentiality. Physical measurement was done by performing measurements at an ART clinic room that has been screened off to maintain the individual's privacy. All biochemical analysis was performed free of charge, and results were provided to the clinicians for further investigation and possible management.

Results

Descriptive and Bivariable Analysis Results

Socio-Economic and Demographic Characteristics

A total of 633 people living with HIV (PLHIVs) (139 cases and 494 controls) were included in the analysis. Among the cases, more than half, 62.2% (87) were women and 67.6% (94) were from urban area residents. The result from the binary logistic regression analysis identified age, marital status, ethnicity, education, and occupation as significant factors associated with MS (Table 1).

HIV/AIDS-Related Factors

Sixty-eight point three percent (95) of the cases and 66.2% of the controls were antiretroviral therapy (ART) exposed; of which higher proportion (63.3% (88) of the cases and 65.6% (324) of the control) was on the 1st line

Table 1 Bivariable Analysis, Socio-Economic and Demographic Factors and MS, Cases and Controls, PLHIVs, Gedeo-Zone, Southern Ethiopia, 2019

Predictors	Metabolic Syndrome		COR (95% CI)	P-value
	Cases (n=139)	Controls (n=494)		
	Number	Number		
Age Groups in year				
≤34	42	273		
35–44	52	151	2.24 (1.42–3.52)*	<0.01**
≥45	45	70	4.18 (2.55–6.86)	<0.01**
Marital status				
Single	22	123	1	
Married	42	147	1.60 (0.91–2.82)	0.11
Separated	29	106	1.53 (0.83–2.82)	0.17
Widowed	46	118	2.18 (1.24–3.84)	<0.01**
Educational status				
No formal schooling	39	124	1	
Less than 1° school	24	99	0.77 (0.44–1.37)	0.09***
1° school completed	45	166	0.86 (0.53–1.40)	0.25
2nd school completed	16	68	0.75 (0.39–1.44)	0.08***
High school completed	15	37	1.15 (0.49–2.66)	0.60
Occupation				
Government employed	24	60	1	
NGO-employed	7	20	2.44 (1.05–5.71)	0.18
Self-employed	67	261	2.14 (0.70–6.51)	0.24
Student	12	67	1.57 (0.74–3.34)	0.57
Homemaker	29	86	1.53 (0.36–6.50)	0.08***
Wealth index in quintile				
Lowest	12	18	1	
second	31	114	0.41 (0.18–0.94)	0.04*
middle	8	59	0.20 (0.07–0.58)	0.01**
Fourth	28	119	0.35 (0.15–0.82)	0.02*
Sex				
Men	52	205	1	
Women	87	289	1.19 (0.81–1.75)	0.39
Place of residence				
Urban	94	312	1	
Rural	45	182	1.22 (0.82–1.82)	0.33

Notes: *Significant at $P<0.05$, **Significant at $P<0.01$, ***Significant at $P<0.1$. Predictors: Age groups in year, Educational status, Ethnicity, Marital status, Occupation, Wealth index in quintile, sex, place of residence. Outcome: cases with Metabolic Syndrome (MS), control without MS.

Abbreviations: MS, metabolic syndrome; PLHIVs, people living with HIV; 1°, primary; 2nd, secondary; COR, crude odd ratio; AOR, adjusted odds ratio

regimen. Nearly, one-third of the participants (71.2% (99) cases and 78.9% (390) controls) had been found less than three WHO staging levels. The mean viral RNA levels were 3501.7 copies per mL (+2379.3) for the cases and 1408.25 copies per mL (+1249.4) for the control. Around, 6% (9) of the cases and 2.8% (14) of the controls had more than 1500 copies per mL. A Bivariable analysis has shown that ART status, duration since diagnosed with HIV,

opportunistic infections other than tuberculosis, type of ART regimen, use of 1st line and 2nd line ART were significantly associated with MS occurrence (Table 2).

Lifestyle/Behavioral Risk Factors The mean age of smoking started for the cases and controls were (27.4 years (± 7.5) vs 24.2 years (± 5.0)), and the duration was (5.5 years (± 2.1) vs 4.4 years (± 1.8)),

Table 2 Bivariable Analysis, in the HIV/AIDS-Associated Factors and MS, Cases, and Controls PLHIVs, Gedeo-Zone, Southern Ethiopia, 2019

Predictors	Metabolic Syndrome		COR (95% CI)	P-value
	Cases (n=139)	Controls (n=494)		
	Number	Number		
ART status				
ART-naive	44	167	1	
ART exposed	95	327	1.14 (1.00–1.75)	0.02*
Type of ART regimen				
Non-in either of the two Therapy	44	167	1	
1st line	88	324	1.03 (0.69–1.55)	0.90
2nd line	7	3	8.86 (2.20–35.65)	0.02*
1st line ART regimen				
AZT-3TC-NVP	12	67	1.65 (0.609–4.50)	0.14
AZT-3TC-EFV	8	27	1.37 (0.68–2.73)	0.98
TDF-3TC-EFV	47	193	3.19 (1.40–7.27)	0.37
TDF + 3TC+ NVP	20	35	1.91 (1.01–3.58)	0.05***
ABC + 3TC + EFV	1	2	1.69 (0.84–3.34)	0.93
NA/Not applicable	51	170	1	1
2nd line ART regimen				
AZT-3TC-LPV/r	4	1	14.88 (0.65–134.24)	0.32
TDF-3TC-ATV/r;	0	1	NC	NC
TDF-3TC-ATV/r	2	0	NC	NC
ABC + 3TC + LPV	1	1	3.72 (0.23–59.87)	0.35
NA/Not applicable	132	491	1	
Duration since diagnosed with HIV				
<1 year	19	69	1	
1–4 Years	47	173	0.99 (0.54–1.80)	0.96
5–9 Years	11	51	0.78 (0.34–1.79)	0.56
Duration since on ART				
1–4 Years	13	48	1	
5–9 Years	27	71	1.40 (0.66–3.00)	0.38
Functional status				
Ambulatory	49	123	1	
Working	90	371	1.14 (1.00–1.75)	0.02*
WHO staging				
<III stage	99	390	1	
≥III stage	37	97	1.50 (0.97–2.33)	0.07***
OI other than TB				
No	110	429	1	
Yes	29	65	0.58 (0.35–0.93)	0.03*
Recent TB status				
No	117	424	1	
Yes	22	70	1.14 (0.68–1.92)	0.62
CD4-levels cells mm3				
<350	18	69	1	

(Continued)

Table 2 (Continued).

Predictors	Metabolic Syndrome		COR (95% CI)	P-value
	Cases (n=139)	Controls (n=494)		
	Number	Number		
350–500	38	110	1.32 (0.70–2.50)	0.39
≥500	83	315	1.01 (0.57–1.79)	0.97
Viral RNA levels ≥ 1500 copies/mL				
No	130	480	1	
Yes	9	14	2.37 (1.00–5.61)	0.05***

Notes: *significant at $P < 0.05$, ***Significant at $P < 0.01$. Predictors: ART status, Type of ART regimen, 1st line ART regimen, OI other than TB, Functional status, WHO staging, Viral RNA levels ≥ 1500 copies per mL, CD4-levels cells mm³, Duration since on ART, Duration since diagnosed with HIV. Outcome: cases with Metabolic Syndrome (MS), control without MS.

Abbreviations: MS, metabolic syndrome; Rx –Therapy; HIV, human immunodeficiency virus; PLHIVs, people living with HIV, ART, antiretroviral therapy; 1st, first; 2nd, second; OI, opportunistic infections; TB, tuberculosis; WHO, world health organizations; RNA, ribonucleic acid; mL, milliliter; mm³, cubic millimeter; COR, crude odds ratio; AOR, adjusted odds ratio.

respectively. Nearly, 13% (19) of the case 9.7% (48) of the controls were current Khat chewer; 24.5% (34) and 14.2% * of the respected groups were used Khat daily. The average number of days per week on which fruit and vegetables consumed was 2.7 (± 1.3) for the cases and 2.8 (± 1.2) for the control group. More than half (71.2% (99)) of the cases and nearly 67% (331) of the control were consumed less than five servings of fruit and/or vegetables on average per day (Table 3). Further, around 28% (40) of the cases and 30.4% (150) of the controls did not meet the WHO recommendations on physical activity for health. Of which, nearly 80.6% (112) of the cases and 83.3% (413) of the controls were physically active; with the greatest contribution (73.4% (102) of the cases and 76.1% (376) of the control) were found from transport-related activity. The level of physical activity per day for the cases and controls were found to be (55.8 (± 72.3) and 61.1 (± 70.1)) minutes per day, respectively. The mean time spent for sedentary life for the cases was 189.8min-utes (+144.7) and the controls were 153.6 minutes (+90.0) (Table 3). Moreover, the result from binary logistic regression analysis revealed that smoking state, alcohol consumption status, all alcoholic consumer, the average frequency of serving fruit/vegetables/day, type of oil, total physical activity state, physical activity levels, running sedentary life, and daily chew Khat status as a factor associated with MS (Table 3).

Predictors of MS

The overall model fitness check statistics for the final model were as follows: ($X^2(df=30) = 84.83$, $p < 0.001$, -2

Log likelihood = 314.151, Nagalkerke $R^2 = 0.303$ and Overall Percentage predicted 81.6%, and the Hosmer and Lemeshow Test of significant $P = 0.905$). The multi variable analysis result revealed that age (AOR=1.09, 95% CI (1.05–1.12)); educational status being completed secondary school (AOR=0.22, CI (0.02–0.42)); occupational status being of students (AOR=0.11, 95% CI (0.24–0.51)); wealth index being in the middle quintile (AOR=0.22, $P=0.02$, 95% CI (0.06–0.79)); ART status exposed to ART (AOR=3.07, 95% CI (1.37–6.89)); total physical activity state being physically active (AOR=0.36 95% CI (0.16–0.79)), and engaged in low levels physical activity (AOR=3.83, 95% CI (1.46–10.05)) were significant predictors of MS development (Table 4).

Discussion

In areas where the routine screening of PLHIVs for metabolic syndrome in the chronic HIV care clinics is not regularly done, resources and evidence on HIV/AIDS comorbidities are constrained, the report from this study has public health and clinical implications that supplement the body of knowledge towards HIV-positive individuals. While education, occupation, wealth index, antiretroviral therapy status, total physical activity, and lower physical activity levels were concluded by the study as modifiable predictors of metabolic syndrome, age was found as a non-modifiable independent risk of metabolic syndrome (MS). The finding implicated that the odds of increasing MS is 1.09 times higher with a unit increase in age in a year. Similarly, a marked disturbance in the MS with aging has also been reported by several epidemiological studies done worldwide.^{14,15,23–29} The observed comparability among

Table 3 Bivariable Analysis, in the Behavioral Risk Factors and MS, Cases and Controls, PLHIVs, in the Gedeo-Zone, Southern Ethiopia, 2019

Predictors	Metabolic Syndrome		COR (95% CI)	P-value
	Cases (n=139)	Controls (n=494)		
	Number	Number		
Smoking state				
Non-smoker	98	376	1	
All smoker	41	118	1.33 (0.88–2.03)	0.18
All smoker				
Past smoker	23	72	1	
Current smoker	18	46	0.82 (0.4–1.67)	0.58
Alcohol consumption status				
Lifetime abstainer	66	267	1	
Consumer	73	227	1.30 (0.89–1.90)	0.17
Current alcoholic drinker (past 30 days)				
No	99	397	1	
Yes	40	97	1.65 (1.08–2.54)	0.02*
Past alcoholic drinker (drank in the past 12 months)				
No	87	347	1	
Yes	52	147	1.41 (0.95–2.09)	0.29
The average frequency of serving fruit/vegetables/day				
<5 servings	16	96	1	
≥5 servings	123	398	1.85 (1.05–3.27)	0.03*
Type of oil				
Vegetable oil	10	32	1	
Butter	33	51	2.07 (0.90–4.77)	0.09***
Margarine	20	142	0.45 (0.19–1.06)	0.07***
Solid fats	67	218	0.98 (0.46–2.11)	0.97
Do not know	9	51	0.57 (0.21–1.54)	0.26
Self-reported consumption of salt				
Far too much	56	197	1.28 (0.50–3.25)	0.61
Too much	58	198	1.32 (0.52–3.35)	0.56
Just the right amount	19	72	1.19 (0.43–3.29)	0.74
Total physical activity state				
Inactive	27	81	1	
Active	112	413	0.81 (0.50–1.32)	0.09***
High levels physical activity among physically active				
No	91	280	1	
Yes	48	214	0.69 (0.47–1.02)	0.16
Moderate physical activity				
No	107	365	1	
Yes	32	129	0.85 (0.54–1.32)	0.46
Low levels physical activity				
No			1	
Yes	117	389	1.44 (0.87–2.38)	0.06***

(

Table 3 (Continued).

Predictors	Metabolic Syndrome		COR (95% CI)	P-value
	Cases (n=139)	Controls (n=494)		
	Number	Number		
Composited total physical activity from work				
No			1	
Yes	42	159	0.91 (0.60–1.38)	0.66
Composited total physical activity from transport				
No	22	105	1	
Yes	102	376	0.87 (0.56–1.33)	0.51
Composited total physical activity from recreation				
No			1	
Yes	15	61	0.86 (0.47–1.56)	0.62
Meeting the WHO GROPAFH				
No	128	451	1	
Yes	11	43	0.90 (0.45–1.80)	0.77
Running sedentary life				
No	46	121	1	
Yes	93	373	0.95 (0.65–1.38)	0.04*
Daily Khat chew state				
No	105	424	1	
Yes	34	70	1.96 (1.24–3.11)	0.01**

Notes: *Significant at $P < 0.05$, **Significant at $P < 0.01$, ***Significant at $P < 0.1$. Predictors: Smoking state, all smoker, Alcohol consumption status, All alcoholic consumer, Average frequency of serving fruit/vegetables/day, Type of oil, Total physical activity state, Physical activity levels, High levels physical activity among physically active, Moderate physical activity, Low levels physical activity, Running sedentary life, Composited total physical activity from work, Composited total physical activity from transport, Composited total physical activity from recreation. Outcome: cases with Metabolic Syndrome (MS), control without MS.

Abbreviations: MS, metabolic syndrome; PLHIVs, people living with HIV; WHO, World Health Organizations; COR, crude odds ratio; AOR, adjusted odds ratio; GROPAFA, Global Recommendation of Physical Activity for Health.

the studies might be due to, regardless of the difference in the target population, age is also a common non-modifiable risk factor that equally likely predisposes the subjects to such health mater. In the reverse, Boshoet al 2018,³⁰ Livia D. Akl et al 2017,³¹ Tesfaye et al 2014,¹⁵ and Kaduk et al 2012³² were reported that age is not an independent predictor of MS. The differences across studies might be due to the variation in the studies approaches used; the differences in the standard criteria used and the variation in the characteristics of the target population, along with the time differences. Overall the finding might be highlighted, succeeding with the advance of ART, the PLHIVs have prolonged lifetimes and increasing age that eventually leads the subjects to be a victim to a chronic health problem like MS, by inflicting equivalent effect on PLHIVs, as they do in the general population. This signifies the risk of MS increases with the advance of age due to the regression of intrinsic metabolic actions.⁴

Inline, the study implicated that the odds of MS developing among PLHIVs completed secondary schooling was 0.22 times lower than individuals with no formal schooling. This was quite similar to a cross-sectional study from resi-dents of Mizan-Aman town, South West Ethiopia, in which individuals with the educational status of below degree are up to 89% protective to develop MS than those with the educational status of degree and above.³³ This finding cor-respondingly align with the studies from Kenya (Kiama, 2018 and Kaduk, 2012).^{32,34} This confirms that education is a key to open any locked secrets of life in the world that enable everybody to have a standardized and healthy life-style by getting a behavioral change. Unlike with our find-ings, few studies from Ethiopia (Ataro and Ashenafi, 2020,⁴ and Bosho, et al, 2018)³⁰ were informed not enrolled in formal education and lack of formal education as a protective factor associated with metabolic syndrome. Likewise, Kagaruki, 2015,³⁵ study from Tanzania shared,

Table 4 Multivariable Analysis, in Between All Predictor and MS, Cases and Controls, PLHIVs, Gedeo-Zone, Southern-Ethiopia, 2019

Predictors	Metabolic Syndrome	
	AOR (95% CI)	P-value
Age	1.09 (1.05–1.12)	0.00**
Educational status		
No formal schooling	1	
Less than 1° school	0.76 (0.32–1.82)	0.53
1° school completed	0.63 (0.27–1.39)	0.28
2nd school completed	0.22 (0.06–0.79)	0.02**
High school completed	0.61 (0.14–2.58)	0.50
Marital status		
Single	1	
Married	1.14 (0.46–2.83)	0.77
Separated	0.89 (0.34–2.32)	0.82
Widowed	1.63 (0.69–3.89)	0.26
Occupation		
Government employed	1	
NGO-employed	0.39 (0.07–2.31)	0.30
Self-employed	0.36 (0.12–1.03)	0.06
Student	0.11 (0.24–0.51)	0.01*
Homemaker	0.42 (0.13–1.32)	0.14
Wealth index in quintile		
Lowest	1	
second	0.43 (0.16–1.14)	0.09
middle	0.22 (0.06–0.79)	0.02*
Fourth	0.43 (0.15–1.21)	0.11
ART status		
ART-naive	1	
ART exposed	3.07 (1.37–6.89)	0.01*
OI other than TB		
No	1	
Yes	0.76 (0.30–1.98)	0.58
Functional status		
Ambulatory	1	
Working	1.42 (0.73–2.76)	0.30
WHO staging		
<III stage	1	
≥III stage	1.93 (0.85–4.39)	0.12
Viral RNA levels ≥ 1500 copies/mL		
No	1	
Yes	1.98 (0.39–9.92)	0.40
Current alcoholic drinker (past 30 days)		
No	1	

(Continued). **Table 4 (Continued)**

Predictors	Metabolic Syndrome	
	AOR (95% CI)	P-value
Yes	1.87 (0.91–3.82)	0.09
The average frequency of serving fruit/vegetables/day		
<5 servings	1	
≥5 servings	1.48 (0.48–4.58)	0.40
Type of oil		
Vegetable oil	1	
Butter	1.08 (0.32–3.63)	0.90
Margarine	0.40 (0.12–1.29)	0.13
Solid fats	1.18 (0.41–3.37)	0.76
Do not know	0.48 (0.10–2.40)	0.37
Total physical activity state		
Inactive	1	
Active	0.36 (0.16–0.79)	0.01**
Low levels physical activity among physically active		
No	1	
Yes	3.83 (1.46–10.05)	0.01*
Running sedentary life		
No	1	
Yes	2.05 (0.88–4.78)	0.10
Daily Khat chew state		
No	1	
Yes	1.47 (0.59–3.65)	0.40

Notes: *Significant at $P < 0.05$, **Significant at $P < 0.01$. Predictors: Age in year, Educational status, Ethnicity, Marital status, Occupation, Wealth index in quintile, ART status, OI other than TB, Functional status, WHO staging, Viral RNA levels ≥ 1500 copies per mL, Alcohol consumption status, Average frequency of serving fruit/vegetables/day, Type of oil, Total physical activity state, low level of Physical activity, Running sedentary life, Daily chew Khat. Outcome: cases with Metabolic Syndrome (MS), control without MS.

Abbreviations: MS, metabolic syndrome; PLHIVs, people living with HIV; ART, antiretroviral therapy; OI, opportunistic infections; TB, tuberculosis; WHO, World Health Organizations; AOR, adjusted odds ratio, 1°, primary; 2nd, secondary.

metabolic syndrome was significantly greater with a higher level of education. This might be an attribute of the differences in the measurement schemes implemented by the studies. Generally, the finding indicates the significance of the equitable distribution of education to the community to be accessed by all, regardless of their health condition, as one prevention measure. The relation between occupation and the risk of MS is worth further discussion. Our result has shown that the odds of experiencing MS among student PLHIVs were 0.11 lower than individuals working as a government-employed. This corresponds with Mashinyaet al 2015²⁶

reports. In our view, the possible reason for the analogs report may not be out of the domains of variations on the income generated schemes in between the government employed, and not yet employed but worked as a student. This is because, since students always earn no income that they are run their life not by themselves rather by letting them dependent on either their families or any relevant others that eventually forced them to have assumed lower standards of lifestyle; which might contribute to have less risk and save from high standards of lifestyle-related health chronic diseases, including metabolic syndrome. Nonetheless, the planning of awareness creation action to all, irrespective of their occupational status may be played an essential role in the prevention of MS risks.

Our finding likewise asserted that the odds of experiencing MS were 0.22 times lower in the PLHIVs whose wealth index grouped under the middle quintile than those categorized in the lowest quintile. It was contradicted with a cross-sectional study done in St. Paul's Hospital, in Ethiopia.³⁶ This could be due to the differences in the type of study subjects involved in the study, the variation in the study approaches, and the method used to measure income by studies. This suggests, since we did not find validated evidence in the subject area, a future confirmatory study is needed to examine how wealth in quintiles influences the MS occurrences. Notably, the odds of acquiring MS among ART exposed PLHIVs were 3.07 times higher than ART naïve individuals. Correlating with our finding, quite a lot of studies worldwide were revealed that exposure to ART as a predictor of MS, regardless of the effect of the other factors.^{14,15,37-41} In this regard, for example, a meta-analysis study across five continents showed that the MS prevalence in the ART exposed was significantly higher than in the ART-naïve.¹⁴ Correspondingly, a cross-sectional study from the southern region of Ethiopia notified that HIV patients on ART have higher risks to acquire MS than ART naïve subjects.¹⁵ Further studies from Italy,³⁷ Spain,³⁸ India,⁴⁰ Thailand,²⁵ Ghana,³⁹ Burkina Faso,⁴² and Nigeria,⁴¹ also suggested similar reports. This could be due to the direct impacts of the mitochondrial dysfunction, oxidative stress, altered abiogenesis, and differentiations that are mostly associated with the development of every cluster of MS after exposure to a combination of treatment.^{27,43,44} The situations may accentuate the significances of awareness creation towards lifestyle-related risk factors such as physical activity, diet, and other harmful

substance use habits reduction. However, our finding worth a confirmatory study with a strong design to be initiated to differentiate the specific effects of each drug regimen with MS incidence in these PLHIVs. Finally, our study found that the odds of increasing MS among physically active PLHIVs were 0.36 times lower than physically inactive individuals, and 3.83 times higher in PLHIVs engaged in low levels of physical activity than individuals' not engaged in such activity. This corresponds with different epidemiological studies.^{26,45,46}

On the other hand, against our report, several works of literature were stated the absence association among the two variables.^{15,30,47} This might be partly explained due to the lower number of individuals grouped under each category that might affect the analysis. Another possible justification may be due to the nature of the data relies on self-reporting data, which is liable to response bias.

The study is one of the few primary studies conducted in the sub-Saharan Africa region, using a case-control study design among a relatively larger number of PLHIVs. To improve the power of the study, all cases seen during the one-year survey (gathered to respond for different objectives) together with the three corresponding controls were involved in the study. To decrease bias associated with measurements, the revised standardized ATP III criteria were used to identify the metabolic syndrome. Given the participants were found whenever they visited the clinics for the routine care, the inclusion probability of subjects in the study was not associated with their exposure status that there was an equivalent degree of recall among cases and controls. Besides, intensive training was given to data collectors, and there was firm supervision. Despite all the efforts made, the reports in this study are subject to some limitations. As the study was restricted only in public hospitals, the finding may not typically be applied to patients found at the other health institutions of the study zone. Correspondingly, given the recruitment of subjects was undergone through the use of a consecutive sampling technique; this might cause the study misses its randomness that might lead one to conclude that the participants fail to represent cases of metabolic syndrome occurred in the Gedeo zone. Using secondary data for most HIV/AIDS exposure factors that could be the cause for missing of important confounding variables. But, we believe that the populations are homogenous and the selection bias is minimal. Moreover, the consideration of preexisting chronic disease state, family history, lipid-lowering drug intake

history and other clinical data related factors as part of outcome ascertainment criterion might confound the result. Hence, it is advisable to interpret the current study result carefully.

Conclusion

While education, occupation, wealth index, antiretroviral therapy status, total physical activity, and lower physical activity levels were concluded by the study as modifiable predictors of metabolic syndrome, age was found as [3] non-modifiable independent risk of metabolic syndrome (MS). Revising of the existing guideline for chronic HIV care and management strategy to address the routine screening of PLHIVs for MS, especially for those individuals exposed to ART with the advance of age is mandatory. Realizing an integrated care plan that addresses both the routine care given to PLHIVs and regular MS screening and management program in primary health care units is essential to reduce the potential risk related to long-term complications. In the meantime, strengthening the primary health care system towards that program will be a vital action to reduce future epidemic costs. Actions aimed at improving better access to formal education for PLHIVs at least to the level of secondary schooling are mandatory. Besides, there is a need for the provision of consistent health education to all about lifestyle modification particularly on performing low-level physical activity. Further, wide-ranging scale studies using a multi-center representative sample of HIV-infected subjects are essential to assess predictors of MS occurrence. Also, research is needed to confirm the relationship between occupational statuses, wealth indexes in quintiles with MS incidences among PLHIVs.

Note: This manuscript was prepared fully as per the guideline of the Reporting of Observational Studies in Epidemiology (STROBE).⁴⁸

Data Sharing Statement

All data generated or analyzed during this study are included in this manuscript and uploaded tables.

Research Ethics and Consent

All the ethical guidelines and principles placed in the Declaration of Helsinki and others, necessary to address the ethical aspects of the research initiated in humans were taken into account. Based on that, the proposal submitted to Addis Ababa University (AAU) College

of Health Sciences School of public health (SPH) Research and Ethics Committee (REC) and then to the College of health science Institutional Review Board (IRB) (Meeting No.001/2017 and protocol No.0069/16/SPH) to obtain ethical clearance. Subsequently, the official letter granted from the SPH by citing the above ethical approval reference number was distributed to the respective Southern Nations Nationalities Regional health bureaus, Gedeo zone, and Woreda health bureaus, including to all of the institutions selected to conduct the study. Data were collected unlinked anonymously, without any personal identifiers. Each individual was enrolled entirely voluntarily after written consent was obtained. Any information obtained during the study was retained with the greatest confidentiality. Physical measurement was done by performing measurements at an ART clinic room that has been screened off to maintain the individual's privacy. All biochemical analysis was performed free of charge, and results were provided to the clinicians for further investigation and possible management.

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Author Contributions

All authors made a substantial contribution to conceptions and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published, and agreed to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest for this work.

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Paper III

The role of sociocultural contexts in forming adult HIV-patients' behavior towards metabolic syndrome and its lifestyle related risks; *A descriptive phenomenological study*

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Abstract

Background: Metabolic syndrome (MS) is the risk markers of NCDs in Sub-Saharan Africa, including Ethiopia, which are the epicenter of HIV infection. It is becoming an important concern due to the extra-economic, social, and disease burdens on society. Limited knowledge of MS risks and how to prevent MS outcomes are implicated.

Aim: To understand the role of sociocultural contexts and explain how personal knowledge of, and attitudes toward, metabolic syndrome influences the physical exercise, dietary and other harmful substance use practices individual choose to decrease MS risks, in Gedeo zone, Southern-Ethiopia.

Methods: A deductive descriptive phenomenological study, enhanced with a focus group discussion (FGDs) and an in-depth interview method were used; beginning from February 1st to 30th of March 2018. Adult PLHIVs purposefully chosen were involved in the interview. Finally, using Atlas.ti (Version.7.5.7) and SPSS (Version.22) software, all primary documents analyzed iteratively.

Result: A total of 32 male and female respondents were involved in the discussion. More than half, 68.8 %(22) of the subjects were found within the age range of (35-44)years, with a mean age of 36.96 (+8.94)years-old. The getting hold of MS risk associated health knowledge of a person encompasses multiple sources. Family, the spouse's children, sisters, and brothers; the government structure, mainly the health care structures; the social systems, principally, the religious organization, the social calls 'Idir', were primary role player in educating the PLHIVs.

Conclusion: The sociocultural contexts dictate the PLHIVs' to have inadequate knowledge concerning risk factors and methods for preventing MS. And, this in turn contributed to form an unfavorable attitude and inadequate practices. implicates the significance of the adoption of the healthy living practices associated awareness creation program, which targets the PLHIVs to bring behavior change that eventually enable them for the better prevention and control of MS and its long term consequences.

Key terms: Sociocultural Contexts, PEN-3 model, phenomenology, Southern-Ethiopia.

1. Introduction

Globally, 38.0 million peoples were living with HIV(PLHIVs), and 690 000 died from AIDS-related illnesses at the end of 2019(1). Despite the globe continuing severity of the epidemic, as of the end of 2019, 25.4 million people were accessing antiretroviral therapy (ART)(1). In East and Southern Africa, in 2018, 85% of 79%(2) ,and in Ethiopia, in 2016, 71% of PLHIVs were on treatment (4). With such expanding access to the treatment, the prognosis of HIV/AIDS is improved (5-8).

As a result, the worldwide morbidity and mortality from infectious diseases have occupied a backseat(9); instead, non-communicable diseases (NCDs) is increasingly emerging.(9-11) These PLHIVs have high

rates of NCDs (5, 12) due to the acquisition of non-AIDS-related comorbidities, called metabolic syndrome (MS). (5) Metabolic syndrome (MS) is commonly defined as a constellation of interconnected complex diseases: abdominal fat, high blood pressure, dyslipidemia, elevated blood sugar (7, 13, 14). Incontestably, people with MS will have a twofold as likely to die from and three times as likely to develop cardiovascular disease (CVDs) (114) and a five-fold greater risk of developing diabetes mellitus (DM) (115, 116), comparative with the people without it. These two diseases are among the four most common and the leading causes of NCDs related deaths (14, 42).

This suggested the significance of the shift of paradigm to prevent the incidence of NCDs at least in these vulnerable segments of the populations through promoting the PLHIVs behavior towards the lifestyle related risk factors than treating them with additional drugs. This is because premature deaths from NCDs are largely preventable, and mainly driven with four big lifestyle factors, comprised of physical inactivity, unhealthy diets, tobacco use, and the harmful use of alcohol (18, 19, 114).

However, promoting one's health behavior towards those factors requires a change in behavior through acting upon the contexts surrounding it. This is because they are interrelated and rooted in the sociocultural contexts, which are often outside of individual control (21, 22). Sociocultural contexts refer to shared norms, values, and codes that jointly shape a group's beliefs, attitudes, and behavior by interacting themselves within and with their surroundings. (21-24)

The PEN-3 cultural model provides valuable guidelines for the cultural sensitivity of an individual's health behavior by identifying and organizing a community's cultural components as an input for the planning of an effective strategy to address minority health issues. The core idea was based on the concepts of Airhihenbuwa that the sociocultural setting in which one's life is guided to a very large amount of what a person is known, the attitudes s/he holds, and the practices s/he develops. The model is unique that it is constructed with the African contexts. It comprises three main domains, each constructed with three intrinsically linked sub-domains, which forms, acronyms of "PEN." (21-23)

The cultural identity domain is a tool that directs the origins of health behavior. It correspondingly used as intervention entry point at various levels of the person extended family and neighborhood. The relationships and expectations domain is the second domain having with perception, enabler, and nurtures sub-domains. The construction and interpretation of behavior are usually based on the interaction of those three sub-domains. The cultural empowerment domain is the third constructs with the positive, existential, and negative sub-domains. It often is used to identify the role of sociocultural contexts on health behavioral decision. (21-24)

Despite this, there is a dearth of studies done using the PEN-3 model to understand the role of sociocultural contexts in forming the PLHIVs behaviour towards MS risks in Ethiopia. Besides, most of the few were addressed quantitatively.

This study wanted a description of told, saw, and accepted health behaviors within a sociocultural perspective. The use of such approaches were designed to gain a qualitative data on personally gained knowledge attitude and practices (KAP), and a clarification of sociocultural effects that stimulated the acceptance of present attitudes, and practices. The alignment of knowledge and practices were determined as adequate and or inadequate, whereas the attitude was asserted as favorable and or unfavorable. These data provides justification of how, why, and who an individual accepted a specific set of health behaviors associated with those lifestyle risk factors of MS or neither of the two) were found responses in all domains of the model (Fig 1.tif). Knowing this is the 1st phase in the right way to prevent MS occurrence at individual and public health levels, since the contrasting thoughts and understandings from participants open newsflash means of thoughtful and identifying what is known and unknown.

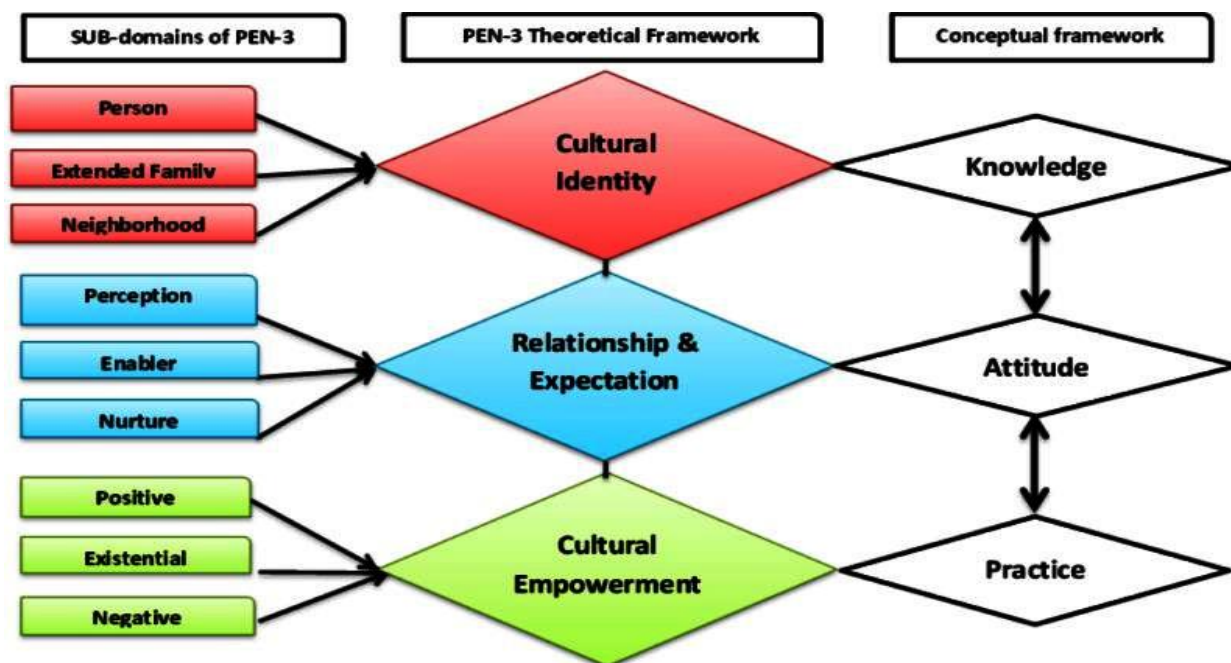


Fig 1-Adopted study conceptual-framework,(Iwelunmor, 2014(23) and C. Airhihenbuwa, 1995(24)), and adapted into the study contexts, shows the emergence of KAP, through PEN-3 domains, PLHIVs, Gedeo-Zone, Sothorn-Ethiopia, 2018

2. Materials and Methods

Qualitative approach and research paradigm-The study applied deductive descriptive phenomenological qualitative approach. It was decided based on the epistemological and ontological stands of the research questions. It used the case study technique from the social epistemology contexts as an affirmation towards phenomenon. This was because the sociocultural context is a socially formed knowledge circumstance, shaped by the relations of human being with their realm. This manuscript was prepared fully based on the SRQR guidelines(117), completed checklist found in (S1_Table 1 attached as a supplementary data).

Researcher characteristics and reflexivity-Two weeks before conducting the study, there were three teams established in the selected health institutions; a research team and two task teams. The research team was formed with the combination of the chief author and two public health professionals; all having with 2nd Degrees and sound experiences in research and the profession. While the particular role of the main author's was in moderating the whole discussions, the rest team members were engaged in note-taking, documentation of audiovisual data, and field notes expansion. The other team was the two task teams', which were formed with the combination of three health workers and two adherence counselors (male and female), served under each ART-clinic of those health facilities. Their role was to engage in the recruitment of subjects. During this time, each participant have got chance to spending some time with the team members' that the likely chance of introduction of amongst each other was obvious. Besides, all the members were deployed in the study after they provided with two days onsite training.

Context-This study was done in the Gedeo zone, located in the Southern Nations, Nationalities, and Peoples (SNNP) region; 360km to the south of Addis Ababa, the capital city of Ethiopia. It was conducted in the purposefully chosen health institution: Dilla University referral hospital (DURH), and Wonago health center (HC), which are located in the urban and rural area, respectively. The rationale was due to their convenience to run the study. The study was conducted from February 1st to 30th, 2018. During the study period, there were 3597 adult PLHIVs in the study zone.

Sampling strategy-All confirmed adult peoples living with the HIV (PLHIVs) in the Gedeo-zone were considered as a source population. Of whom, those who fulfilled the eligibility criteria presented below were involved in the study. While HIV positive above 18 years old adult peoples and permanent resident of Gedeo-zone, who speak Amharic language and took the routine care at least for $\geq$ six months in the above referenced HIV clinics were used as inclusion criteria. Inactive participants during the study time for various reasons and have restrictions that impeding their participation were correspondingly were used as exclusion criteria. The sample size was determined based on saturation of idea, which was achieved as it gave similar answers for questions. Accordingly, four FGDs organized with (6-8 male and female individuals) and two spontaneous in-depth interviews were made. Hence, a total of 32 participants were

considered for the study. To recruit the subjects, a purposive sampling method was used. Initially the subjects were informed orally about the study's aims before they took their routine care. Soon, the team appreciated the subjects' willingness' and immediately linked with the health workers to map out and enriched them with more information about the study. Subsequently, the securing of written consent and personal data collection process were quickly initiated and appointed for the discussion. The recruitment and data collection time schedules of the participant were undergone sequentially; running first in DURH among the female group followed by the male, and WHC second.

Ethical issues pertaining to human subjects-All the principles of ethics laid down in the Declaration of Helsinki, and its successive amendments were used. Accordingly, ethical clearance was first granted from Addis Ababa University (AAU) College of Health Sciences School of public health REC (Ref.No.SPH257/09) then from College of health science IRB (Meeting-No.001/2017 and protocol-No.0069/16/SPH). Then, the official letter was produced and delivered by the author to the respective SNNP-Regional health bureaus, Gedeo-zone, district health bureau, and to the institutions selected to conduct the study. Data was collected unlinked anonymously, without any personal identifiers. Each individual was enrolled entirely voluntary after written consent was secured. All the data are preserved in the lead author's side for some time and planned to be destroyed by the AAU IRB schedule.

Data collection methods-The primary data type created includes rich text document audio and video recordings, picture and survey data on participants' demographic characteristics. The data collection procedure was iterative, comprising appraisals and discussions at various stages of data collection; continuous comparison of new data with previous data, and performing of the correct reforms on the questions. Moreover, reflections or hints related to the data in a memo were used by the author for future interviews.

Data collection instruments and technologies-a semi-structured open-ended FGD guide was used to enhance the discussion. The guide was first adopted from previous studies done (23, 24), and then adapted into the current study contexts of the phenomenon under investigation. It contains all the fundamental components that help the participants feel a sense of comfort while they give an answer to delicate questions and develop a feeling of closure before they leave. The introduction section fully explains the purpose of the study, consent, confidentiality, and the reimbursement scheme. The questions were structured based on the conceptual frame work of knowledge, attitude, and practice (KAP) using the three PEN-3 model-constructs as a theoretical basis. In which questions were sequenced in the logical sense holding a neutral ice-breaker, the transition and wrap up questions to mark the end of the discussion and give one more chance to participate to share their opinion and thought. The rest main questions were

similarly structured in (Table 1). Exactly 2-hours were allotted for the discussion, after pre-testing of the guiding.

Table 1; Simple schematic structure of the FGDs Guide, the sociocultural contexts of M among PLHIVs, Gedeo-Zone, Sothorn Ethiopia

S.N	Topic	PEN-3 domain	Conceptual Framework
1	Personal source of knowledge Extended families role in knowledge acquisition Neighborhood role in knowledge acquisition	Cultural Identity	Knowledge
2	Personal perception of MS risks and long-term outcome Enabler of personal attitude towards MS risks Nurturer of personal attitude towards MS risks	Cultural relationship and expectation	Attitude
3	Positive (beneficial) practice held Existential (neither beneficial nor harmful) practice held Negative (detrimental) practices held	Cultural empower	Practice

Data processing- The audio recording of all discussion was made by using a Huawei P7 smartphone digital sound recorder and was saved to a micro SD-card in the MP3 format and backed up daily to the lead author's laptop computer to prevent any unnecessary events. All the discussions were correspondingly recorded on video and picture using a Sony digital camera (Sony Lens, 5X Optical Zoom; 3,2-6,4/4,6-23). In which the files were stored on the SD-card, and then backed up to the researcher's computer as usual for similar reasons. Both used to recall the events. Besides, the field note on verbal and non-verbal cues were taken partly using a short way of nonfiction using a Sinar-Line notepad and Lexi-pen. The documentation of all the originally formed physical data was accomplished in one place in a locked filing cabinet for each study site, using the large heavy-duty archival envelope per-

event. Ultimately, all the primary soft data were uploaded into Atlas.ti7, version-7.5.7 software, as a primary documents family (PD), and then stored in a large electronic envelope called “Hermeneutic Unit.” Additionally, SPSS version-22 software was used to handle and analyze the survey data.

Data analysis-The data analysis procedure was iterative. Although the final step of the analytic procedures was done by GirmaTenkolu (GT) alone, however Sadat Mohamed(SM) was besides involved in first phase of the analysis. To enhance this, GT and SM were met several times and discussed to the extent to which categories reflected in the data and reached consensus on the segmentation, a summary text data formation, and partial determination of coding and code category. In the coding process, each data item has been given equal attention and codes have been thoroughly inclusive and comprehensive. All relevant extracts for each code have been collated and checked against each other and back to the original data set to maintain it to be internally coherent, consistent, and distinctive. Overall, enough time has been allocated to complete all phases of the analysis adequately without rushing a phase or giving it a once-over-lightly. Based on the individual and approaches used, it was completed into three phases. The first phase was iterative characterized with step by step activities of data capturing and transcription. It was accomplished with the integration of GT and SM manually using the pre-established codebook, which was constructed using the model as a theoretical basis and the KAP as conceptual frameworks (Codebook attached as S2_Table 2). The 2nd phase of the analysis likewise lasted from data transformation to translation. Initially, all transcribed texts data existed in hard copy and Amharic language were soon transformed into soft data, with the help of two secretaries. Subsequently, translation of each document from its original language to English, accomplished sometime after all data collections were ended, with the assistance of a bachelor's degree holder English teacher on a foreign language from Cambridge University, in UK. In addition, the lead author was involved to cross-checking of the transformed and translated text data with its original document through taking of several samples. The third phase of the analysis was a step by step activity that ranges from uploading primary data into computer software's up to the synthesis and formulation of the themes. Uploading primary data was made using the above referenced software. The synthesis and theme formation process were made in five steps. Initially, reading of the text document several times, back and forth and understanding of the overall contexts of the transcripts were made. Subsequently, a summary of each transcripts formed were reviewed and color-coded by using the words, phrases, clauses, and sentences as a meaning unit to identify the knowledge, attitude, and practice themes. This was compared with initial coding done manually using a close coding method in the previous data analysis phases. Further review of the conceptual and theoretical frameworks revealed pattern not seen prior to analysis was done. Using the revealed connections, constraining the themes along the lines of the theoretical framework and the conceptual framework was made. Use of this

method allows the lines of connection between the theoretical and conceptual frameworks more direct and clearer. This method was chosen because the research was grounded in theory and allowed for the extension of the theory into new areas of understanding. Coding the data along the major domains of the theory and then by sub-domain assisted in determining relationships of the sub domains through the major domains to the conceptual frameworks. Finally, the production of the reports with the selection of vivid and compelling extract examples were made, and then sent to the study participants for further verification of the findings.

Techniques to enhance trustworthiness-It was ensured by pretesting the discussion guide, the prior establishment of trust among the research team and the participants, spending much time with the data on reading back and forth, vivid outlining of the analytical steps, and contrasting of the codes and code categories after discussion and making of contrasting of it with the main themes and the interview data. Likewise, it was achieved through sending of final reports to the participants.

3. Results and Discussion

A total of 32 male and female respondents were involved in the discussion. More than half, 68.8 % (22) of the subjects were found within the age range of (35-44) years, with a mean age of 36.96 (+8. 94) years old. Of which, 40.6%(13) of the participants were found to be on antiretroviral therapy for about (1-3)years, with a mean duration of 5.2 (+ 3.16) years (Table 2). All the discussions focused on the origin, development, and culturally worth health behavior. In the analysis of the transcripts, themes were established using the PEN-3 model constructs to push the conclusions toward the conceptual framework of knowledge, attitude, and practices (KAP).

Table 15; the socio-demographic characteristics of the participants, in Gedeo zone, Sothern Ethiopia, 2018

Characteristics	No	%
Type of discussion		
In-depth interview	2	33.3
Focus group	4	66.7
Location		
Dilla university referral hospital	18	56.3
Wonago health centers	14	43.8
Occupation		
A counselor	6	18.8
Carpenter	1	3.1
Day labor	7	21.9
Farmer	6	18.8

Housewife	9	28.1
Prisoner	2	6.3
Private worker	1	3.1
Religion		
Muslim	2	6.3
No religion	2	6.3
Orthodox	16	50.0
Protestant	12	37.5
Marital status		
Married	22	68.8
Single	1	3.1
Widowed	9	28.1
Educational status		
Illiterate	8	25
Grade 1 st to 6 th	7	21.9
Grade 7 th to 12 th	16	50
Diploma and above	1	3.13
Area of residence		
Rural	13	40.6
Urban	19	59.4
Age of the respondents in year		
<=25	5	15.6
26-34	5	15.6
35-44	22	68.8
Duration on ART in year		
1-3	13	40.6
4-6	10	31.3
7-9	2	6.3
>=10 years	7	21.9

The knowledge associated health behavior

In the cultural identity of the health behavior domain, how subjects acquire health information about behavior was explored. The questions for this part focused on how knowledge was attained at the individual level. What role did extended family play in the course? How did structures and institutions found in the community played a role to gain knowledge of health behavior is the last part of this section. Indeed, while using this domain, special care was taken to recognize how did persons individually

attained information on metabolic syndrome and its associated risks (69-71). All the quotations are verbatim without rectifications.

Based on this, a typical response to the question of "the long-term effects of aging with HIV?" was failed to indicate colloquial word for "metabolic syndrome." Approval for this concept may be found in this response: "So far, I was not sick... even, I know people who have taken the tablet for many years...but I have never seen them facing any health problem...As to me, I don't believe it may cause any problem"(W7_FGD1). Even after the probing of the participants by calling the term "metabolic syndrome" they reacted as "they didn't have any know-how and perceived it as hardly had any connection with their health conditions. An echo of the thickener concept can be comprehended in the following statements. "I don't believe that taking the medicine continuously will have negative side"(MP_Ind2). Instead, they itemized other kinds of health complications that have no link with the theme under study. With this regard, the second woman participant in the focus group discussion three sat quietly responded with: I have experienced health problems, which I didn't have earlier after I started the medicine. "My eyesight is blurred...Taking the medicine for a long; therefore, causes eye problem.

Further by using checking questions about each component of metabolic syndrome for the subjects' mostly accepted conversational term for it was "hypertension and diabetes mellitus." A common theme that emerged was "blood pressure and sugar disease." A few brief quotes on the issue "I think...the diseases (blood pressure and sugar diseases) that demand extreme attention and priority"(M6_FGD2). "Like any disease, sugar diseases have medication"(W3_FGD).

Also, the exact response to the question of "the risk factors of MS and its components?" For the participants, the common conventionally spoken word emerged were not engaged on "physical exercise" and or "inappropriate feeding (mal feeding)" as the risk factors of the elevated magnitude of the syndrome. Participants shared the following: "Not performing of physical exercise is the first and foremost...Because if the body gets fatter, the more it faces various diseases."(W7_FGD1). "Inappropriate feeding (mal-feeding) may cause these problems (diabetics and hypertension).To echo the preceding sentiments, a male participant in the second discussion explained "These diseases (blood pressure and diabetics) are problems which occur as a result of feeding disorders...For example if we often eat meat-related food item it causes such kinds of diseases...It's in this way I understand" (M8_FGD2). Further adding to this, the quotes from the focus groups represent: "A diabetic's disease is an illness caused by eating many sweet item...Blood pressure is a disease occurred concerning a diabetic's disease...The existence of one presupposes the other"(W8_FGD1). Some brief quotes on the long-term outcomes for metabolic syndrome. "Though I haven't faced any health problem owing to

taking the tablet, using it for long cause's changes on the body. This, in turn, predisposes us to different health matters, entails blood pressure (hypertension), heart failure, and diabetics.

Many of the involved participants had lacked basic knowledge about MS risk factors and its long-term effects. Nonetheless, for whatever reason, there appeared to be an overriding view of the personal malpractices indicated by the participants as it was associated with the non-performance of physical exercise and having inappropriate feeding habits, as possibly the risk factors of MS. Congruently, the study of Ka'opua, (101) was highlighted the influences of sociocultural contexts on HIV-infected subject's knowledge to participate in anal cancer screening. This shows that notwithstanding of the type and amount and the means of various sources are a key for the building of health knowledge.

Person: As Airhihenbuwa asserts, an individual's connection to family, public, and neighborhood customs the foundation of acculturation to a common idea of health teaching(69-71). Interviewee response regarding how they educated about MS and its corresponding risks. A conjoint issue that emerged was "the personal serious disease tragedies were the colloquial words found as their source of health education." The under designated participant response informed the various efforts of the infectious and non-infectious disease events role to learn: "In 1999 E.C, I was sick...and I was given a drug for pneumonia after diagnosis. As I began taking the drug, allergy (which is called 'Shifitah' in Amharic) appeared on my whole face"(W6_FGD3). "In the beginning, I got diarrhea...Then, my face was getting swollen...and all my situation got strange...I was completely indulged in a strange situation"(W7_FGD3). Echoing this concern, very few numbers of snippets from participants described chronic diseases related tragedies role to educate: "My experience to see people died of the sudden situation made me know about the dangerousness of these diseases" (W7_FGD1). "I came to know more about these health problems; after I saw my neighbor fell into sick and took insulin"(W7_FGD1). Besides, suggestions are given about mass-media particularly "the use of radio and television" were found words as primary sources of health information. The following participant response revealed: "Like everyone else, I get information through listening to a radio and watching television"(M6_FGD2). A few brief quotes on the efforts of the "peer discussion" arranged in the health institutions are described. "There is a group or peer discussion in the hospital every morning...So; we get health education through these sessions. We mostly discuss our health situation, and about the problem, we faced in association with it. And, about the precautions or measures, we should take...We never discussed metabolic problem"(W1_FGD1). A consistent thread in most of the participant transcriptions focused on any disease tragedies encountered by individuals; the various mass-media sources as well as the peer discussions were the primary ways in which the people living with HIV gained information about the syndrome at the individual level. This resembles with Airhihenbuwa(94), William(95), and Sheppard (96) reports.

Extended Family: A classic response to the issues rose about "for the first event that encourages the respondents who bothered for their health?" was "The spontaneous blood HIV tests that they had undergone subsequent with the spouses' acquaintance to the virus" was the first event that encourages the participant to bother about their health. Although family members' disease tragedies provide the origin of education about health, its particular focus was based on the virus they live-in. Confirmation for this concept may be found in this response: "I came to know about my health because of my spouse...When my wife was fallen into sick, she had a test in a health facility...and as she was found to have the virus, I was requested to have the test...Then, both of us were informed that we have the virus in us, too"(M4_FGD2). "I came to know it because my husband died of HIV...That is all"(W4_FGD3). A few brief quotes about the chronic disease: "I came to know about diabetic's disease pretty well because of my friend... She was infected by this disease...She had been told that she was a diabetic, and she ought to have taken the drug properly...She quitted taking the drug and died; failing to act following the health practitioner's advice"(W3_FGD1). "I came to know more about these health problems; because my mother got a disease called blood pressure"(W4_FGD1).The diseases experience especially "hypertension and diabetics" by one of the family members, mainly by mothers and intimate friends were found as a primary source of health information. Further, this section will use little snippets from the participant replies to provide a general overview of the apparent role family played. "My husband highly supports me. For example, he advised me not to eat and drink which is not fresh. But we never discussed other related health problems...our awareness is also diminutive"(FP_Ind1). "My families highly support me...Especially, my children give me the drug; saying: "Drug taking time is up." In this regard, they help me a lot...If God hadn't given them to me, what the hell would have been to me? (Wagging his index fingers unto the sky)"(M8_FGD2). "Unquestionably, my family (my brothers and sisters) support me to have awareness"(W4_FGD1). "Concerning keeping health and preventing disease, we, among our families, discuss and teach each other"(M1_FGD4).

From the responses, all seemed to have gained information on their condition. Individual diseases experience by one of the family members, mainly by mothers and intimate friends provide the beginning of the teaching of some participants about health education, particularly regarding diabetes and hypertension. Through family support, the spouse (wife or husband), children, brother, and sisters looking out for each other the knowledge of MS risks and methods of prevention was spread. Also, some found no family support. This finding aligns with Airhihenbuwa(22),Mieh(97),Brown(98), and Rhonda Belue(99) literatures relating to the family as an important driving force influencing individual behavior associated with several public health concerns.

Neighborhood: The formal and the informal systems that existed in the area were found to be central to most participants' attainment of health knowledge. Of which, the formal systems far outweighed the impact of informal systems mainly associated with the government agencies that emerged as sources of personal health knowledge acquisition. One of which is the mass media described. Even though it is not a specific suggestion of assisting to teach the public on the issue of discussion, a respondent noted, "We watch a program called "your health at your home" known in Amharic as 'Tenawo Be-Betwo' transmitted through television...Most of the advice delivered is in connection with our health (HIV/AIDS). Hence, I wish they (government agents) would do that. That might help the community more"(W2_FGD1). Echoing the situation, a participant voiced this idea: "I get more health information from other media, television, and radio...Though it is not about such problem as you heard in recent weeks, we heard health-related information from these media"(W7_FGD1).

Other participants spoke of the main role of the health care organization played. "On top of that, health institutions are delivering information on various types of health problems in the outpatient department before issuing cards"(W1_FGD1). One respondent saw things from this perspective. "They (the government agencies) discuss and teach only about HIV...This is because, I think, the policy the government holds...It's all about HIV...Even on this issue, it's not as such done...Individuals drawn from sector offices are assigned to share information about HIV on 21st of the month...every year...No one ever thought of other related health problem"(W2_FGD3). Although it is obvious that some feel the government is doing its job to teach and give supports to the community overall on HIV/AIDS, there remains the question of how the growing occurrence of chronic disease and metabolic syndrome will claim that policy assigned for infectious disease be readdressed to teach the PLHIVs and provide some form of better access to routine screening and management for those at higher risk to develop the syndrome.

Another characteristic participant described as an important primary source of health teaching was about the informal systemic structures. A common subject that emerged was "the churches." While few of the participants advocated the role played by the church without specifying the exact name, as is stipulated in the replies: "The church also gives us a lesson to protect ourselves and not transmit to others with negligent and not to commit sine...but they never give us other health-related lessons we only got this kind of lesson only from health institutions. Other participant described the specific religious organizational roles along with the name of the institution as follow. "Religious institutions (Churches); for example, St. Marry and St. John churches teach about HIV during the preaching of Gospel. They (the churches); especially, focus on how to keep healthy, to stick to one partner, and not to commit adultery. "As for the diseases that would occur through time; let alone for them to teach us, we have just heard of

them from you”(M3_FGD2). Furthermore, the other ideas emerged as participants described their perception focused in on “the social call,” which is known in Amharic as ”Idir,” as a prime player of personal knowledge about health education. This issue can be conferred with the replies: "Besides, in social gatherings, such as "Idir", we, carry out peer discussion on the health-related problem”(W6_FGD1). “With regards to this, I dare to say that members of ‘Idir’ are organizing a discussion forum for health education; especially on HIV...And, I'd like to recommend such a discussion forum should sustainably organize”(W1_FGD1).

All participants described that the getting hold of MS risks and outcome knowledge on the individual level encompasses the use of the mass-media (Television and radio); the peer discussion; volunteers' education; the neighbor's disease tragedies, and others. Family, in particular, the spouses (the husband at large and the wife), children, sisters, and brothers have been demonstrated to be the primary source of education on MS risks. Few educated from individual tragedies in the diseases and death of family members. Government structure, mainly the health care structures; the religious organization, the social calls ‘Idir’, employed numerous means to get the message out concerning the reduction of MS risk factors. This supports Iwelunmor(100) and Brown(98) studies in which the role of the community system was found as an important contributor to disclose seropositive status among PLHIVs and as an excellent resource in assisting families affected by HIV/AIDS, respectively.

Attitude associated health behavior

The current study used these constructs based on the assumption that the knowledge, belief, and values of the person, family, and community that the participant communicated and holds of about MS risks, and preventive measures explain the practices they engaged about the theme under study (21). Out of these concepts, perceptions about health attitudes are made. Those perceptions are enabled and nurtured by well-meaning individuals from one's social circle (69, 70, 72). Indeed, this may not exactly look to fit well with the attitudes facet of the conceptual framework. Nonetheless, how a person perceives the surroundings and those who enable or nurture different behaviors that are reflected acceptable gives foundational supports for the attitudes individual holds about the contexts under investigation(69, 70, 72). The sections below will first explore the perceptions relative to MS risks, and outcomes and prevention believed by the members. Later, the enabling factors that encourage holding onto certain attitudes and the occasions or individuals that nurture those attitudes will be revised.

Perception; the perceptions participants hold of about MS risks, outcomes, and preventive measures explain the practices they made with chronic disease prevention. Having taken this into account, "a distinctive reaction for the question of "who is responsible to maintain individuals own health?" was "the individual him/herself ought to be accountable to his/ her health," they said. The man in the fourth

discussion was replied, "First and foremost, a man can exist if he can keep himself. I am responsible for my health...I must take care of myself...If I fail to do so, what on earth others do for me?"(M6_FGD4). The next is from subjects who have given thought to the question of "what is the feeling about acquiring MS problem?" The majority of the participants provided a reflection that highlighted that acquiring this problem is a simple health problem as compared to HIV." I say it should be for HIV due to attention is given. It's because...This disease has recently been recognized on us...it is terrible...These diseases (metabolic problems); however, existed long ago, and they (metabolic problems) exist now, too...They are not horrifying"(M4_FGD2).Further subjects feel like nothing if in case they can be a victim of metabolic disorders." These responses extended the idea with participants' assertion: " If I am told that I have diseases like...Blood pressure and diabetes, I will feel nothing...because if I can able to live with the big one HIV...I might feel nothing beyond that...I think HIV is better than these diseases"(MP_Ind2).

A few brief quotes on the participants' beliefs. "They (metabolic problems) are serious health problem...It is so difficult, even to think...Because once you got these diseases(metabolic disorders), death awaits at the door of your house at any time...It means that I have deserted my children as orphans...What would more a catastrophe come upon you?"(W7_FGD3). The majority of the involved participants described that developing the metabolic syndrome is a serious health threat that necessitates every one's attention. Though they reflected in that way, the contexts echoed how much horrified life experiences they spent with the virus and dictated as a major influencing factor for the current perceptions they hold about MS risks, without recognizing its future catastrophic health impacts.

Concerning actions to be in place, participants put forth: "We are abandoned to thinking about health," they said. "I also perceive it as others do...Poverty, unemployment, and the likes are here quite high...Due to this, people abandoned thinking about health...Everyone here runs to win their daily bread...As to me; therefore, I don't regard it as a problem...The real problem is a shortage of food"(M5_FGD4). Echoing this concept, "No disease is big (major) and no disease is small (minor)...Generally, every disease is harmful. Likewise, I think these health problems(metabolic diseases) need due attention...It's because...If these once happened to come, we will be forced to purchase more drugs and use...we will be obliged not to eat food item we have at hand...Instead, we will be obliged to select food item risks...And, this is unaffordable for us"(M3_FGD4). Overall, a subject was spoken of about the worth of acquiring the syndrome due to its extra demands of cost, the uptake of more drugs, and other the obligation linked with the diseases, like selection of diet, etc.

As to the prevention measure associated questions like "about diet, sports and harmful substance use habits?" raised for the participants; the overall accepted terms expressed as a limitations were "the lack of

strengths", and "the absence of capacity to afford and secure protein-rich foods that they traditionally perceived as a full nutrition diet," and "working as a day laborer." The following participant quotations explain more: "Doing a sport is good...But I can't do it...For one thing, I work as a daily laborer, and I don't have the strength to do...as you all know, if we do sport, we need to get full nutrition; such as eating raw meat...For this to happen, we need to have money...Therefore, owing to the limitation of my health and financial status, I can't"(M1_FGD4). Furthermore, the 4th man in the fourth discussion noted, "Most of the time we...No need to hide the fact...we often get irritated due to the disease...so, to forget the annoyance we may sometimes smoke a cigarette, and drink alcohol...We also know that it causes another problem...Conversely, we repeatedly do it"(M4_FGD4). The response provided a reflection that meanwhile highlighted the habitual drinking of alcohol, as a means to overcome their anger as an experience where they perceived as bad to develop metabolic syndrome.

Generally, the finding revealed that the perceived severity of living with the virus grounded with, the social, economic and cultural values directives as factors associated with the dearth of contextual knowledge, which is contributed to form unfavorable perception that leads them to have unfavorable attitudes towards the study theme. This finding supports the Ka'opua(101), Airhihenbuwa (22), and Iwelunmor(102) studies report. This implies that living with HIV is a serious public health matter stranded with multicultural and socioeconomic factors that might prompt the PLHIVs to build unfavorable perceptions or attitudes towards any health contexts, including the theme understudy.

Enabler: are systematic, structural, societal, cultural forces, or influences that may encourage or hinders change such as the accessibility of resources, availability, government officials, managers, referrals, skills, and types of services (24, 70, 73-75).The response from the participants will represent; encouraging or obstacles to change. Little snippets from the participants' response voiced this concern: "I got full support from health institutions"(W1_FGD1).“Regarding our health problem (HIV/AIDS)...the government provides us with a supply of the tablet, but it doesn't provide us with any other support”(W5_FGD3).There was an apparent term of “the government”, while the word “government” did not directly refer to any entities, the contexts dictate the health care organizations enhancing enabling role-played in the delivery of education and other supports to the PLHIVs. Following this bit of evidence, we inquired "were there any structural or system-level enhancing or hindering efforts made for the prevention of the syndrome?" The respondents continued and several others joined in. "As we know most often, there are many situations that the government endeavors with a great initiation to create awareness on issues of worth-noting among the community in any way available; as well as to implement"(M8_FGD2).

Also, the report revealed some non-governmental organizational structures tremendous enabling role played on the perception of a person holding about the contexts under investigation. The female patient shared, "OSA organization is the other one that enables me to have awareness. This organization works only to matters related to HIV so it creates deep awareness to me"(FP_Ind1). Briefly, the study suggested that the "governments, mainly of the health care institutions' and the NGO structural role played" were found as enhancing enabler of the current individual perception holds about the study theme. This corresponds with Ka'opua (101) in which a "systemic factors" were found as an enhancing enabler of anal cancer screening promotion practice. William and Iwelunmor (22) consistently shared enhancing enabling factors associated with different public health related perceptions.

In the contrary, concerning the hindering role made for the prevention of the syndrome?" Some participants were shared the following: "The absence of having ample awareness and the absence of the required activities...due to little attention given by all concerned bodies, entails individuals, families, including government bodies...I guess this is a drawback "(M7_FGD2)."I think it's because of the absence of uniformity of solid activities concerning these and other health problems carried out by the government and non-government organizations"(M3_FGD4). Participant further disclosed the current abandoned role of the NGOs as discouraging the enabler of the study theme. This idea is reflected in the participant's replies below, as: "Currently, there is no organization engaged in providing health-related aids and awareness creation education in the area. In the previous time, there were some. There was an organization called the "Medan Act", for example...It went out a long time ago" (W2_FGD3). Another provided answers that pointed, "If you are living with this disease (HIV/AIDS), you will especially be troubled not to work your job properly...and this will lead you to be a victim to several problem...to be reliant on someone...Thus...being live with HIV is so dreadful to me"(M6_FGD2).

Furthermore, subjects in the discussion were felt that their socioeconomic context made a tremendous discouraging enabling role for educational attainment make in health in general and the study theme in particular. "I perceive our being dependent (needy); our being illiterate; our being daily laborers for winning our daily bread; as well as having a meager income, as a hindrance"(M3_FGD4). "As most of us live in avert poverty, we may fail to get daily bread; let alone select food items for this and other diseases"(W4_FGD3). "Even though there are schools, most youth go out to look for a daily labor job instead of going to the schools...Owing to this, they stay along with the asphalt all day long"(W3_FGD3). By emphasizing these concerns, other participants justified, "Due to the high population size, there is no ample farming land here...I guess that we couldn't feed ourselves and our families yielding more production"(W7_FGD3). "As is known, the population size is highly increased here...there is no ample farming land as compared to the population size in our Zone...Hence, our inability to producing other

alternative food production to feed ourselves and our families"(M4_FGD4). "The absence of food aid here is the foremost problem that hinders us not to improve our feeding style"(M2_FGD4).

In short, the inadequate contextual knowledge, living with HIV/AIDS, the social health-seeking habit, socioeconomic problem implicated with lack of good governance, and the systemic level unresponsiveness were the words identified as discouraging enabler of the current individual attitude holds about the study theme. Similarly, Iwelunmor, (2010) further develops "disruptions in mother to daughter relationships" as a theme and as a hindering enabler associated with disclosure of HIV status to mothers (104). Kannan(105), Scarinci(106), and Iwelunmor(107) studies were moreover described terms that represented as a negative enabling factor of the corresponding public health concerns.

Nurturer: refers anyone in the extended family, friends, and kin, peers who exert influence on "health beliefs, attitudes, and actions (24, 70, 73-75). According to the recommendation of nurturers, PLHIVs will follow some form of directed health behavior.

Respondents shared, "I don't underestimate my families': my spouse's and my children's support...they often support me in many ways...Above all, they sometimes help me to have know-how on issues related to the virus as per their knowledge...I have told you that their support is high"(M1_FGD4). The quotations designate participants who have given thought to the encouraging roles of the family as nurture to live healthily. They also provided insight on some of the role of the children, mothers, and spouse carrying one back or even the struggle to teaching one of the health doctrines that can preserve their health. Other participants further shared, individual experience of diseases tragedies developed the energy for giving lesson that will advance their health to others. "I came to know about such diseases (chronic disease) because I have seen it on my mother...indeed she (my mother) is a diabetic patient...If she gets a minor wound, the wound never gets cured soon...She can't eat what she wants...I could understand that it is a big health problem"(W5_FGD3). Conversely, the following drawn-out suggestions perhaps shared the role of the family that hindered them to be benefited to restore or maintain their health situation, for various reasons like: "being lived far apart from the family," "being unwilling to disclose one's real health status," and "lack of interest to know about the health problem of family members. The above concepts reflected in the following quotations. "I merely say, my family didn't provide me with any support"(W6_FGD1). "No one from my family supported me to have knowhow about my health...because I hid my situation to them"(W7_FGD3)."My family lives far away from me...I have no support from them (family)"(W2_FGD1). Emphasizing this issue, one participant noted, "Let alone supporting me, my families do not want to know about my problem...I work for my livelihood...No one helps me anything"(M1_FGD4). One of the overarching themes emerged was about "the contextual understanding level of the family unit." "They (the family) didn't have any information about metabolic issues. Had they

had; hopefully, they would have taught me”(W4_FGD1). The trend exhibited that their lack of knowledge and poor perception towards disclosing themselves hurts their health status.

Besides, the subsequent response from participants perhaps best explains “community's experience illness tragedies” enhanced to nurture their current perceptions they hold about MS risks. “I came to know more about these health problems; after I saw my neighbor fell into sick and took insulin”(W2_FGD1). “My experience to see people died of the sudden situation made me know about the dangerousness of these diseases (metabolic problems)”(W7_FGD1). Further, a woman in the second discussion reacted uniquely as: “Every community varies...Some are educated, and some are uneducated...As compared to these,...The uneducated community rarely does so in such activities...To your surprise, we come across people who do not have any know-how about HIV...Imagine! How many years have gone out since HIV was introduced into our country? What does this indicate? It indicates that the activities being carried out are insufficient. Therefore, such a problem will not be solved unless the government works along with the community...Be it in educational institutions...Even on this issue, it's not as such done...No one ever thought of other related health problems”(W2_FGD3). She described that education plays a huge role in health effects. It was felt by a participant in the interview that his education made a tremendous difference between educated and those who were uneducated communities. The fact of the statement is understood in the variance educational level and knowledge gain and perception hold regarding MS risk reduction. In the reverse, one participant extended remark probably best describes the hindering nurturing role of the “community stigma and discrimination,” to have a proper health habit and the consequence upon the PLHIVs. “It is needless to talk about the community(Gesticulating)...What I have realized is that the community strongly detests using the cups we used...And, the community let alone supporting us; even after such all activities, they kept stigmatizing or discriminating us from any social interactions. (Expressing unintentional, deep sorrow on her face)... What surprises me (Pointing her fingers towards her...they are discriminating not only us but also our children...They don't allow their children to play with our children...The best example is, my child is under ART as I am...When my child plays with other children, the community often orders these children not to play with this boy...Knowing this fact, I also say to my child not to play with them... And, my kid, in turn, asks “me why they say like this?”....and “why you let me not to play with them?” That is why I don't let him do so... (Being in melancholy or low-spirit... as her eyes are full of tears, her speech interrupts... wiping out her tears, all persons there fell in a sheer silence for minutes)... (After a while, she ended up her speech); the community is imposing discomfort on me...”(W4_FGD1). As is seen in the aforementioned response, the PLHIVs were forced to live under strong pressure due to the ill-advised discrimination imposed on them by the community; which, in turn, could aggravate the individual's health circumstances. Such practices of stigmatization

were not only limited to the victim but also on the lives of their children who did not have any accountability on their parents' health status. From this, one can deduce that getting support from others is a sort of luxury life or is unthinkable for them under such a condition.

Still, the quotes from the discussion shared, “The doctors advise us...As for feeding, they say to us; "Before you eat the food whatever you cooked...Don't eat uncooked food"(M4_FGD2)." The health workers provide me high support...often inform us in advance as of administering the drugs...Besides, they give us the advice to quit our bad habit; such as smoking cigarettes and drinking alcohol...They also advise us concerning our way of feedings”(M3_FGD4). Oppositely, a woman in the third discussion proposed “The health practitioners working in the institution never tell us clearly that the cause of our illness is associated with the drug or not...They see us off providing the routine treatment...It would be better if they help us create desirable awareness; especially on metabolic diseases risks that you have told us right now...they never gave us pieces of advice”(W2_FGD3). Echoing these contexts, a woman in the interview explained: When we come to the health center, often the adherence counselors ask and give us advice regarding the virus and whatsoever problem we faced about the drugs"(M7_FGD2). All participants described some level of impact experienced through the pieces of advice given by the health workers, and adherence counselors in the health care institution, and asserted them as a nurturing role players for the correct knowledge gain about keeping their health. Nonetheless, the entire roles have no effect on knowledge gain and attitude develops about the contexts under investigation. Additionally, some other participant further noted, "The presence of health extension workers in our area...However, their focus area to teach and to nurse is only on issues of mother-childhood; as well as HIV and TB cases...Unquestionably, it's worth noting in its right...They didn't do the same on other health problem...So, I don't dare to say they helped us in areas of other health problem."(M5_FGD4). Given the efforts made by the health extension workers were not undermined, yet their area of focus being restricted on another disease (i.e. other than NCDs) were sensed as a discouraging influence to nurture the knowledge gain and attitude that participants hold regarding MS-associated risk reduction.

Overall, our study found the nearby community's experience illness tragedies, and health workers and adherence councilor's role were intuited as enhancing influence. Literature besides notified several phrases like: “the cultural norms”(101),“internal motivation and awareness about cervical cancer screening”(108), and “the contextual knowledge state” (109) as an enhancing nurturing role player of the various public health related behavior. The social stigma or discrimination, the health extension workers restricted effort were found as a discouraging influence to nurture the knowledge gain and attitude that participants hold regarding MS-associated risk reduction, by the current report. Correspondingly, “organizational stigma” was found by Sofolahan(110) study as a hindering nurturing role player of

PLHIVs care related health behavior. This might implicate that the positive and the negative pivotal enabling and nurturing roles that the sociocultural contexts play on influencing the PLHIVs current attitude hold towards diet, physical exercise, and other healthy lifestyle practices. Thus, any future intervention actions designed in PLHIVs, should take the above sociocultural contexts in to account first, in order to promote their attitude about the study concepts. Yet, the finding offers a starting point that now inspires further investigation.

Practice associated behavior

Airhihenbuwa (1989) suggested that the cultural empowerment domain of the PEN-3 model is intercepted with the conceptual framework of practices associated with health behavior. It is essential to identify the impact of sociocultural contexts of individual lifestyle practices. It works with the assumption that "the way of life is a predecessor or obstacle to disease and it is well known (23, 70). Despite this, our finding concluded that there remains a wide gap amongst individual practices associated to prevent and conserving health and individual knowledge about diet, physical activities and other harmful substance use habit. Correspondingly, Nomsa R.(118) revealed the cultural contexts as an important mediator on making decisions the contraceptive use and sexual activity amongst adolescents in three rural communities in the Eastern Cape. Moreover, Rhonda Belue (99) and Barbara and Krass (119) studies congruently reported that the sociocultural contexts as a significant mediator of self-management behavior associated with Type 2 DM and DM among adult participants, in Senegal, Maltese immigrants, in Australia. This implicates the sociocultural contexts dictates the health behavioral decision of a person in any directions and mainly dependent on the knowledge contexts.

The paragraph below presented the participants replies as the positive, existential, and negative practices sub-domains.

Positive practices: are those deep-rooted in individual beliefs and knowledge that are known to be valuable to health (23, 70). The PLHIVs were largely known that positive practices were based on diet and physical activity. Respondents shared the following: "I say: eating vegetables, fruits, and light food items which do not discomfort us; and improving our living style and feeding system...help us to keep ourselves from such health problems"(W8_FGD1). "I believe that our feeding style...like...Vegetables, Tomato, Sweet-Potato, Potato, Carrot, Tomato, Swiss Chard Cabbage, and Pimento (locally called in Amharic as 'Daattaa' are sensible feeding habit to be safe from such health problem" (W5_FGD1). The third woman in the discussion three furthered this idea by suggesting, "I consider refining feeding style, like reducing over-salted foods, as a preventive method, as one of the sensible practices"(W3_FGD3). And this highlighted the necessity of the refraining feeding lifestyle from over-salted foods as a sensible

habit. In short, the responses on feeding practices were articulating the overall positive health impacts of vegetables and fruit consumption.

Another respondent' noted, "Regarding protecting and controlling health problems I take as a positive thing that I do exercises. "Everybody should do exercise regularly to protect themselves from any sickness...If we sit idle, our leg will contract, exposed to other diseases, and might cause a psychological disorder"(MP_Ind2). Echoing this situation, the third woman in the first discussion reacted, "I dare to say that walking a long distance, and working for many hours indoors; including cooking as discharging my responsibility helped me a lot...By doing so, I am benefited(W3_FGD1). They also focused on doing physical activity and feeling that doing regular exercise as a high-quality practice associated with them to maintain their health by reducing body weight. Yet, the response lacks term that explains the explicit role of such behavior in the prevention of the MS risks and its long term effects, along with the compulsory rate and extent required in pursuing a healthy life. Generally, the discussion suggested that no difference was exhibited on the welfares of engaging in positive practices that improve MS risks.

Existential practice: are those identified within the sociocultural perspective and are not essentially undesirable or helpful in its use (23, 70). It presented practices in a new context perhaps not ever well-thought-out already. Accordingly, little snippets from the participants' response were identified "the long-lasting habitually eating of food item called in Amharic as 'Kochoo' and 'Bulla' prepared in the form of porridge and gruel were the catchphrases emerged under such feeding habits. These ingredients (i.e. 'Kochoo' and 'Bulla') are produced from a plant known in Amharic as 'Enset' (i.e. false Banana) that are extracted from the root section of the plant." These food items are organic, locally endemic, indoor prepared and culturally accepted food items with the highest social values. To repeat the preceding opinions, other subjects shared eating 'Injera' together with 'Wot', also seen as the other existential feeding practices identified in the responses of the PLHIVs. Additional participant sides included: Despite the frequent use of 'Injera' has a such health impact...particularly...the use of 'Shiro-Wot'...together will have a better outcome (M1_FGD4).

The term 'Injera' is an Amharic word refers to the name given to the cultural legend, well-known, and the most widely used food item in the country and in the study area for a long. It is commonly prepared with the cereal name called in Amharic as 'Teff'. It's often eaten by using an indoor stewed sauce called in Amharic as 'Wot', might be prepared using several ingredients called as 'Shiro'(i.e. prepared with the processed pea, bean, chickpea cereals). Overall, such feeding habits are culturally legend habits, not only in that locality but also all over the country of Ethiopia. However, still, there is no supportive evidence about the scientific nutritional values of 'Injera' in the promotion of health. Another participant noted, "Since we are living with the virus...we never use alcoholic drinks that can intoxicate us...however,

occasionally we use of 'kiineettoo' (which is locally prepared Coca-Cola like drink)" (W1_FGD3). As is grasped in the aforementioned response, "the use of Coca-Cola like fermented drink called in Amharic as 'kiineettoo' appeared term that is grouped as existential practices. It is known as indoor fermented Coca-Cola like drinks that the society used occasionally. It is a unique, culturally based and socially accepted type of drinks used by all segments of the population, irrespective of their health, age, sex, and religion status.

Still, other participants noted, "As most of the communities, including me, are religious... mmm... That's to say, as we live with the Lord; let alone such kind of problem we are well-looked-after by God from another kind of health problem. Only by being in the Lord; what's more, as we are going to be well-kept-up unnecessary practices: like an addiction of alcohol, cigarette, and infidelity to women; no problem happens to us"(W3_FGD3). These statements illustrate essential aspects of being in the Lord to safeguard themselves from any evil practices that aggravates the MS occurrences.

Negative practice: relies on the undesirable practice related concepts with bad health outcomes (23, 70). Perhaps when we think of negative practice, there is a trend to shrink back from self-blame. Subsequently, few attempted to offer information in this respect. Their replies are concepts that were pronounced at different times all over the discussion. The practice revealed may be reflected in negative or harmful behaviors. Subjects noted: "I perceive that the prevailing habit of feeding often "raw meat" (i.e. called in Amharic as 'Tire-Sigga') here as one practice"(M8_FGD2). Participants described recognizing that "eating raw meat" is the culturally preferred food type that habitually practiced by the vast majority of the community in the country in general and the population in the study area in particular. Against of the preceding views, one subject shared, "In my opinion...As she does...eating meat is regarded as a noble traditional feeding system in here...however, I don't think it's worthy"(W7_FGD1). Despite the cultural nobility, she advised one to abstain from "eating raw meat" as one action to improve health in general and the theme under study in particular.

To echo the former opinions, the "fatty food item" idea can be realized in the next statements. "Most of the time, it is noticed that people often use fatty food items risks here"(M3_FGD2). In the reverse, another participant remarked: "I guess we shouldn't eat fat meat and fatty food items...Because food items cause diarrheal disease and other problems that affect people who live with the virus"(W1_FGD1). There was only one mention of the habit of the use of "the food item called in Amharic as 'Injera' with 'Wot' or "meat-sauce" (the sauce prepared using ingredient meat called in Amharic as 'Sigga-Wot'), as contributors to chronic disease in general and metabolic syndrome in particular during the discussions. Confirmation of this concept is noted in the next quotation. "Our habit of eating 'Injera' with 'meat-Wot,' sauce prepared using with meat as an ingredient (i.e. called in Amharic 'Sigga-Wot') is a sensible

food...You know why?... such food items are good for people like us (living with HIV-infection) to be free from any health problem including the kind of disease that you talk about now...and even to get strength"(W3_FGD3).

Participants were also aware that the negative practices were based on running sedentary life and engaged in other harmful substance use habits, like alcohol consumption and smoking cigarettes. This concept is affirmed in the following responses. "You know what? While you live with the virus(HIV)...this doesn't give you time, rather exposes you to various illnesses...this, let alone give you the chance to perform the exercise, rather it imposed you to fail to get your daily bread...Spend much of your time in bed"(M3_FGD4). "It is difficult to try to even to think...due to the inadequate power, we experienced...and the economic problem encountered succeeding with the disease we live in (HIV/AIDS)"(W7_FGD3). This insightful report demonstrates vital aspects of PLHIVs life experiences; the development of various opportunistic infections accounted for the HIV-infection deemed the PLHIVs to fall into bad health states that eventually leads these people to run a bedridden life. It also designates the socio-economic implication of the virus and the antiretroviral therapy that they regularly use as contributors to their habit relating to a sedentary lifestyle.

Still, participants notified, "The youth, as they are most addicted, uses the wage from daily labor for...especially, drinking 'Areke' to get drunk"(M2_FGD4). In my opinion, I believe we should abstain from drinking alcohol...It's because...We will be exposed to many problems as we can't control ourselves "(M7_FGD2). One participant reacted differently. "As has been known, the big problem of living with HIV is...You often get irritated due to the disease...So, we may sometimes smoke a cigarette and drink alcohol to forget the annoyance. Health professionals most often advise us that it causes another health problem...Conversely, we keep using it covertly...by ignoring their advice...Hope, we better quit our bad practice."(W3_FGD3). Participants described the long term impact of the virus on the day to day life of the PLHIVs and its attached psychosocial problem as contributors to increase metabolic syndrome through leading harmful lifestyle habits. Furthermore, other participants shared: People usually sit idle throughout the day without doing anything, mostly on chewing 'Khat'...It is a common trend...Even, there are peoples who I know living with the virus and who habitually use this substance...I feel that may harm" (M2_FGD2). Conversely, the man in the fourth discussion revealed, "Having the initiation and exercising our effort...For example, we have to...abstaining ourselves from bad addiction, such as cigarette, "Khat", and alcohol"(M1_FGD4). He suggested that abstaining oneself from the use of 'Khat', cigarette and alcohol as a positive practice to control MS risks; meanwhile was introduces a new risk factor "'Khat' use habit" for the occurrence of the syndrome. Overall, the discussion asserted that the

consumption of different substances like a smoking cigarette, and ‘Khat’ were found expressions related to harmful substance use habits as contributors to advance metabolic syndrome.

Our finding revealed the participants replies in the empowerment health behavior domain as the positive, existential, and negative practices. Indeed, the positive behavior was certainly explained. The habit of eating vegetables and fruits, restricted harmful substances use, and intentional physical activity were notified as positive practices that the PLHIVs perceived measures to prevent MS risks. Correlating with the current study report, "my child will get well" was the phrases, found as a positive perception of child malaria treatment-seeking behavioral decisions of women suggested by Iwelunmor(102). Several other studies conducted worldwide were further established an important sociocultural contexts that support this concept (75, 96, 104, 111). The long-lasting habitually eating of 'Kochoo', 'Bulla', 'Injera' together with 'Wot', were emerging as an existential practice that is locally recognized as a noble habit, with no any scientific evidence on the progression of MS. Analogs words that reflect existential practice associated perceptions with the neutral progression of MS risks were reported in our findings. The word "breastfeeding" was found as an existential practice of motherhood to divulge the HIV-status to the family" suggested by Iwelunmor(104). Likewise, the "beliefs related to child teething" as existential practices related contexts linked with the perception of child malaria treatment-seeking behavioral decisions of women reported by Iwelunmor(102). This implicated that any of the positive and existential perceptions, enablers, and nurturing factors that may lead to a positive health outcome need to be promoted and recognized. Others acknowledged their habit of "eating raw meat", running sedentary lifestyle, the use of locally prepared alcohols, called in Amharic as: 'Areke' 'Tella and 'Tejj, and smoking cigarettes were the practices that might lead the PLHIVs to advance a negative health outcome. Using a substance called in Amharic 'Khat' was also stated as a negative practice. The "fear, stigma, and discrimination" are words that emerged as a negative individual behaviour of PLHIVS related with the non-disclosure of seropositive status to significant others stated by Iwelunmor 2014(22). The phrases," my child's illness is not severe" were correspondingly found as negative factors associated with the perception of child malaria treatment-seeking behavioral decision of women suggested by Iwelunmor(102).The finding suggests, although the negative practices that the community tied up are a culturally preferred habit that much of them practiced, it needs to be resolved. More quotations among participants under this theme located in the supplementary excel document attached.

Trustworthiness and limitations of findings

This study run in a room designated for study purposes that unnecessary external condition was unlikely. The subjects had a prior chance to contact the research at the time of recruitment. During discussion, testing was made to validate the accuracy of replies. During the discussion, saturation of idea was

achieved as it gave similar answers for questions across the domains. The frequent playing of recording devices, to aid the correct transcription of recordings was correspondingly executed to ensure the trustworthiness of the result. Besides, as indicated elsewhere the transferability of the study is enriched by providing definite facts of the method process. Initially, themes were investigated manually using a codebook followed with Atlas.ti7. The transcripts were reviewed and color-coded to identify the themes. This was compared with initial coding. The delivery of detailed, rich reports provides others enough aspects for contrasting study and an overall background from which other interested researchers can do some decisions that may not be unfounded regarding the direction of future research. Nevertheless, the study was limited by several factors. Given the study was grounded with the PEN-3 model; this may likely to blind researchers to overtly look newly emerging themes from the perspectives of the model constructs. Besides, since the study was interviewing participants about their past actions relations and supports; the finding might not be free from recall biases. Furthermore, as this study used phenomenological and non-probability sampling techniques, the likely workability of the data may be questionable. Hence, using the findings should be done with great care.

Conclusions

This descriptive phenomenological study intended to understand the role of sociocultural contexts in shaping adult HIV-patients' behavior towards feeding habits, physical activity, and harmful substance use habits. We were fascinated by realizing how personal knowledge forms the basis of personal attitudes, and how knowledge and attitude do gained influence eating habits, physical exercise, smoking, and alcohol intake practices? This delivers virtual intuition for health care executives; health services professionals, public health professionals, researchers, community, and PLHIVs. As the study concluded that the sociocultural contexts influence the PLHIVs to have inadequate knowledge concerning risk factors and methods for preventing MS. And, this leads to form an unfavorable attitude and inadequate practices towards the situation. This asserted that the question of knowledge of MS and its risks affect upon attitudes of personal concern for dietary, physical activity, and other harmful related practices replied undeniably. This suggests, having recognized the long-lasting unique habits, the adoption of the dietary habits of eating plenty of fresh fruits and vegetables for three or more days per week, coupled with purposeful physical activity, and restricted harmful substance use habits would enable for better control of the syndrome and its risks of acquiring NCDs.

Therefore, Dilla University referral and teaching hospital, Gedeo-zone health bureau, and other health care institutions, along with the corresponding health workers to take the initiative in providing health education to the PLHIVs on a regular basis. Within this program, emphasis can be placed on the provision of training on the reduction of lifestyle-associated risks and build their knowledge, attitude, and practices

against the incidence of MS and control of NCDs risk at least in this segment of the general population. In doing so, if the PEN-3 model is adopted across the Gedeo zone, Southern Nations Peoples regions and in the country, the task of meeting the health education needs and the reduction in the incidence and prevalence of MS risks and NCDs among the PLHIVs could be more achievable.

4. Other

Conflicts of Interest-I confirm that there is no competing interest in this research work.

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Data Availability-All data generated or analyzed during this study are included in this manuscript [and its supplementary information files].

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5. Supplementary materials

1. S1_Table1 The SRQR reporting guidelines completed checklist
2. S2_Table 2 Code-Book.sup_doc
3. S3_Table 3 Themes, from respondents' quotation_sup.xcl.doc

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Annex 2: code book

A Code-Book constructed, Using the PEN-3 Model and KAP as a Framework, Phenomenological-Study, PLHIVs, Gedeo, Southern-Ethiopia, 2018

S.N	Themes (CFW)**	The PEN-3 model domains(Categories)	Sub-domains (Subcategories)	Consolidated Code(CFW)*	Codding-unit (words, phrases, and sentences)
1	Knowledge	Cultural identity	Person	Knowledge	Enabling aspects of life for personal health concerns
					Means of information gain regarding MS
			Extended Family		Extended family member's role played for personal knowledge gain
			Neighborhood		Neighborhood encouraging/ discouraging role played for personal knowledge gain
					Ways of Neighborhood role played for personal education of MS
			Person	Attitudes	Enabling aspects of life for personal health concerns
					Personal feeling of MS
			Extended Family.		Extended family member's encouraging role played for personal current attitude
					Extended family member's discouraging role played for personal current attitude
			Neighborhood		Neighborhood encouraging role played for personal current attitude about MS
					Neighborhood discouraging role played for current personal

					attitude about MS,
			Person	Practices	Personal belief about healthy practices responsibility
			Extended Family		Extended family member’s encouraging role played for personal health practice
					Extended family member’s encouraging role played for health practice about HIV –MS
			Neighborhood		Neighborhood encouraging role played for personal engagement of healthy practice HIV and other
					Neighborhood encouraging role played for personal healthy practice engagement about prevention of HIV–MS risk reduction, prevention and control of long term outcome
2	Attitudes	Cultural relationship and expectancy	Perceptions	Knowledge	Individual, family members and community perception (knowledge, beliefs, and values) of MS prevention
			Enablers		The cultural, societal, systemic, or structural enhancing /barrier factors of knowledge gain about MS
			Nurturers		The encouraging/discouraging role of family kin, peers, and community in helping you gain a correct knowledge of MS
			Perceptions	Attitude	State of individual attitude/concern of MS
			Enablers		Enabler of current attitude (negative or positive) of

				Practice	MS
			Nurturers		Reinforcing factors of concern about prevention of MS
			Perceptions		Personal belief about healthy lifestyle practices of MS
			Enablers		Encouraging enabler to engaged in healthy lifestyle practice
					Discourage enabler to engaged in healthy lifestyle practice
			Nurturers		Ways of family, kin or relatives, influence to engaged in healthy lifestyle practice to prevent MS
					Ways of community influence to engaged in healthy lifestyle practice
3	Practices	Cultural empowerment	Positive	Knowledge.	Positive knowledge for prevention of MS
		Existential	Existential knowledge for prevention of MS		
		Negative	Negative knowledge for prevention of MS		
			Positive	Attitude	Positive attitude for prevention of MS
			Existential		Existential knowledge for prevention of MS
			Negative		Negative knowledge for prevention of MS
			Positive	Practice	Positive practice engaged for prevention of MS
			Existential		Existential practice engaged for prevention of MS
			Negative		Negative practice engaged for prevention of MS

*CFW: Conceptual Framework used to consolidate the code

**CFW: Conceptual Framework used to determine latent themes

Annex 3: The description and instrument questions of behavioral factors

The description and instrument questions used to define some of behavioral factors of the dissertation

Behaviour	Description		Instrument question:
	Tobacco Use		
Behaviour	Current smoking:	Current smokers among all respondents.	Do you currently smoke any tobacco products, such as cigarettes, cigars, or pipes?
	Smoking Status:	Smoking status of all respondents.	Do you currently smoke any tobacco products, such as cigarettes, cigars, or pipes? Do you currently smoke tobacco products daily? In the past, did you ever smoke any tobacco products?
	Daily smoking:	Percentage of current daily smokers among smokers.	Do you currently smoke any tobacco products, such as cigarettes, cigars, or pipes? Do you currently smoke tobacco products daily?
	Initiation and duration of smoking:	Mean age of initiation and mean duration of smoking, in years, among smokers (no total age group for mean duration of smoking as age influences these values).	Do you currently smoke any tobacco products, such as cigarettes, cigars, or pipes? How old were you when you first started smoking? Do you remember how long ago it was?
Alcohol Consumption	Alcohol consumption status	Alcohol consumption status of all respondents.	Have you ever consumed any alcohol such as ...? Have you consumed any alcohol in the past 12 months? Have you consumed any alcohol in the past 30 days?
	Frequency of alcohol consumption	Frequency of alcohol consumption in the past 12 months among those respondents who drank in the last 12 months.	During the past 12 months, how frequently have you had at least one alcoholic drink?
	Drinking occasions in the past 30 days	Mean number of occasions with at least one drink in the past 30 days among current (past 30 days) drinkers.	During the past 30 days, on how many occasions did you have at least one alcoholic drink?
	Standard drinks per drinking occasion	Mean number of standard drinks consumed on a drinking occasion among current (past 30 days) drinkers.	During the past 30 days, when you drank alcohol, on average, how many standard alcoholic drinks did you have during one occasion?
Diet	Mean number of days of fruit and vegetable consumption	Mean number of day's fruit and vegetables consumed.	In a typical week, on how many days do you eat fruit? In a typical week, on how many days do you eat vegetables?
	Mean number of servings of fruit and vegetable consumption	Mean number of fruit, vegetable, and combined fruit and vegetable servings on average per day.	In a typical week, on how many days do you eat fruit? How many servings of fruit do you eat on one of those days? In a typical week, on how many days do you eat vegetables?
			How many servings of vegetables do you eat on one of those days?
	Fruit and vegetable	Frequency of fruit and/or vegetable consumption. Instrument questions:	In a typical week, on how many days do you eat fruit?

	consumption per day		How many servings of fruit do you eat on one of those days? In a typical week, on how many days do you eat vegetables? How many servings of vegetables do you eat on one of those days?
	Fruit and vegetable consumption per day	Percentage of those eating less than five servings of fruit and/or vegetables on average per day.	In a typical week, on how many days do you eat fruit? How many servings of fruit do you eat on one of those days? In a typical week, on how many days do you eat vegetables? How many servings of vegetables do you eat on one of those days?
	Salt consumption	Percentage of all respondents who think they consume far too much or too much salt.	How much salt or salty sauce do you think you consume?
	Oil used most frequently	Type of oil or fat most often used for meal preparation in households (presented only for both sexes because results are for the household not individuals).	What type of oil or fat is most often used for meal preparation in your household?
	Eating outside home	Mean number of meals per week eaten outside a home.	On average, how many meals per week do you eat that were not prepared at a home? By meal, I mean breakfast, lunch and dinner.
Physical Activity	Introduction:	A population's physical activity (or inactivity) can be described in different ways. The two most common ways are (1) to estimate a population's mean or median physical activity using a continuous indicator such as MET-minutes per week or time spent in physical activity, and (2) to classify certain percentages of a population in specific groups by setting up cut points for a specific amount of physical activity. When analyzing GPAQ data, both continuous as well as categorical indicators are used.	
	Metabolic Equivalent (MET):	METs (Metabolic Equivalents) are commonly used to express the intensity of physical activities, and are also used for the analysis of GPAQ data. Applying MET values to activity levels allows us to calculate total physical activity. MET is the ratio of a person's working metabolic rate relative to the resting metabolic rate. One MET is defined as the energy cost of sitting quietly, and is equivalent to a caloric consumption of 1 kcal/kg/hour. For the analysis of GPAQ data, existing guidelines have been adopted: It is estimated that, compared to sitting quietly, a person's caloric consumption is four times as high when being moderately active, and eight times as high when being vigorously active. Therefore, for the calculation of a person's total physical activity using GPAQ data, the following MET values are used:	
	Work:	MET:	Moderate MET value = 4.0 Vigorous MET value = 8.0
	Transport:	MET:	Cycling and walking MET value = 4.0
	Recreation	MET:	Moderate MET value = 4.0 Vigorous MET value = 8.0
	WHO global recommendations on physical	For the calculation of the categorical indicator on the recommended amount of physical activity for health, the total time spent in	• 150 minutes of moderate-intensity physical activity OR • 75 minutes of vigorous-intensity

Total physical activity median	Median minutes of total physical activity on average per day.	• activity at work • travel to and from places • recreational activities
Domain specific physical activity-mean	Mean minutes spent in work-, transport- and recreation-related physical activity on average per day.	• activity at work • travel to and from places • recreational activities
Domain specific physical activity – median	Median minutes spent on average per day in work-, transport- and recreation related physical activity.	• activity at work • travel to and from places • recreational activities
No physical activity by domain	Percentage of respondents classified as doing no work-, transport- or recreational related physical activity.	• activity at work • travel to and from places • recreational activities
Composition of total physical activity	Percentage of work, transport and recreational activity contributing to total activity.	• activity at work • travel to and from places • recreational activities
No vigorous physical activity	Percentage of respondents not engaging in vigorous physical activity.	• activity at work • recreational activities
Sedentary:	Minutes spent in sedentary activities on a typical day.	sedentary behaviour

*Adopted from the Ethiopia steps report on risk factors for NCDs and prevalence of selected NCDs(150).

Annex 4 :Participant Information Sheet and Consent form English version

The researchers: My name is Girma Tenkolu Bune. I am a PhD candidate in AAU, CHS, SPH and I am carrying out this study as part of a Doctoral qualification in public health epidemiology. The research is being supervised by professor Alemayehu worku (PhD), and Dr Abera Kumie (PhD).

What is the purpose of the research: This study project is the one that assess MS associated epidemiology and socio-cultural contexts among people living with the virus. Hence, the current study intends to give answer the magnitude, risk factors affecting the MS.

Why have I been invited to take part in the study: Since the aim of the study is to explore the problem among all PLWHs with or without HAART exposure that you are invited to take part.

Do I have to take part: You are under no obligation to take part, and even after agreeing to do so you may change your mind at any time, without having to give a reason

What is involved: We plan to enroll as many as around 1030 peoples with HIV-infection who are registered and followed in the chronic HIV care clinic of all of the health care organizations (HCO,s) found in the zone. If you join the study, you might have come again and again in variably with the normal follow up schedule, until the study is completed. On your first time visit after launching of this study, the staff member will ask you more question to fill the questionnaire about various contexts of MS associated risk factors, prevention action you takes perform and others related issues. After completing the question's, you will be told to sit for and stayed for a while about 10 minute, and then after taking of your blood pressure measures will follow using the BP-apparatus. Subsequently, you will be asked to take off your souses and closes, and then will be ordered to be standing on the weight scale to measure your weight and then to stand straight on the height scale to measure your height. After the completing all the respected procedure, they will send you to the bio-medical laboratory unit.

What will happen to this information: Anonymised sections of the information collected from the interview will be looked at by my supervisors, and may also be looked at by representatives from academic and professional assessment bodies in order to assess the quality of this doctoral research project. If you give additional consent, I would also like to discuss anonymous parts of the transcript with a group of my colleagues who are interested in this type of research and may assist me in the analysis like myself and have the same duty of confidentiality towards all participants. As part of the doctoral programme, I will write up a report of the research. Within this report I may include anonymous extracts of the interview to illustrate themes that have

been discussed. These extracts will not include any information that could identify participants. I will also write a shorter article for publication in an academic journal, and might be presented at conferences in the future and that this may also include brief anonymous extracts of the interview.

What are the possible disadvantages and risks of taking part: You will be asked to discuss your views about yourself in some detail, the experiences you have had that have contributed to how you see yourself, and how you think this has affected your health. This could be potentially distressing, and every measure will be taken to minimize the risk of distress. If during the interview you are asked a question that you are not happy to answer you can skip it, and if you do become upset, you will be given the option to take a break or stop the interview altogether. Additionally, you may experience discomfort from the blood tests, which involve a needle puncture, with possible bleeding and bruising; Moreover, being involved in the studies, if you learn that you have the syndrome it may cause you stress; records will be kept about your health that might be seen by people other than your doctor.

What are the potential benefits of taking part: I cannot promise that the study will help you, but the information we get from this study will help improve understandings of MS disorder and may therefore help improve the intervention in the future. You may also appreciate having the opportunity to talk openly about your experiences. Additionally, your involvement in the study, will help learn more about your health and the risks of metabolic syndrome related with HIV; helps the research team to learn more about how to prevent and treat HIV and other infections so that more lives can be saved and quality of life can be improved.

What will happen if I don't want to carry on with the study: Your participation is voluntary. You do not have to join this study and you can quit at any time.

How much will it cost to be in this study: All the clinical examination, tests and frequent meetings with doctors will be free.

Will my taking part in this study be kept confidential: All information which is collected about you during the course of the research will be kept strictly confidential?

Who has reviewed the study: All research in the AAU is looked at by independent group of people, called a Research Ethics Committee, to protect your safety, rights, wellbeing and dignity.

Who can I talk to for more information about this study or if I have been injured as a consequence of Participating in this research study:

If you have questions about these studies, you should first discuss with your clinicians/study teams, to be established in the chronic HIV care clinic: and communicate the focal person of the study team.

Name of study teams focal person: _____ Telephone number: _____

If they have not provided you with answers to your satisfaction, you should contact the principal investigator and CHS-IRB with the following address.

S.N	PI- Name	e-mail of PI	Phone No
1	Girma Tenkolu Bune	Girmatenkolu1973@gmail.com	251-911-35-62-14
2	CHS-IRB		Tel No0118961396

Annex5 : Participant Information Sheet and Consent form Amharic version

ለጥናቱ ተሳታፊዎች በጥናቱ ለውቀውና ተረድተው በስምምነት ለመሳተፍ የሚረዳቸው (Consent) መግለጫ ቅጽ

- ተመራማሪዎች፤ እኔ ግርማ ተንኮሉ ቡኔ** በአዲስ አበባ ዩኒቨርሲቲ በህብረተሰብ አቀፍ ጤና ት/ቤት ውስጥ የዶክተራት (የፒ-ኤች-ዲ) ተማሪ ስሆን ለዶክተራት ዲግሪዬ ሃሳድ ይረዳኝ ዘንድ በማሰብ ነበር ይህን ጥናት የማድረግዎ። ከእኔ በተጨማሪ **ፐሮፌሰር አለማየሁ ወርቁ ና ዶክተር አበራ ቁሜ** ጥናቱን በተመለከተ ምክር በመስጠት ይተባበራሉ።
- የጥናቱ አላማ፤** የጥናቱ ዓላማ ከኤች አይቪ ጋር ተያያዥነት ያላቸውን ከሰው ወደ ሰው የማይተላለፉ በሽታዎችን በተመለከተ ምርምር ለማከናወን የታቀደ ነው።
- በጥናቱ መሳተፍ ግዴታ ነው፤** በጥናቱ የመሳተፉ ሁኔታ ሙሉ ለሙሉ በፍቃደኝነት ላይ የተመሰረተና በማንም ተፅኖ ስር የወደቀ አይደለም።
- በጥናቱ ወቅት ምንድን ነው የሚከናወነው?** ባጠቃላይ ወደ **1564** የሚጠጉ ከቫይረሱ ጋር የሚኖሩ እድሜያቸው ከ 18 ዓመት በላይ የሚሆኑ ወንድና ሴቶች ሰዎች ያካትታሉ። ነገር ግን ይህን ሴት ከሆነ የአርግዝና ምርምር አድርገው ፅንሰ እንደሌለባቸው ሲረጋገጥ ብቻ ይካተታሉ። በጥናቱ ወቅትም፡ 3 ደረጃዎችን መሰረት ያደረጉ መጠይቆች ይከናወናሉ። በመጀመሪያ ደረጃ ፡

የእርስዎን ማህበራዊ ጉዳዮችን ብሎም ሌሎች ከጤና ጋር ተያያዥነት ስለሚኖራቸው የእርስዎን ባህሪያት የተመለከቱ መጠይቆችን ይጠየቃሉ። በሁለተኛው ደረጃ ቁመትዎን፣ ከበደተዎን፣ የደም ግፊትዎን ለመለካት የሚያስችሉ ስራዎች ይከናወናሉ። በሦስተኛ ደረጃ ላይ ደግሞ ወደ ለብራቶሪ ክፍል ተልከው የደም ውስጥ የስጋና የኮሌስተሮል መጠን ለመለካት ከአጅዎ ስር ከሚገኘው የደም ስር በመርፌ ከ5 – 10 መሊ/ሊ የሚሆን ደም ተወስዶ ምርመራ እንዲያከናውኑ ይደረጋል።

5. **በጥናቱ ወቅት የተሰበሰበው መረጃ ምን ይደረጋል?** በእርስዎ ዙሪያ የተሰበሰበውን መረጃዎች የእርስዎን ማንነት በማይጠቁም ሁኔታ ከላይ በተጠቀሱት ተቆጣጣሪዎች አልያም ደግሞ በሌሎች በሚመለከታቸው የትምህርትና የዶክተራት ምርምር ተቆጣጣሪዎች ዘንድ ሊታይ የሚችልበት ሁኔታ ሊኖር ይችላል።
6. **በጥናቱ በመሳተፌ ምክንያት ሊገጥመኝ የሚችለው ችግር ወይም አደጋ ምንድን ነው?** በጥናቱ ወቅት እርስዎን በተመለከተ በጥልቀት ከዚህ ቀደም ስለሚኖርዎ ባህሪያቶችና ሌሎች የእርስዎንና የቤተሰቦችዎንና ብሎም ሌሎች በአቅራቢያዎ ስለሚኖረው ማህበረሰብም ባህልና ልምዶች ወዘተ ስለሚጠየቁ እርስዎ እነዚህን ጉዳዮች የተመለከቱትን ጥያቄዎችን በሚመልሱት ወቅት ሊጨነቁ ይችላሉ። በዚህ ላይ እንዳንዶቹ ጥያቄዎች እርስዎን በጣም ሊያስቀይምዎ ይችላሉ። በተጨማሪም ጥናቱ የደም ምርመራንም ስለሚፈልግ በመርፌ መወጋቱ ህመም የመፍጠር፣ የመድማት ብሎም የመቁሰል ችግር ሊያስከትልብዎ ብሎም ጥናቱን ተከትሎ የችግሩ ተጋላጭ መሆኑን ከታወቁ ተጨማሪ ጫና መፍጠሩ አይቀርም።
7. **በጥናቱ በመሳተፌ የምጠቀመው ምንድን ነው?** በጥናቱ መሳትፍ በፍጥነት ለእርሶ ብቻ ሊሰጥዎ የሚችለው ጥቅም አለ ብዬ ለመናገር አልደፍርም። ነገርግን በሂደት በጥናቱ አማካኝነት ሊገኙ የሚችሉትን ጥቅሞች ከሚሰጠው አገልግሎት መሻሻል እንገር ተጠቃሚ የሚሆኑበት ሁኔታዎች ግን ይኖራሉ።
8. **በጥናቱ ለመሳተፍ ፍቃደኛ ባልሆን ምን እሆናለሁ?** ከዚህ ቀደም የሚሰጥዎ አገልግሎቶችን ብቻ እግኝተው እንዲሄዱ ይደረጋል። በተጨማሪም እንደ እርስዎ ፍላጎት ለጥናቱ ተሳትፈዎች ብቻ ሲሰጥ የነበረውን ምርመራም ሆነ ምክር በፈለጉበት ወቅት መውሰድም እንዲችሉ ይደረጋል።
9. **በጥናቱ መሳተፍ ምን ያክል ወጪ የበወጣል?** ማናቸውም አይነት ምርመራዎችም ሆኑ ከህኪም የሚያገኙዎች ህክምናዎችና ምክር የሚደረግልዎ በነፃ ነው።
10. **በጥናቱ መሳተፌ ሚስጥራዊነቱ የተጠበቀ ይሆናል?** ማናቸውም በጥናቱ ወቅት የሚሰበሰቡት መረጃዎች ሙሉ ለሙሉ ሚስጥራዊ ነው የሚሆኑት።
11. **የጥናቱን አጠቃላይ ሁኔታ ማን ነው የሚገመግመው?** ማናቸውም በአዲስ አበባ ዩኒቨርሲቲ ስር የሚሰሩ ጥናቶችን የሚገመግመው ለዚህ ተብለው በዩኒቨርሲቲው በተመደቡ የምርምር ተቆጣጣሪ ቦረድ ኮሚቴዎች አማካኝነት ሲሆን የሚገመገሙትም የጥናቱን አስፈላጊነትና ብሎም ጥቅሙ ከጉዳቱ የበለጠ መሆኑን አጣርተው ለመወሰን ነው።
12. **ጥናቱን በተመለከተ የበለጠ መረጃ ብፈልግ አልያም ደግሞ ጥናቱ ላይ በመሳተፌ ምክንያት ጉዳተ ቢያጋጥመኝ ማንን ነው የማንጋግረው?** ለሚኖርዎ ማናቸውም ዓይነት ጥያቄዎች በቅድሚያ በጤና ተቆሙ ከሚያገኙቸው የጤና ባለሙያዎች ብሎም ተቆጣጣሪዎች ጋር ውይይት ያድርጉ። ካልሆነም ተጨማሪ መረጃዎችን ከዚህ በታች የተጠቀሰውን አድራሻ በመጠቀም ማግኘት ይችላሉ።
ለጥንቅቃ የተመደበው ሃላፊ ሰው ስም _____ ስልክ ቁጥር: _____ አድራሻ _____
በተጨማሪም የጥናቱ ዋና ተመራማሪ እንዲሁም ጥናቱን የሚቆጣጠረውን ተቋም በሚከተሉት አድራሻ በማግኘት ተጨማሪ ማብራሪያዎች ስለጥናቱ መጠየቅና ምላሽ ማግኘት የሚችሉ መሆኑን አገልግላለሁ። 1. **ግርማ ተንኮሉ ቡኔ (ኪ.ቁ: 0911356214)**

1. አዲስ አበባ ዩኒቨርሲቲ የጥናት መርማሪ ቡድን (ኪ.ቁ:0118961396)

Annex 6 : English version English version of participants Consent Confirmation Form

Researcher: Girma Tenkolu Bune		
S.No	Sign if	Please put tick mark
1	I confirm that I have read and understand the information sheet (dated _____) for the above study. I have had the opportunity to consider the information and if needed ask questions that were satisfactorily answered.	
2	I understand that participation is voluntary and that I am free to withdraw at any time, without giving any reason.	
3	I understand that my information will be filed in a locked cabinet and the information I provide will be Anonymised for the use of the study.	
4	I understand that relevant sections of my medical notes and data collected during the study may be looked at by health care professionals assigned in the study; by supervisor's from Addis ababa university SPH, and by the regulatory authorities	

6	Time and date of completion of step (1-2) instrument	HH: / ____ / ____ / : MM / ____ / ____ / Time DD /MM /YYYY	14	
7	End Time and date of completion step(1-3) instrument	HH: / ____ / ____ / : MM / ____ / ____ / Time DD /MM /YYYY	15	
Question related with HIV/AIDS				
	Question	Response	Remark	Code
8	HAART status	1. Pre-ART state 2. On HAART		C1a
9	If the response for question C1a is 1 then what the duration was since diagnosed with HIV?	1. _____ Day 2. _____ Month 3. _____ Years		C1b
10	If the response for question C1a is 2 then what was the type of HAART regimen he/she took?	1. 1 st line HAART 2. 2 nd line (specifically state the drug combination_____	<i>Listing the ART regimen is mandatory</i>	C1c
11	List of current drug regimen	1. 1 ST Line D.R 2 nd Line D.R		C1ca C1cb
12	What was the duration since on ART?	1. _____ Day 2. _____ Month 3. _____ Years		C1d
13	Recent Tb status of patient	1. Has Tb symptom but not on medication 2. Had Tb symptom and was on medication 3. Never had any Tb symptom but was being ontaken IPT 4. Never had any Tb symptom and was never been taken any medication 5. Others indicate _____		C1e
14	Other OI's (other than Tb) status of participants	1. Yes 2. No_____ if No go to C1h		C1f
15	If C1f= Yes then indicate the kind of OIs	1. HZ 2. PCP 3. Bacterial P 4. Cervical.Ca 5. Oral candidiasis 6. CNS toxo 7.Esophagial Candidiasis 8. C.Menenngitits 9. Diharial disease 10. C.sarcoma 11. Mouth ulcer 12. Others indicate _____	<i>Morethan one answare is possible</i>	C1g
16	Recent Functional status of participants	1. Ambulatory/ 2. Working / 3. Bed ridden /		C1h
17	Recent WHO staging levels/	1. Stage I, 2.Stage II, 3.Stage III, 4.Stage IV		C1i
Laboratory test results associated factors				

	Serology test			
18	Hepatitis B	1. Positive 2. Negative 3. Not known _____	NB: for those with less than 6 months since testing/	C1j
19	Hepatitis C	1.Positive 2.Negative 3.Not known _____		C1k
	Hematology test			
20	Recent CD4+count level (cells mm3) , irrespective of treatment status	1. <350 2. 350-500 3. >500	NB: for those with less than 6 months since testing	C1L
	Viral load			
21	Recent Viral RNA levels	1. _____RNA copies/mL/ 2. Lower detected limit ____copies/mL 3. Undetectable _____ 4. Not done _____	NB: for those with less than 6 months since testing	C1M

Annex 9: Amharic version check list

ስለተሳታፊው በክትትል ወቅት መዝገብ ላይ(Pre/ART document) ተመዝግበው የሚገኙ መረጃዎችን ለማሰባሰብ የሚረዳ መጠይቅ

ተ.ቁ	የተሳታፊው መደበኛ መ.ቁጥር	ለጥናቱ መ.ቁጥር	ተሳታፊ	በጥናቱ	የተሰጠው	ክድ
አጠቃላይ ጥናቱን የተመለከቱ መረጃዎች						
1	የፍቃድ መግለጫው ቅፅ (consent) ተነበሉት በጥናቱ ለመሳተፍ ፍቃደኛ ስለመሆኑ ተረጋግጧል	1.አዎ	2. አይደለም	ምላሹ አይደለም ከሆነ እዚህ ጋር ያቁሙ		10
2	የወረዳው መጠሪያ ስም					11
3	የጤና ተዘመኑ ስም					12
4	መጠይቅ እድራጊው ሰው /በለሙያ ስም					13
5	የላብራቶሪ ባለሙያው/ቴክኒሺያን ሰው ስም					14
6	ደረጃ (1 እና 2) የተመለከተ መረጃ መስጠብ የተጀመረበት ሰዓትና ጊዜ	ሰዓት_____	ደቂቃ_____	ጊዜ(ቀ/ወ/ዓምዓም)		15
7	ከደረጃ(1-3)/አጠቃላይ/መጠይቁ ተሞልቶ የተጠናቀቀበት ሰዓትና ጊዜ	ሰዓት_____	ደቂቃ_____	ጊዜ(ቀ/ወ/ዓምዓም)		16

ከኤች አይ ቪ ቫይረስ ጋር ተያያዥነት ስላላቸው ጉዳዮች የሚያተኩር መጠይቅ

	ጥያቄ	መልስ	አስተያየት	ክድ
8	በአሁኑ ሰዓት ተሳታፊው በክሊኒክ በምን የኤች አይ ቪ ሁኔታ (HAART statatus) ተመዝግቦ ይታወቃል?	3. ቅድመ ፀረ ኤች አይ ቪ መድሀኒት ደረጃ/ሁኔታ (Pre-ART-Phase) 4. ድህረ ፀረ ኤች አይ ቪ መድሀኒት ደረጃ/ሁኔታ(ART-pahse)		C1a
9	ቫይረሱ በደሙ/ሚ ውስጥ እንዳለበት/ባት እውቁ/እውቃ ከቫይረሱ ጋር አብሮ መኖር (ወይም እውቁ በክሊኒክ ክትትል ማድረግ) ከጀመረ ሰዓት ጊዜ ሆነው/ሆናት?	1. _____ሳምንት 2. _____ወር 3. _____ዓመት	(እዚህ መጠይቅ በሽተኛው ለመጀመሪያ ጊዜ ያዋቀበትን ወቅት ትኩረት መስጠቱ የተሻለ ይሆናል)	C1b
10	ለመጠይቅ C1a ምላሽዎ 2 ክንባረ ፤ የየተኛው ደረጃ የፀረ ኤች አይ ቪ	3. የመጀመሪያ ደረጃ መዲሀኒት ስብጥር (ስብጥሩን ጥቀስ) 4. ሁለተኛ ደረጃ መዲሀኒት ስብጥር (ስብጥሩን ጥቀስ)		C1c

	መድሀኒት ተጠቃሚ ነው/ናት?			
11	በአሁኑ ወቅት እየተጠቀማቸው ያለው/ችው የፀረ ኢች አይ ቪ መድሀኒቶቹን ስብጥሩ የትኞቹ ናቸው?	1. ደረጃ አንድ : _____ 2. ደረጃ ሁለት : _____		C1ca C1cb
12	ከላይ የተጠቀሱትን የፀረ ኢች አይ ቪ መድሀኒት መውሰድ ከጀመረ/ረች ምን ያክል ጊዜ ሆነው/ሆናት ?	1. _____ ሳምንት 2. _____ ወር 3. _____ ዓመት	እያንዳንዱን የመድሀኒት ስብጥር ለምን ያክል ጊዜ እንደተወሰደ ከተቻለ ቢጠቀስ	C1d
13	የቅርብ ጊዜ የሳንባ ነቀርሳ በሽታ (TB-Status) ሁኔታው ምን ይመስላል? (ይህ መጠይቅ የሳንባ(Pulmonary.Tb) ከሰንባ ውጪ (Extra.P.Tb)ያሉትን ነቀርሳዎች ሁሉ ይመለከታል)	1. አዎ: ምልክቱ ነበረው ነገር ግን መዲሀኒት አልጀመረም 2. አዎ: ምልክቱ ነበረው የፀረ ሳንባ ነቀርሳ መዲሀኒት እየወሰደም ነበር 3. ምንም እይነት የበሽታው ምልክት አልነበረውም ነገር ግን የሳንባ ነቀርሳ ማካላካያ (IPT) እየወሰደ ነበረ። 4. ምንም እይነት የበሽታው ምልክት ስላልነበረው ምንም እይነት የሳንባ ነቀርሳ መድሀኒት አልጀመረም 5. ሌሎች ይጠቀስ-----	የፀረ ሳንባ ነቀርሳ መዲሀኒት እየወሰደም ነበር ከሆነ ምላሽ፤ የመዲሀኒቱን ስም ቢጠቀስ :	C1e
14	ህመምተኛው በቅርብ ጊዜ የተመዘገቡ ከኢድስ ጋር ተያያዥነት ያላቸው ነገር ግን ከሳንባ ነቀርሳ ውጪ የሆኑ በሽታዎች (OI's other than TB) ነበሩበት?	1. አዎ : 2. አይደለም ምላሽዎ አይደለም ከሆነ ወደ መጠይቅ C1h በቀጥታ ይሂዱ		C1f
15	ለመጠይቅ C1f ምላሽዎ እዎ ከሆነ እንማን እንደነበሩ ጥቀስ (ከአንድ በላይ መልስ መስጠት ይቻላል)	1..የሰውነት-ሽፍታ(HZ) 2. ፒ.ሲ.ፒ(PCP) 3. የባክቴሪያ-ኒሞኒያ (B.P) 4.የማህፀን በር-ካንሰር(C.Ca) 5.የአፍ-ካንሲዳዲስ(O.C) 6. ሲ.ኤ.ግ.ኤስ-ቶከሶ(C.T) 7..የጉሮሮ-ካንሲዳዲስ(O.C) 8.ክርፕቶኮክል-ሜኒንጃሊቲስ(C.M) 9.የተቅማጥ በሽታ(D.dx) 10.ካፖሲስ-ሳርኮማ(C.S) 11.የአፍ-ቁስል(M.U) 12.ሌሎች ይጠቀሱ		C1g
16	የህመምተኛው የቅርብ ጊዜው የስራ የመስራት/እንቅስቃሴው የማድረግ ሁኔታው (Functional status) ምን ይመስላል	1. ተንቀሳቃሽ 2. ስራ የሚሰራ 3.አልጋ ላይ የቀረ		C1h
17	በአለም ጤና ድርጅት መስፈርት መሰረት፡ በቅርቡ የተመዘገበው የበሽታው ደረጃ (WHO-stage) ስንት ነው?	1. ደረጃ I, 2.ደረጃ II, 2. ደረጃ III, 4. ደረጃ IV		C1i
የላቦራቶሪ ምርመራ ወጤትን የተመለከተ መጠይቅ				
በደም ፈሳሽ ውስጥ የሚገኙ በሽታ ጠቆሚ ነገሮችን (serology) የተመለከተ መረጃ				
18	ሂፓታይት-ቢ(Hepatitis B) ሁኔታው	4. ፖስቲቭ 2.ነጋቲቭ 3.አይታወቅም _____	ይህ መጠይቅ የሚመለከተው የምርመራው ውጤት ከ 6/12 ወር በታች ለሆነው ብቻ ነው	C1j
19	ሂፓታይት-ሲ(Hepatitis C) ሁኔታው	5. ፖስቲቭ 2.ነጋቲቭ 3.አይታወቅም _____		C1k
የ ሲዲ-ፎር (CD4+Count) መጠንን የተመለከተ መጠይቅ				
20	በቅርቡ የተመዘገበው የሲዲ-ፎር(CD4+Count) (cells mm3) ብዛት ስንት ነው	1. <350 2. 350-500 3.>500 4. _____ አማራጭ ውስጥ ከሌለ ይጠቀስ	ይህ መጠይቅ የሚመለከተው የምርመራው ውጤት ከ 6/12 ወር በታች ለሆነው ነው።	C1L
በደም ውስጥ ያለውን ቫይረስ ብዛት(Viral loads) የተመለከተ መጠይቅ				

21	በቅርቡ የተመዘገበው ቫይረስ (RNA quantitative level) እርእሱ ኮፒ ብዛት ስንት ነው ?	1. _____ እርእሱ (RNA)/ኮፒ/ሚሊ. 2. ዝቅተኛው የመለያ መጠን _____ እርእሱ (RNA) ኮፒ/ሚሊ. 3. ለመለያት እስከጋሪ የሆነ መጠን 4. አልተሰራም _____	ይህ መጠን የሚመለከተው የምርመራው ውጤት ከ 6/12 ወር በታች ለሆነው ብቻ ነው።	C1M
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Annex 10: English version of WHO- Steep Tools for Quantitative Studies

WHO STEEP TOOLS FOR THE QUANTITATIVE STUDIES			
Step 1 Demographic Information			
Demographic Information			
Unique ART. No/ _____		Participant ID No given for the study: /____/____/____/____/____/____/____/____/____/____/	
Question		Response	Code
22	Sex	1. Male _____ 2. Female _____	C1
23	Place of residence	1. Urban 2. Rural	C12
24	What is your date of birth? If Don't Know -----77 77 7777	_____ DD MM Year if no go to C4	C2
25	How old are you?/	_____years	C3
26	In total, how many years have you spent at school or in full-time study (excluding pre-school)?	_____years	C4
27	What is the highest level of education you have Completed?	1. No formal schooling 2. Less than primary school 3. Primary school completed Secondary school completed 4. High school completed College/University completed 5. Post graduate degree 88. Refused	C5
28	What is your ethnicity	1. Gedeo 2. Sidama 3. Wolayita 4. Oromoo 5. Amahara 6. Tigre 7. Gurage 88.Others specify _____	C6
29	What is your marital status?	1. Never married 2. Currently married 3. Separated 4. Divorced	C7

		9. Other, go to T5 other, else go to T6			T5f/T5fW
		10. Other (please specify) :			T5other/ T5otherw
46	During the past 12 months, have you tried to stop smoking?	1. Yes 2. No			T6
47	During any visit to a doctor or other health worker in the past 12 months, were you advised to quit smoking tobacco?	1. Yes If T2=Yes, go to T12; if T2=No, go to T9 2. No If T2=Yes, go to T12; if T2=No, go to T9 3. No visit during the past 12 months: If T2=Yes, go to A1a; if T2=No, go to T9			T7
48	In the past, did you ever smoke any tobacco products?	1. Yes 2. No If No, go to <u>T12</u>			T8
49	In the past, did you ever smoke daily? (<i>Ask the participant to think of the time when he/she may have been smoking tobacco products on a daily basis ?</i>)	1. Yes , If T1=Yes, go to T12, else go to T10 2. No , If T1=Yes, go to T12, else go to T10, / If T1=Yes, go to T12, else go to T10/			T9
50	How old were you when you stopped smoking? (<i>Ask the participant to think of the time when he/she stopped smoking tobacco products.</i>)	1. Age (years) _____ 77. Don't Know 77, ___ if known go to A1a			T10
51	How long ago did you stop smoking? (RECORD ONLY 1, NOT ALL 3)	1. Years ago _____ , If Known, go to A1a			T11a
		2. OR Months ago _____ , If Known, go to A1a			T11b
		3. OR Weeks ago _____ , If Known, go to A1 77. Don't Know 77			T11c
52	Do you currently use any smokeless tobacco products such as [snuff, chewing tobacco, betel]? (USE SHOWCARD)	1. Yes 2. No If No, go to A1			T12
53	Do you currently use smokeless tobacco products daily?	1. Yes 2. No If No, go to A1			T13
531	On average, how many times a day/week do you use (IF LESS THAN DAILY, RECORD WEEKLY) (RECORD FOR EACH TYPE, USE SHOWCARD)		WEEKLY ↓		
		DAILY ↓ Snuff, by mouth			T14a/ T14aw
		Snuff, by nose			T14b/T14bw
		Chewing tobacco			T14c/ T14cw
	Don't Know 7777				

		Chewing Kaht		T14d/T14dw
		Others specify		T14e/ T14ew
Alcohol Consumption				
	Question	Response	Code	
54	Have you ever consumed an alcoholic drink such as beer, wine, spirits, fermented cider or [Areke, Tella , others])?	1. Yes 2. No , if no go to D1	A1	
55	Have you consumed an alcoholic drink within the past 12 months?	1. Yes if yes go to A4 2. No if no go to A3	A2	
56	Have you stopped drinking due to health reasons, such as a negative impact on your health or on the advice of your doctor or other health worker?	1. Yes : If Yes, go to D1 / 2. No : No , if no go to D1	A3	
57	During the past 12 months, how frequently have you had at least one alcoholic drink?	1. Daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week 5. 1-3 days per month 6. Less than once a month	A4	
58	Have you consumed an alcoholic drink within the past 30 days?	1. Yes 2. No , if no go to A13	A5	
59	During the past 30 days, on how many occasions did you have at least one alcoholic drink?	1. Number _____ 77. Don't know	A6	
60	During the past 30 days, when you drank alcohol, on average, how many standard alcoholic drinks did you have during one drinking occasion?	1. Number _____ 77. Don't know	A7	
61	During the past 30 days, what was the largest number of standard alcoholic drinks you had on a single occasion, counting all types of alcoholic drinks together?	1. Largest Number. _____ 77. Don't know	A8	
62	During the past 30 days, how many times did you have for men: five or more for women: four or more standard alcoholic drinks in a single drinking occasion?	1. Number of times _____ 77. Don't know	A9	
63	During each of the past 7 days, how many standard drinks did you have each day? Don't Know 77	1. Monday	A10a	
		2. Tuesday	A10b	
		3. Wensday	A10c	
		4. Thursday	A10d	
		5. Firiday	A10e	
		6. Saturday	A10f	
		7. Sunday 77. Don't Know	A10g	

64	During the past 7 days, did you consume any homebrewed alcohol, any alcohol brought over the border/from another country, any alcohol not intended for drinking or other untaxed alcohol? [AMEND ACCORDING TO LOCAL CONTEXT]	1. Yes 2. No , No : if no go to A13	A11
65	On average, how many standard drinks of the following did you consume during the past 7 days?	1. Homebrewed spirits, e.g. moonshine/	A12a
		2. Homebrewed beer or wine, e.g. beer, palm or fruit wine	A12b
		3. Alcohol brought over the border/from another country /	A12c
		4. Alcohol not intended for drinking, e.g. alcohol-based medicines, perfumes, after shaves	A12d
		5. Other untaxed alcohol in the Country/ 77. Don't Know	A12e
66	During the past 12 months, how often have you found that you were not able to stop drinking once you had started?	1. Daily or almost daily 2. Weekly 3. Monthly 4. Less than monthly 5. Never	A13
67	During the past 12 months, how often have you failed to do what was normally expected from you because of drinking?	1. Daily or almost daily 2. Weekly 3. Monthly 4. Less than monthly 5. Never	A14
Diet			
	Question	Response	Code
68	In a typical week, on how many days do you eat fruit? /	1. Number of days _____ 77. Don't Know , If Zero days, go to D3	D1
69	How many servings of fruit do you eat on one of those days?	1. Number of servings _____ 77. Don't Know	D2
70	In a typical week, on how many days do you eat vegetables?	1. Number of days _____ 77. Don't Know , If Zero days, go to D3	D3
71	How many servings of vegetables do you eat on one of those days?	1. Number of servings _____ 77. Don't Know	D4
72	What type of oil or fat is most often used for meal preparation in your household? ?	1. Vegetable oil 2. Lard or suet 3. Butter or ghee	D5

		4. Margarine 5. Other , If Other, go to D5other 6. None in particular 7. None used 8. Don't know	
		Others	D5 others
73	On average, how many meals per week do you eat that were not prepared at a home? By meal, I mean breakfast, lunch and dinner	1. Number of days _____ 77. Don't Know	D6
73a	How often do you add salt or a salty sauce such as soya sauce to your food right before you eat it or as you are eating it?	Always 1 Often 2 Sometimes 3 Rarely 4 Never 5 Don't know 77	D7
73b	How often is salt, salty seasoning or a salty sauce added in cooking or preparing foods in your household?	Always 1 Often 2 Sometimes 3 Rarely 4 Never 5 Don't know 77	D8

Physical Activity

	Question	Response	Code
74	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like [carrying or lifting heavy loads, digging or construction work] for at least 10 minutes continuously?	1. Yes 2. No , if no go to P4	P1
75	In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	1. Number of days _____	P2
76	How much time do you spend doing vigorous-intensity activities at work on a typical day?	1. Hours : _____ 2. Minutes : _____	P3(a-b)
77	Does your work involve moderate-intensity activity, which causes small increases in breathing or heart rate such as brisk walking [or carrying light loads] for at least 10 minutes continuously	1. Yes 2. No , if no go to P7	P4
78	In a typical week, on how many days do you do moderate-intensity activities as part of your work?	1. /Number of days _____	P5
79	How much time do you spend doing moderate-intensity activities at work on a typical day?	1. Hours : _____ 2. Minutes : _____	P6(a-b)

Travel to and from places

p80	Do you walk or use a bicycle (pedal cycle) for at least 10 minutes continuously to get to and from places ?	1. Yes 2. No , if no go to P10	P7
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81	In a typical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places?	1. No. of days _____	P8
82	How much time do you spend walking or bicycling for travel on a typical day?	1. Hours : _____ 2. Minutes : _____	P9(a-b)
Recreational activities			
	Question	Response	Code
83	Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like	1. Yes /አዎ 2. No , if no go to P13	P10
84	In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities?	1. Number of days _____	P11
85	How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?	1. Hours : _____ 2. Minutes : _____	P12(a-b)
86	Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that causes a small increase in breathing or heart rate such as brisk walking,(cycling, swimming, volleyball)for at least 10 minutes continuously?[INSERT EXAMPLES] ?	1. Yes 2. No , if no go to P16	P13
87	In a typical week, on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities? ?	1. Number of days _____	P14
88	How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day?	1. Hours : _____ 2. Minutes : _____	P15(a-b)
Sedentary behavior			
89	How much time do you usually spend sitting or reclining on a typical day?	1. Hours : _____ 2. Minutes : _____	P16(a-b)
History of Raised Blood Pressure			
	Question	Response	Code
90	Have you ever had your blood pressure measured by a doctor or other health worker?	1. Yes 2. No , if no go to H6	H1
91	Have you ever been told by a doctor or other health worker that you have raised blood pressure or hypertension? <i>ከዚህ</i>	1. Yes 2. No , if no go to H6	H2a
92	Have you been told in the past 12 months?	1. Yes 2. No	H2b
History of Raised Blood Pressure			
93	In the past two weeks, have you taken any drugs (medication) for raised blood pressure prescribed by a doctor	1. Yes 2. No	H3

	or other health worker ?		
94	Have you ever seen a traditional healer for raised blood pressure or hypertension?	1. Yes 2. No	H4
95	Are you currently taking any herbal or traditional remedy for your raised blood pressure?	1. Yes 2. No	H5
History of Diabetes			
	Question	Response	Code
96	Have you ever had your blood sugar measured by a doctor or other health worker?	1. Yes 2. No , if no go to H12	H6
97	Have you ever been told by a doctor or other health worker that you have raised blood sugar?	1. Yes 2. No , if no go to H12	H7a
98	Have you been told in the past 12 months?	1. Yes 2. No	H7b
99	In the past two weeks, have you taken any drugs (medication) for diabetes prescribed by a doctor or other healthworker?	1. Yes 2. No	H8
100	Are you currently taking insulin for diabetes prescribed by a doctor or other health worker	1. Yes 2. No	H9
101	Have you ever seen a traditional healer for diabetes or raised blood sugar?	1. Yes 2. No	H10
102	Are you currently taking any herbal or traditional remedy for your diabetes?	1. Yes 2. No	H11
History of Raised Total Cholesterol			
	Question	Response	Code
103	Have you ever had your cholesterol (fat levels in your blood) measured by a doctor or other health worker?	1. Yes 2. No , if no go to H17	H12
104	Have you ever been told by a doctor or other healthworker that you have raised cholesterol?	1. Yes 2. No , if no go to H17	H13a
105	Have you been told in the past 12 months?	1. Yes 2. No	H13b
106	In the past two weeks, have you taken any oral treatment (medication) for raised total cholesterol prescribed by a doctor or other health worker?	1. Yes 2. No	H14
107	Have you ever seen a traditional healer for raised cholesterol?	1. Yes 2. No	H15
108	Are you currently taking any herbal or traditional remedy for your raised cholesterol?	1. Yes 2. No	H16
CORE: History of Cardiovascular Diseases			
	Question	Response	Code
109	Have you ever had a heart attack or chest pain from	1. Yes	H17

	heart disease (angina) or a stroke (cerebrovascular accident or incident)?	2. No	
110	Are you currently taking aspirin regularly to prevent or treat heart disease?	1. Yes 2. No	H18
111	Are you currently taking statins (Lovastatin/Simvastatin/Atorvastatin or any other statin) regularly to prevent or treat heart disease?	1. Yes 2. No	H19
CORE: Lifestyle Advice			
	Question	Response	Code
112	During the past three years, has a doctor or other health worker advised you to do any of the following?(RECORD FOR EACH)		
113	Quit using tobacco or don't start	1. Yes 2. No	H20a
114	Reduce salt in your diet	1. Yes 2. No	H20b
115	Eat at least five servings of fruit and/or vegetables each day	1. Yes/Yes 2. No	H20c
116	Reduce fat in your diet	1. Yes 2. No	H20d
117	Start or do more physical activity	1. Yes 2. No	H20e
118	Maintain a healthy body weight or lose weight	1. Yes 2. No if C1 =1 go to M1	H20f
Step 2 Physical Measurements			
Blood Pressure			
	Unique ART. No/	Participant ID No given for the study _____	
	Question	Response	Code
119	Interviewer ID	/____/____/____/	M1
120	Device ID for blood pressure	Record device Id _____	M2
121	Cuff size used?	1. Small 2. Medium 3. Large	M3
122	Reading 1	1. Systolic (mmHg) /____/____/____/	M4a
		2. Diastolic (mmHg) /____/____/____/	M4b
123	Reading 2	1. Systolic (mmHg) /____/____/____/	M5a
		2. Diastolic (mmHg) /____/____/____/	M5b
124	Reading 3	1. Systolic (mmHg) /____/____/____/	M6a
		2. Diastolic (mmHg) /____/____/____/	M6b
125	During the past two weeks, have you been treated for raised blood pressure with drugs (medication) Prescribed by a doctor or other health worker	1. Yes 2. No	M7
Height and Weight			
126	For women: Are you pregnant?	1. Yes If Yes, go to M16 2. No	M8

127	Interviewer ID	_____	M9
128	Device IDs for height and weight	1. Height : _____ 2. Weight : _____	M10a M10b
129	Height	In Centimeter's (cm) _____ Average/ 1 st _____ 2 nd _____ 3 rd _____	M11
130	Weight, If too large for scale, code 666.6	in Kilograms (kg): _____ Average 1 st _____ 2 nd _____ 3 rd _____	M12
Waist and HiP			
131	Device ID for waist /Hip circumfrance		M13
132	Waist circumference	In Centimeter's (cm)/ _____ / _____ / _____ / _____	M14
133	Hip circumfrance	In Centimeter's (cm)/ _____ / _____ / _____ / _____	
Step 3 Biochemical Measurements			
Blood Glucose			
	Unique ART. No/	Participant ID No given for the study _____	
	Question	Response	Code
2	District Name		11
3	Health institution name		12
4	Interviewer Name		13
5	Lab Technician Name		14
6	Starting Time and date of step 3 data collection	HH: /____/____/: MM /____/____/ Time DD /MM /YYYY	15
7	End Time and date of step 3 data collection	HH: /____/____/: MM /____/____/ Time DD /MM /YYYY	17
134	During the past 12 hours have you had anything to eat or drink, other than water?	1. Yes 2. No	B1
135	Laboratory Technician ID		B2
136	Blood suger measuring device ID	_____	B3
137	Time of day blood specimen taken (24 hour clock)	1. Hours :HH 2. Minutes : MM	B4
138	Amount Fasting blood glucose level	mmol/L _____	B5
139	Today, have you taken insulin or other drugs (medication) that have been prescribed by a doctor or other health worker for raised blood glucose	1. Yes 2. No	B6
Blood Lipids			
140	Blood Lipids measuring device ID	_____	B7
141	Amount blood Total cholesterol levels	Mmol/L _____ or Mg/dl _____	B8

142	During the past two weeks, have you been treated for raised cholesterol with drugs (medication) prescribed by a doctor or other health worker?/	1. Yes 2. No	B9
Triglycerides, LDL and HDL Cholesterol			
143	Triglycerides, LDL and HDL Cholesterol measuring device name and Id no		B10a B10b B10c
144	Amount of blood Triglycerides levels	mmol/L_____or Mg/dl _____	B11
145	Amount of blood LDL Cholesterol levels	mmol/L_____or Mg/dl _____	B12
146	Amount of blood HDL Cholesterol levels	mmol/L_____or Mg/dl _____	B13

Annex 11: Amahric version of quantitative tool

ከተሳታፊው ጋር ፊት ለፊት በመሆን ቁጥር ነክ የሆኑ መረጃዎችን ለማሰባሰብ በሚል በአለም የጤና ድርጅት ለማካኝነት ከሰው ወደ ሰው ለማይተላለፉ የጤና ችግሮችን የሚጠቁሙ ችሮችን ደረጃ በደረጃ ለመሰብሰብ የሚረዳ ቅፅ፤

ደረጃ አንድ፡
የግለሰቡን ግልና ማህበራዊ ጉዳዮች (Demographic) የተመለከቱ መረጃዎች

ተ.ቁ	ጥያቄ	መልስ	ኮድ
22	ፆታ	1. ወንድ _____ 2. ሴት _____	C1
23	የመኖሪያ አካባቢዎ የት ነው?	1. ከተማ 2. ገጠር	
24	የትውልድ ዘመንዎ መቼ ነበረ? የማያውቁት ከሆነ 77 77 7777 በማለት መልስ ይስጡ	_____ (ቀ/ወ/ዓምዓም) መልሱ የሚያውቁት ከሆነ ብቻ ሙሉና በመቀጠል ወደ መጠይቅ C4 በቀጥታ ይሂዱ	C2
25	አሁን እድሜዎ ስንት ነው? (ካለወቀው እንዲገምት አስችል)	_____ በሙሉ አመት ይጠቀስ	C3
26	ባጠቃላይ በትምህርት ቤት ትምህርተዎን ለማጠናቀቅ ያጠፋት ጊዜያቶች ምን ያክል ይሆናሉ? (ከ ቅድመ ተምህርት በፊት ያለውን ለምሳሌ ፡ የቀስ ተምህርት ፤ ኬጂ እና የመሳሰሉትን የወሰዱትን እያካትትም)	_____ በሙሉ አመት ይጠቀስ	C4
27	በአሁኑ ወቅት ከፍተኛው የትምህርት ደረጃዎ ስንት ነው?	1.. ዘመናዊ ትምህርት ያልወሰደ 2. ከመጀመሪያ ደረጃ ትምህርት በታች 3.. 1ኛ ትምህርት ያጠናቀቀ 4. 2ኛ ዳረጃ ትምህርት ያጠናቀቀ 5.. ከፍተኛ 2ኛ ደረጃ ተምህርትን የጠናቀቀ 6.ፎክሎር ትምህርትን ያጠናቀቀ 7.. 2ኛ ዲግሪ ትምህርት የጠናቀቀ 88. መልስ ለመስጠት አልፈልግም	C5
28	ብሄርሰብክ/ብሽ ምንድን ነው?	1.. ጌዲዮ 2. ሢዳሞ 3. ምላይታ 4. ኦሮሞ 5. አማራ 6. ትግሬ 7. ጉራጌ 88. ሌሎች ጥቀስ _____	C6
29	የትዳር ሁኔታ	1.. ያላገባ 2. በቅረቡ ያገባ 3. ተጋብተው ተለያይተው የሚኖሩ	C7

		4.የፈታ የሞተበት/ባት 6. እብረው የሚኖሩ ግን ያልተጋቡ 88. መልስ መስጠት አልፈልግም	5. ባል /ሚስት	
30	ከተዘረዘሩት አማራጮች ውስጥ የተኛው በትክክል ላለፉት 12 ዋራዎች የነበረውን የስራዎን ሁኔታ ይገልጻል ?	1.የመንግስት ተቀጣሪ ያልሆኑ ድርጅቶች ተቀጣሪ 3.የራስ ስራ የሚሰሩ 5.ተማሪ 6. ቤት ውስጥ የሚሰሩ/የቤት እመቤት 7. ጡረተኛ 8. ቅጥረኛ ያልሆነ (መስራት የሚችል) 9. ቅጥረኛ ያልሆነ (መስራት የማይችል) 88. መልስ መስጠት አልፈልግም	2.መንግስታዊ 4.ተከፋይ ያልሆነ	C8
31	ከተዘረዘሩት የእቃ ዓይነቶች ውስጥ በቤተዎ የሚገኙትን ጥቀስ (ከአንድ በላይ መልስ መስጠት ይቻላል)?	1. የኤሌትሪክ መብራት 3. ሬዲዎ 4. ቱልፒ»ን 6.የማይንቀሳቀስ የቤት ስልክ 7. ፍሪጅ 8. ጠረቢዛ 9. ወንበር 10. አልጋ 11. የኤሌቲክ መጋገሪያ ምጣድ 12. ኩራዝ	2. የግድግዳ ሰዓት	HW1
32	በቤት ውስጥ ለምግብ ማብሰያነት የሚጠቀሙት በምንድን ነው (ከአንድ በላይ መልስ መስጠት ይቻላል)?	1. በኤሌትሪክ 2. በተፈጥሮ ጋዝ 3. ባዮ-ጋዝ 4. የድንጋይ ክሰል 5. እንጨት 6. ጭድ/የደረቀ ሳር 7. የግብርና ምርቶችን 8. የአንስሳቶችን ምሁዳር 77.ሌሎች ከሆኑ ይጠቀሱ		HW2
33	ምግብ የሚያበስሉት የተ ነው ?	1. በቤት ውስጥ ውስጥ 2. ከቤት ውጪ 3. ሌሎች ከሆነ ይጠቀስ -----		HW3
34	ለኩሽና /ለማብሰያ ተብሎ የተለየ ቤት አለዎት ?	1..አዎ 2. የለም		HW4
35	የቤትዎ ወለል ምንድን ነው?	1.. አፈር ቤት 2. እበት 3. የእንጨት ጣውላ 4. በቀርከሃ 5. ሲሚንቶ 6.ሸክላ 77.ሌሎች የጠቀሱ -----		HW5
36	የቤትዎ ጣሪያ የተሰራው ከምንድን ነው	1.. ከሳር/ቅጠል/ጭቃ 2.ከቆርቆሮ 3. ከላስቲ 4.. ከእግዳ/ቀርከህ 5. ከካርቶን 6. ከእንጨት 77. ሌሎች ይጠቀሱ		HW6
37	የቤትዎ የውጪኛው ክፍል በምንድን ነው የተሰራው?	1.. ግድግዳ የለውም 2. በእግዳ/ቀርከሃ 3.. በቀርከህ /እንጨትና ጭቃ 4. በድንጋይና በጭቃ 5.. በድንጋይና በሲሚንቶ 6.በጣውላ 77. ሌሎች ይጠቀሱ		HW7
38	ለመኝታነት የሚያገለግሉ ክፍሎች ብዛት ስንት ናቸው?	የመኝታ ክፍሎች ብዛት -----		HW8
39	የእርሻ ቦታ አለዎት ?	1. አዎ 2. የለም		HW9
40	ማንኛውምም እንስሳቶች አለዎት (ለምሳሌ፤ የጋማና የቀንድ ከብቶች፤ እንዲሁም ሌሎች እንደ ዶሮ የመሳሰሉትን) ?	1. አዎ 2. የለም		HW10

ደረጃ እንድ:

የግለሰቡን ባህሪዎች (Behveral Measurements) የተመለከቱ መረጃዎች መጠይቅ				
ቶባኮ ከማጨስ ጋር (Tobacco smoking)ተያያዥነት ያላቸው መጠይቆችን የተመለከተ				
ከዚህ በታች የተመለከቱት መጠይቆች(T1-T8) የሚመለከቱት በአሁኑ ወቅት (Current Smoker) ማንኛውንም ዓይነት የቶባኮ ምርቶች የሚያጨሱትን ብቻ ነው				
ተ.ቁ	ጥያቄ	መልስ		ኮድ
41	በአሁኑ ወቅት ማንኛውንም ዓይነት የሚጨሱ የቶባኮ ውጤቶችን ለምሳሌ ሲጋራ፣ ሲጋር፣ ጋሮ፣ጋ			

	የነበሩትን የቶባካ ምርቶች ማጨስ ለማቆም ሞክረው ነበር ?	4. አይደለም	
47	ባለፉት 12 ወራቶች ውስጥ፣ ማናቸውንም አይነት ህኪሞችንም ሆነ ሌሎች የጤና ባለሙያዎችን በጎበኝበት ወቅት፣ ሲጋራም ሆነ ሌሎች የሚያጨሱዎቸው የነበሩትን የቶባካ ምርቶችን እንዳያጨሱ ምክር ተለግሰው/ተሰጥተዎት ያውቃሉ?	1. አዎ 2. አይደለም፣ 3. ባለፉት 12 ወራቶች ውስጥ ማናቸውንም አይነት ህኪሞችንም ሆነ ሌሎች የጤና ባለሙያዎችን አልጎበኘውም • ለመጠይቅ T2=Yes/አዎ ከሆነ፣ ወደ መጠይቅ <u>T12 ይሂዱ</u> • ለመጠይቅ T2= No/አይደለም ፣ ከሆነ ደግሞ ወደ መጠይቅ <u>T9 ይሂዱ</u>	T7
48	ድሮ ባለፉት ጊዜያቶች ውስጥ ማናቸውንም ዓይነት የቶባካ ውጤቶችን አጭሰው የውቃሉ?	1. አዎ 2. አይደለም፣ምላሽዎ አይደለም ከሆነ ፣ ወደ መጠይቅ <u>T12 ይሂዱ</u>	T8
49	ድሮ ሲጋራም ሆነ ሌሎች ማንኛውንም ዓይነት የቶባካ ምርቶችን በሚያጨሱበት ወቅት፣ በየቀኑ ይጠቀሙ ነበር?	1. አዎ, ፤ 2. አይደለም፣ • ለመጠይቅ T1=አዎ ከሆነ ወደ መጠይቅ <u>T12 ይሂዱ</u> • ለመጠይቅ T1=አይደለም ከሆነ ደግሞ ወደ መጠይቅ <u>T10 ይሂዱ</u>	T9
50	ማጨስ ሲያቆሙ እድሜዎ ስንት ነበር? (ተሳታፊውን ግለሰብ ማጨስ ያቆመበትን ጊዜ አስቦ እንዲመልስ ያስችሉ)	1. መጨስ ሲያቆሙ _____ የሚታወቅ ከሆነ ፣ ወደ መጠይቅ <u>A1 ይሂዱ</u> 77. አላውቀም _____ አላውቀም ከሆነ ፣ 77 ይምረጡ	T10
51	ምን ያክል ጊዜ ሆነዎት ማጨስ ካቆሙ? (አንዱን መልስ መምረጥ በቂ ነው)	1. ከዓመት በፊት _____ የሚታወቅ ከሆነ ፣ ወደ መጠይቅ <u>A1 ይሂዱ</u>	T11a
		2. ወይም ከወር በፊት _____ , የሚታወቅ ከሆነ ፣ ወደ መጠይቅ <u>A1 ይሂዱ</u>	T11b
		3. ወይም ከሳምንት በፊት _____ የሚታወቅ ከሆነ ፣ ወደ መጠይቅ <u>A1 ይሂዱ</u> 77. አላውቀም ከሆነ 77 ይምረጡ	T11c
52	በአሁኑ ወቅት ማንኛውንም ዓይነት የማይጨሱ ለምሳሌ፤ በእፍጫ የሚሰብሩና በእፍ የሚታኘኩ የቶባካም ሆነ ሌሎች የመዲኒኒድ ውጤቶችን እንደ ጫት መቃም የመሰብሱት ነገሮች ተጠቃሚ ነዎት?	1. አዎ, ፤ 2. አይደለም፣ ለመጠይቅ T12=አይደለም ከሆነ ደግሞ ወደ መጠይቅ <u>A1 ይሂዱ</u> (የማይጨሱ ዓይነቶችን የሚጠቁም ካርድ አመለካከት)	T12
53	በአሁኑ ወቅት እነዚህን ከላይ የተጠቀሱትን ማንኛውንም ዓይነት የማይጨሱ ንጥረ ነገሮችን የሚጠቀሙት በየጊዜው ነው?	1. አዎ, ፤ 2. አይደለም፣ ለመጠይቅ T13=አይደለም ከሆነ ደግሞ ወደ መጠይቅ <u>A1 ይሂዱ</u>	T13
	በአማካኝ እነዚህ ንጥረ ነገሮች በቀን ዋይም በሳምንት ለምን ያክል ጊዜ ይጠቀሙታል ? (ለእያንዳንዱ መልስ ስጥ) (ተጠቃሚ ላልሆኑት ባዶ ከመተው ዜሮ ተብሎ ይሞላ) (ለእያንዳንዱ የቶባካ ዓይነቶች በየቀኑ የሚጠቀመው ያነሰ ከሆነ በየሳምንቱ ያለውን ይመልሱ) (የማያውቁት ከሆነ 7777 ብለው ይመልሱ)	1. በእፍ የሚሰብሩ	T14a/T14aw
		2. በእፍንጫ የሚሰብሩ	T14b/T14bw
		3. በእፍ የሚታኘኩ ቶባካዎች	T14c/T14cw
		4. ጫት መቃም	T14d/T14dw
		5. ሌሎች	T14e/ T14ew
ከመጠጥ ጋር(Alcohol consumption)ተያያዥነት ያላቸው መጠይቆችን የተመለከተ			
54	ከዚህ በፊት መናቸውም ዐይነት የአልኮል መጠጦችን ለምሳሌ፡	1. አዎ 2. አይደለም ፤ _____ አይደለም ከሆነ ወደ	A1

	እንደቢራ፤ወይን፤አረቄ፤ጠጅ፤ጠላ፤እንዲሁምደግሞሌሎች የሚያሰክሩ/የሚያነቃቁ መጠጦችንና ተጠቅመው ያውቃሉ? <i>ይህ መጠይቅ የሚመለከተው የአለኮል ነክ መጠጦችን ብቻ ሲሆን፤ ነገር ግን በጤና ችግር ምክንያት በሚወሰዱ መድሀኒት ውስጥ ያሉትን አይመለከትም።</i>	መጠይቅ <u>D1ይሂዱ</u> (የመጠጥ አይነቶችን የሚጠቁም ካርድ ተጠቀም)	
55	ላለፉት 12 ወራቶች እነዚህን የአልኮል መጠጦችን ተጠቅመው ያውቃሉ? (ከላይኛው ጥያቄ የቀጠለ)	1. አዎ ፣ ምለሽዎ አዎ ከሆነ ወደ መጠይቅ <u>A4</u> <u>ይሂዱ</u> 2. አይደለም፣ ምለሽዎ አይደለም ከሆነ ወደ መጠይቅ <u>A3</u> <u>ይሂዱ</u>	A2
56	መጠጥ ባስከተለብዎ የጤና መታወክ ምክንያት ወይም ደግሞ በህኪም/በሌሎች የጤና ባለሙያዎች ዓማካኝነት በተለገስዎት ምክር ምክንያት መጠጥ አቁመው ያውቃሉ? (ይህ መጠይቅ የሚመለከተው ባለፉት 12 ወራቶች ያልተጠቀሙትን ነገር ግን በሂደታቸው አጋጣሚ የተጠቀሙትን ነው።)	1. አዎ፣ ምለሽዎ አዎ ከሆነ ፣ ወደ መጠይቅ <u>D1</u> <u>ይሂዱ</u> 2. አይደለም፣ ምለሽዎ አይደለም ከሆነም ፣ ወደ መጠይቅ <u>D1</u> <u>ይሂዱ</u>	A3
57	እነዚህን ከላይ ላለፉት 12 ወራቶች ተጠቅሜዋለው ብለው የጠቀሱዋቸውን የአልኮል መጠጦችን ለምን ያክል ጊዜ ተጠቀሙት? (ይህ መጠይቅ የሚመለከተው ላለፉት 12 ወራቶች የአልኮል መጠጦችን ሲጠቀሙ የነበሩትን ብቻ ነው።) (የመጠጥ አይነቶችን የሚጠቁም ካርድ ተመልከት)	1. ሁልጊዜ 2. በሳምንት ከ5-6 ቀን 3. በሳምንት ከ3-4 ቀን 4. በሳምንት ከ1-2 ቀን 5. በወር ከ1-3 ቀን 6. በወር ከ1ቀን የነሰ ጊዜ እስታንዳርድ መጠጥ (standard drink) ማለት አልኮልነት ይዘቱ ከ 8-13 ግራም ኢታናል የያዘ መጠጥ አይነትን ይመለከታል።	A4
58	ባለፉት 30 ቀናቶች ውስጥ፣ የአልኮል መጠጦችን ለምሳሌ፡ ቢራ፤ወይን፤አረቄ፤ጠላ፤ ጠጅ እንዲሁም ደግሞ ሌሎች የሚያሰክሩ መጠጦችን ተጠቅመው ያውቃሉ?	1. አዎ 2. አይደለም፣ ምለሽዎ አይደለም ከሆነ ፣ ወደ መጠይቅ <u>A13</u> <u>ይሂዱ</u>	A5
59	ባለፉት 30 ቀናቶች ውስጥ እስታንዳርድ አልኮሊክ መጠጦችን ቢያንስ ለምን ያክል ጊዜ ወስደው ነበር ?	1. ብዛት _____ 77. እላውቅም	A6
60	ባለፉት 30 ቀናቶች ውስጥ የአልኮል መጠጦችን ሲጠቀሙ ፤ በአማካኝ እንዴ ብቻ ሲጠጡ ምን ያክል እስታንዳርድ አልኮሊክ መጠጦችን ወሰዱ ? (እያንዳንዱን እስታንዳርድ የመጠጥ አይነቶችን የሚጠቁም ካርድ በጠቀም ተሳታፊው ከአጠቃላይ አማካኝን አዲያስታወስ አግዝው)	1. ብዛት _____ 77. _____ እላውቅም የተጠቀሙዋቸው የአልኮል መጠጦችን፣	A7
61	ባለፉት 30 ቀናቶች ውስጥ ከጠጡት የአልኮል መጠጦች ውስጥ አንዴ ሲጠጡ ትልቁ እስታንዳርድ መጠጥ የጠጡት ስንት ነበር ? (ባለፉት 30 ቀናቶች ከወሰዳቸው ውስጥ ትልቁን የወሰደውን ብቻ ይመለከታል)	1. ትልቁ ብዛት _____ 77. እላውቅም	A8
62	ባለፉት 30 ቀናቶች ውስጥ የተጠቀሙዋቸው የአልኮል መጠጦችን፣ አንዴ ሲጠጡ ምን ያክል ጊዜ 6 እና ከዛም በላይ እስታንዳርድ መጠጦችን ተጠቀሙ?	1. ብዛት _____ 77. እላውቅም	A9
63	ባለፉት እያንዳንዱ 7 ቀናቶች ውስጥ ፤ ምን ያክል	7. ሰኞ	A10a

እስታንዳርድ መጠኖችን ተጠቅሙ/ጠጡ? (እያንዳንዱን እስታንዳርድ የመጠጥ አይነቶችን የሚጠቁም ካርድ በጠቀም ተሳታፊው ባለፉት እያንዳንዱ 7 ቀናቶች ውስጥ ምን ያክል እስታንዳርድ መጠኖችን እንደተጠቀመ እንዲያስታወስ አግዝው) ምለሽ አለውቅም ከሆነ ፣77 ይምረጡ	8. ማክሰኞ	A10b
	9. እርብ	A10c
	10. ሐሙስ	A10d
	11. አርብ	A10e
	12. ቅዳሜ	A10f
	7. እሁድ	A10g

በመጠይቅ ተራ ቁጥር (A10a እስከ A10g) ውስጥ ተጠይቀው የነበረው፣ ባለፉት 7 ቀናቶች ውስጥ ባጠቃላይ የጠጡት/የወሰዱትን ምንም ዓይነት የአልኮል መጠጦችን የተመለከተ ነበር። በቀጣይ የሚገኙትን ጥያቄዎች ሲመልሱ ግን እስከው መልስ መስጠት የሚገባዎታል። እቤት ውስጥ የተመረቁ/የተሰሩ መጠጦች፤ ከሌላ አገር (ከውጪ ሀገር) የመጡ የአልኮል መጠጦች፤ ለመጠጥነት የማይውሉ የአልኮል ፈሳሾች ፣ ለምሳሌ ፡ አልኮልነት ያለቸው መዲሀኒቶችንና ሌሎች የማይታወቁ የአልኮል ዝርያ ስላላቸው ፈሳሾች ለምሳሌ፤ እንደ አረቄ፤ ጠጅ፤ጠላ፤ብርዝ፤ኪኒቶ፤ቦርዴ፤ቫሚታ፤ኮረፌ፤እና የመሳሰሉትን እያሰቡ ይሆናል።

64	ባለፉት 7 ቀናቶች ውስጥ የተጠቀሙት የአልኮል መጠጦችም ሆኑ፤ለመጠጥነት የማይውሉ የአልኮል ፈሳሾች እና ሌሎች የአልኮል ዝርያቸው በትክክል የማይታወቁ ፈሳሾችን ነበሩ ?	3. አዎ 4. አይደለም፤ ምለሽዎ አይደለም ከሆነ ፣ ወደ መጠይቅ A13 ይሂዱ	A11
65	ከተዘረዘሩት የአልኮል መጠጦችም ሆኑ፤ለመጠጥነት ከማይውሉ የአልኮል ፈሳሽ ዓይነቶች ውስጥ ባለፉት 7 ቀናቶች ውስጥ ሲጠቀሙት በአማካኝ ምን ያክል እስታንዳርድ ተጠቅሙ? (እያንዳንዱን እስታንዳርድ የመጠጥ አይነቶችን የሚጠቁም ካርድ በጠቀም ተሳታፊው ባለፉት እያንዳንዱ 7 ቀናቶች ውስጥ ምን ያክል እስታንዳርድ መጠኖችን እንደተጠቀመ እንዲያስታወስ አግዝ) 77. ምለሽዎ አላውቅም ከሆነ 77 ብለው የመልሱ!	6. እቤት ውስጥ የተመረቁ/የተሰሩ መጠጦች ፣ ለምሳሌ ፡ ጠላ ፤ ጠጅ /___/___/	A12a
		7. እቤት ውስጥ የተመረቁ/የተሰሩ መጠጦች ፣ ለምሳሌ አረቄ፤ ቢራ፤ ከዛፍ/ ከአትክልት የተመረተ ወይን፤/___/___/	A12b
		8. ከሌላ አገር (ከውጪ ሀገር) የመጡ የአልኮል መጠጦች /___/___/	A12c
		9. ለመጠጥነት የማይውሉ የአልኮል ፈሳሾች ፣ ለምሳሌ ፡ አልኮልነት ያለቸው መዲሀኒቶች፤ ሽቶ፤ ወይም ከፂም መላጩት በኋላ ስለሚቀቡ የአልኮል አይነቶች/___/___/	A12d
66	ላለፉት 12 ወራት መጠጥ መጠቀም ከጀመሩ በኋላ ለምን ያክል ጊዜ ለማቆም ሞክረው ማቆም ተሳታፊዎት?	10. ሌሎች የጠቀሱ፡ /___/___/	A12e
		6. በየቀኑ 4. ከወር በታች የለም	A13
67	ባለፉት 12 ወራት ውስጥ መስራት የሚጠበቅብዎን ስራ ከመስራት ተስኖዎት የውቃሉ?	2.በየሳምንቱ 3.በየወሩ 5.. በጭራሽ የለም	A14

ከአመጋገብ ጋር (Diet) ተያያዥነት ያላቸው መጠይቆችን የተመለከተ

ቀጣዩ ጥያቄዎች ሁልጊዜ ስለሚመዝገቡላቸው አትክልትና ፍራፍሬዎችን የተመለከተ ሲሆን ፤ ለዚህም ይረዳ ዘንድ የተወሰኑ አትክልትና ፍራፍሬዎችን እንደምሳሌ የሚያሳዩ ስዕሎች ተዘጋጅተዋል።ዕያንዳንዱ ስእል የሚመለከተው አንድ ሰው የወሰደውን መጠን ነው። ለጥያቄዎቹ መልስ በሚሰጡበት ወቅት ባለፈው ዓመት ውስጥ ልዩ የነበረውን ሳምንት (ማለትም፤ በእምነት፤በባህልም ሆነ በሌሎች ሁኔታዎች ያልተባላሽ ኖርማል/Normal ምግብ) እስከው መልሱን ይስጡ።

	ጥያቄ	መልስ	ኮድ
68	ባለፈው ዓመት ውስጥ ልዩ የነበረውን ሳምንት ውስጥ ምን ያክል ጊዜ ፍራፍሬ ተመግበው ነበር? (መላሹ ማንኛውም አይነት በስእሉ የተመለከቱትን ፍራፍሬዎች እንዲያስብ አድርግ)	1. የቀኑ ብዛት _____ 77. አላውቅም፤ መልስዎ ምንም ቀን ከሆነ ወደ መጠይቅ D3 ይሂዱ	D1
69	በወቅቱ ሲመገቡት ከነበሩትን ፍራፍሬዎች ውስጥ በአንዱ ቀን ስንት ፍራፍሬዎች ተመገቡ (ምስሎችን በመጠቀም የወሰደውን መጠን እንዲገምት አድርግ)	1.የተጠቀሙት ፍራፍሬ ብዛት _____ 77. አላውቅም	D2
70	ባለፈው ዓመት ውስጥ ልዩ የነበረውን ሳምንት ውስጥ ምን	2. የቀኑ ብዛት _____	D3

	ያክል ጊዜ አትክልት ተመግበው ነበር? (መላሹ ማንኛውም አይነት በስላሱ የተመለከቱትን አትክልት እንዲያስብ አድርግ)	77. አላውቅም, መልስዎ ምንም ቀን ከሆነ ወደ መጠይቅ D5 ይሂዱ	
71	ሲመገቡት ከነበሩት አትክልት ዓይነቶች ውስጥ በአነሱ ቀን ስንት ተመገቡ ? (ምስሎቹን በመጠቀም የወሰደውን መጠን እንዲገምት አድርግ)	1. የተጠቀሙት አትክልት ብዛት _____ 77. አላውቅም	D4
72	ብዙ ጊዜ ምግብ እቤት ውስጥ በሚያዟጋጁበት ወቅት ፤ የትኛውን ዓይነት ዘይት ወይም ቅባት ይጠቀማሉ? (ምስሎቹን በመጠቀም) እንዲመርጥ አድርግ።	1. የአትክልት ዘይት 2. የአሳማ ዘይት 3. ቁቤ/ንፁህ ቁቤ 4. ከአትክልት የሚሰራ ቁቤ 5. የሚረጋውን ዘይት 6. ሌሎች ፤ ምላሽዎ ሌሎች ከሆነ ወደ መጠይቅ D5 ሌሎች ይሂዱ 7. አልለየውም 8. ጭራሽ አልጠቀምም 88. አላውቅም	D5
		_____ ሌሎች	D5others
73	በአማካኝ በሳምንት ምን ያክል ጊዜ ከቤት ውጪ ይመገባሉ ? (መመገብ ብለን ስንል ፤ ቁርስ ፤ ምሳ፤ እራት ለማለት ነው)	1. የቀኑ ብዛት _____ 77. አላውቅም	D6

እንቅስቃሴ ከማድረግ/እስፖርት ከመስራት ጋር (Physical Activity) ተያያዥነት ያላቸው መጠይቆች የተመለከተ

አሁን የምጠይቅዎ ጥያቄ ልዩ በሆነው ሳምንት ውስጥ የነበረውን እስፖርታዊ እንቅስቃሴን መሰረት ያደረገ ጥያቄ ይሆናል። ስለሆነም ምንም እንኳን እርስዎ እንቅስቃሴ በማድረግ ሁኔታ ፈጣን ባይሆኑም መልሱን በመስጠቱ ግን ፍቃደኛነትዎን በትህትና አጠይቅዎታለሁ። ላዛም ይረዳ ዘንድ ፤ መልሱን ከመመለስ በፊት ከዘሂ ቀደም ስራ በመስራት ያሳለፉትን ሳምንታዊ እስከ-ለምሳሌ በከፍተኛ ሆኖ ያለከፍተኛ የምትሰሯቸውን ስራዎች ፤ የቤት ውስጥ ስራ ፤ ጥናት/ትምህርት ፤ ግብርና ነክ ስራዎች (ለምግብ የሚሆን ጥራጠራ እህል የማምረት ስራ ፤ አሳ ማጥመድ ፤ ከብት መጠበቅ ፤ ማሰማራትና ሌሎች ወዘተ ስራዎችን) እስከ-የመልስ ስጦታ ሌላው ከግምት ሊያስገቡ የሚገባው ጉዳይ ከፍታኛና መካከለኛ እንቅስቃሴን የተመለከቱትን ሂደቶች ሲሆኑ ለምሳሌ ፤ ከፍተኛ እንቅስቃሴዎች የምንላቸው ከባድ ጉልበት የሚጠይቁትን ስራዎችን የተመለከቱትንና በተጨማሪም የግለሰቡን የአተነፋፊስም ሆነ የልብ ምቹን ሁኔታም በከፍተኛ ደረጃ እንዲጨምር የሚያደርጉትን እንቅስቃሴዎችን የሚመለከት ሲሆን መካከለኛ እንቅስቃሴዎች የምንላቸው ደግሞ መጠነኛ ጉልበት የሚጠይቁትንና እንዲሁም ደግሞ በመጠኑ ብቻ የትንፋሽና የልብ ምት መጨመር የሚያስከትሉትን እንቅስቃሴዎች ብቻ የሚመለከት እንደሆነ ከግምት እንዲያስገቡ ያስፈልጋል።

	ጥያቄ	መልስ	ኮድ
74	እርስዎ እየሰሩት ካሉት ስራዎች ውስጥ በየጊዜው ቢያንስ ለ10 ደቂቃዎች ያክል የሚቆዩ ከፍተኛ እንቅስቃሴ ወይም ከባድ ጉልበት የሚጠይቁ የአተነፋፊስም ሆነ የልብ ምቹን ሁኔታም በከፍተኛ ሁኔታ እንዲጨምር የሚያደርጉት ዓይነት ስራዎች ውስጥ የሚመደቡ አሉ?	1. አዎ 2. አይደለም ፤ መልስዎ አይደለም ከሆነ ወደ መጠይቅ P4 ይሂዱ (ከባድ ጉልበት የሚጠይቁ እንቅስቃሴዎችን የሚያሳይ ምስሎች ይጠቀሙ)	P1
75	በሳምንት ለምን ያክል ጊዜ ከፍተኛ ጉልበት የሚጠይቁ አይነት ስራዎችን እንደመደበኛ ስራዎች ይሰራሉ ?	የስራ ቀናቹ ብዛት _____	P2
76	ከፍተኛ ጉልበት የሚጠይቁ አይነት ስራዎችን እንደመደበኛ ስራዎች ሲሰሩ ለምን ያክል ጊዜ (ሰዓት/ደቂቃ) እየሰሩ ይቆያሉ?	3. ሰዓት: _____ 4. ደቂቃ: _____	P3(a-b)
77	እርስዎ እየሰሩት ካሉት ስራዎች ውስጥ በየጊዜው ቢያንስ ለ10 ደቂቃዎች ያክል የሚቆዩ መካከለኛ እንቅስቃሴ የሚጠይቁ ስራዎች ማለትም መካከለኛ ጉልበትና መጠነኛ የሆነ የአተነፋፊስና የልብ ምት እንዲጨምር የሚያስከትሉ አይነት ስራዎች ጎራ የሚመደቡ ለምሳሌ ፡ እንደ ቀለል ክብደት ያላቸውን ነገሮችን የመሸከም ብሎም የማንሳት፤ የመሰሰሉት አይነት ስራዎች ውስጥ የሚመደቡ አሉ ?	3. አዎ 4. አይደለም ፤ መልስዎ አይደለም ከሆነ ወደ መጠይቅ P7 ይሂዱ (መካከለኛ እንቅስቃሴ የሚጠይቁ እንቅስቃሴዎችን የሚያሳይ ምስሎች ይጠቀሙ)	P4
78	ለየት ባለው ሳምንት፤ ለምን ያክል ጊዜ መካከለኛ ጉልበት የሚጠይቁ አይነት ስራዎችን እንደመደበኛ ስራዎች ይሰራሉ ?	2. የስራ ቀናቹ ብዛት _____	P5

79	መካከለኛ ጉልበት የሚጠይቁ አይነት ስራዎችን አንደመደበኛ ስራዎ ሲሰሩ ለምን ያክል ጊዜ (ሰዓት/ደቂቃ) እየሰሩ ይቆያሉ?	5. ሰዓት: _____ 6. ደቂቃ: _____	P6(a-b)
ከቦታ ቦታ መዘዋወርን/መንቀሳቀስን መሰረት ያደረገ መጠይቅ (Travel to and from places)			
በቀጣይ ያሉት ጥያቄዎች የሚመለከቱት ደግሞ ከላይ ስለመለሱት ማለትም በስራ ቦታዎ ከሚሰሩት ስራዎች ጋር ተያያዥነት ስላላቸው የሰውነት እንቅስቃሴዎችን የተመለከተ ሳይሆን በየጊዜው ስለሚያከናውኑት ከቦታ ቦታ ስለሚያደርጉት የጉዞ እንቅስቃሴዎችን የተመለከቱትን ለምሳሌ: ወደ ስራ ቦታ የመንቀሳቀሻ ሁኔታን የተመለከተ ፤ ወደ ሱቅና አምነት ተቻም የመንቀሳቀሻን ሁኔታ የተመለከቱ ይሆናሉ።			
80	በየጊዜው ከቦታ ቦታ ሲንቀሳቀሱ ቢያንስ ለ10 ደቂቃ ያክል በአግርዎ ይራመዳሉ ወይስ ቢሰከሊሉት ይጠቀማሉ?	3. አዎ 4. አይደለም ፤ መልስዎ አይደለም ከሆነ ወደ መጠይቅ P10 ይሂዱ	P7
81	በየጊዜው ከቦታ ቦታ ሲዘዋወሩ በሳምንት ለምን ያክል ቀናቶች ቢያንስ ለ10 ደቂቃ ያክል በአግርዎ እየተራመዱ ወይም ቢሰከሊሉት እየሱ ይንቀሳቀሳሉ?	የቀናቶች ብዛት _____	P8
82	በየጊዜው ከቦታ ቦታ በአግርዎ እየተራመዱ ወይም ቢሰከሊሉት እየሱ ሲንቀሳቀሱ ለምን ያክል ጊዜ (ሰዓት/ደቂቃ) ይቆያሉ?	ሰዓት: _____ ደቂቃ: _____	P9(a-b)
ከመዝናናት ጋር ተያያዥነት ያላቸውን እንቅስቃሴዎች (Recreational Activities) የተመለከተ መጠይቅ			
በቀጣይም የሚኖሩት መጠይቆች አስፖርታዊ እንቅስቃሴዎችን ፤የአካል ብቃት እንቅስቃሴዎችንና ከመዝናናት ጋር የተያያዙ እንቅስቃሴዎችን (ለምሳሌ: አስፖርት መስራትንና ሌሎችንም) የተመለከቱ ሲሆን ሲመልሱ እንቅስቃሴዎቹን አልፎ አልፎ የሚከናወኑ ሳይሆን ሁልጊዜ የሚከናወኑ መሆን አለባቸው።			
83	በየጊዜው ቢያንስ ለ10 ደቂቃዎች ያክል የሚቆዩ ከፍተኛ አስፖርታዊ / የአካል ብቃት እንቅስቃሴንና የመዝናኛ እንቅስቃሴዎችን ፤ ማለትም ከባድ ጉልበት የሚጠይቁ ብሎም የአተነፋራስዎንም ሆነ የልብ ምቹዎን ሁኔታም በከፍተኛ ደረጃ እንዲጨምር ከሚያደርጉት እንቅስቃሴዎች ጎራ የሚመደቡ ለምሳሌ ፤ እንደ ሩጫና አግር ኳስ የመሳሰሉት አይነት እንቅስቃሴዎችን ይሰራሉ?	3. አዎ 4. አይደለም ፤ መልስዎ አይደለም ከሆነ ወደ መጠይቅ P13 ይሂዱ (ከፍተኛ አስፖርታዊ እንቅስቃሴዎችን የሚያሳይ ምስሎች ይጠቀሙ)	P10
84	ልዩ በነበረው ሳምንት ለምን ያክል ቀናቶች ከፍተኛ አስፖርታዊ እንቅስቃሴዎችን ፤ የአካል ብቃት እንቅስቃሴንና የመዝናኛ እንቅስቃሴዎችን በሳምንት ይሰራሉ ?	1. የቀናቶች ብዛት _____	P11
85	ለየት ባለው ቀን፤ ከፍተኛ አስፖርታዊ እንቅስቃሴዎችን ፤ የአካል ብቃት እንቅስቃሴንና የመዝናኛ እንቅስቃሴዎችን ለምን ያክል ጊዜ (ሰዓት/ደቂቃ) በቀን እየሰሩ ይቆያሉ?	3. ሰዓት: _____ 4. ደቂቃ: _____	P12(a-b)
86	በየጊዜው ቢያንስ ለ10 ደቂቃዎች ያክል የሚቆዩ መካከለኛ አስፖርታዊ እንቅስቃሴዎችን ፤ የአካል ብቃት እንቅስቃሴንና የመዝናኛ እንቅስቃሴዎችን ማለትም መጠነኛ ጉልበትና እንዲሁም የአተነፋራስዎንም ሆነ የልብ ምቹዎን ሁኔታም በመጠኑ እንዲጨምር ከሚያደርጉት እንቅስቃሴዎች ጎራ የሚመደቡ ለምሳሌ ፡ እንደ ዋና፤ የእጅ ካስ ጨዋታ ሳይክል መንዳት የመሳሰሉት አይነት እንቅስቃሴዎችን ይሰራሉ?	3. አዎ 4. አይደለም፤ መልስዎ አይደለም ከሆነ መልስዎ ፤ ወደ መጠይቅ H1 ይሂዱ (መካከለኛ አስፖርታዊ እንቅስቃሴዎችን የሚያሳይ ምስሎች ይጠቀሙ)	P13
87	ልዩ በነበረው ሳምንት ለምን ያክል ቀን መካከለኛ አስፖርታዊ እንቅስቃሴዎችን ፤ የአካል ብቃት እንቅስቃሴንና የመዝናኛ እንቅስቃሴዎችን በሳምንት ይሰራሉ ?	1. የቀኑ ብዛት _____	P14
88	ልዩ በሆነው ቀን፤ መካከለኛ አስፖርታዊ እንቅስቃሴዎችን ፤ የአካል ብቃት እንቅስቃሴንና የመዝናኛ እንቅስቃሴዎችን ለምን ያክል ጊዜ (ሰዓት/ደቂቃ) በቀን እየሰሩ ይቆያሉ?	3. ሰዓት /Hours : _____ 4. ደቂቃ /Minutes : _____	P15(a-b)
እንቅስቃሴ ካለማድረግ ጋር ተያያዥነት ያላቸውን ባህሪያቶች (Sedentary Behaviour) የተመለከቱ መጠይቅ			

ቀጣዩ ጥያቄ የሚመለከተው በስራ ቦታም ሆነ በቤት ውስጥ ብሎም ከጉዳዮችዎ ጋር ሲጫወቱም ሆነ ሲዝናኑ፤ በመኪና፤በባስ፤በባቡር በሚንቀሳቀሱበት ወቅት፤ በሚያነቡበትና የካርድ ጨዋታ በሚጫወቱበት ወቅት ስለሚደርጉት ለረጅም ሰዓት የመቀመጥን ብሎም እንቅስቃሴ ከማድረግ መቆጠብን የተመለከተ ሲሆን ነገር ግን እንቅልፍ በመተኛት የሚከሰተውን ቆይታ አይመለከትም።			
89	በየጊዜው በቀን ለምን ያክል ጊዜ (ሰዓት/ ደቂቃ) ተቀምጠው /እንቅስቃሴ ሳያደርጉ ይቆያሉ?	1. ሰዓት /Hours : _____ 3. ደቂቃ /Minutes : _____	P16(a-b)
የደም ግፊት የመጨመርን ታሪክ የተመለከተ መጠይቅ(History of Raised Blood Pressure)			
90	ከዚህ በፊት የደም ግፊትዎን በህኪም ወይም በጤና ባለሙያ ተለክተው የውቃሉ?	3. አዎ/Yes 4. አይደለም፤ አይደለም ከሆነ መለሰዎ ፣ ወደ መጠይቅ <u>H6 ይሂዱ</u>	H1
91	በዛን ወቅት የደም ግፊትዎ እንደጨመረ አልያም ደግሞ ግፊት እንዳለብዎ ተነግርዎት ያውቃሉ?	3. አዎ/Yes 4. አይደለም ፤ አይደለም ከሆነ መለሰዎ ፣ ወደ መጠይቅ <u>H6 ይሂዱ</u>	H2a
92	ባለፉት 12 ወራት ውስጥ የደም ግፊትዎን በህኪም ወይም በጤና ባለሙያ በተለኩበት ወቅት የደም ግፊትዎ እንደጨመረ አልያም ደግሞ ግፊት እንዳለብዎ ተነግርዎ ያውቃሉ?	1. አዎ 2. አይደለም (ከዚህ ቀደም ተመርምረው ለሚያውቁት ብቻ)	H2b
በቀጣይ የሚገኙት ጥያቄዎች የሚያተኩሩት በቅርቡ የደም ግፊትዎ በመጨመሩ ምክንያት በህኪም /በሌሎች የጤና ባለሙያዎች አማካኝነት ህክምና/ ሌሎች የበሽታውን አስከፊነት ለመቀነስ የሚያስችሉ ጠቀሜታ ስለሚኖራቸው ምክሮች መሰጠት አለመሰጠትን የተመለከተ ይሆናል ።			
93	ባለፉት 2 ሳምንት ውስጥ ለደም ግፊትዎ ሲሉ በህኪም ወይም በጤና ባለሙያዎች አማካኝነት የታዘዘልዎት መድሀኒት አለ?	1. አዎ 2. አይደለም	H3
94	ለደም ግፊቱ ብለው የባህል ህኪም ዘንድ ሂደው ታይተው ያውቃሉ ?	3. አዎ 2. አይደለም	H4
95	በአሁኑ ወቅት ለደም ግፊትዎ መጨመር ብለው እየወሰዱት ያሉት የባህል መዲሀኒቶች አሉ?	1. አዎ 2. አይደለም	H5
የስጋ በሽታ ታሪኮችን (History of diabetes) የተመለከቱ መጠይቆች			
96	ከዚህ በፊት የደም ውሰጥ ስኬት መጠን በህኪም/በሌሎች የጤና ባለሙያዎች አማካኝነት ተለክተው ያውቃሉ ?	3. አዎ 4. አይደለም, አይደለም ከሆነ መለሰዎ ፣ ወደ መጠይቅ <u>H12 ይሂዱ</u>	H6
97	በተለኩበት ወቅት የስጋ መጠንዎ እንደጨመረ አልያም ደግሞ የስጋ በሽታ እንዳለብዎ ተነግርዎት ያውቃል?	3. አዎ/Yes 4. አይደለም, አይደለም ከሆነ መለሰዎ ፣ ወደ መጠይቅ <u>H12 ይሂዱ</u>	H7a
98	ባለፉት 12 ወራት ውስጥ የደም ውሰጥ ስኬት መጠንዎን እንደጨመረ አልያም ደግሞ የስጋ በሽታ እንዳለብዎ ተነግርዎ ያውቃል?	1. አዎ 2. አይደለም	H7b
99	ባለፉት 2 ሳምንታት ውስጥ የስጋ መጠንዎን ለመቀነስ ሲባል በህኪም ወይም በጤና ባለሙያ የታዘዘልዎ የስጋ መድሀኒቶች አሉ?	1. አዎ 2. አይደለም	H8
100	በአሁኑ ወቅት በህኪም ወይም በሌሎች የጤና ባለሙያ ታዘዘልዎት የሚወስዱት <u>ኢንሱሊን</u> የሚባል የስጋ መድሀኒት አለ? (ኢንሱሊንን ብቻ ይመለከታል)	1. አዎ 2. የለም	H9
101	ከዚህ ቀደም ስጋዎ በመጨመሩ ምክንያት የባህል ህኪም ዘንድ ሂደው ታይተው ያውቃሉ ?	1. አዎ 2. አላውቅም	H10
102	በአሁኑ ወቅት ለስጋዎ በሽታዎ ብለው እየወሰዱት ያሉት የባህል መዲሀኒቶች አሉ?	1. አዎ 2.የለም	H11

የኮሌስትሮል መጠን መጨመርን ታሪክን (History of raised Cholestrol)የተመለከተ መጠይቅ			
103	ከዚህ በፊት የኮሌስትሮል መጠንዎን በህኪም ወይም በሎሎች የጤና ባለሙያዎች እማካኝነት ተለክተው የውቃሉ?	3. አዎ 4. አይደለም. አይደለም ከሆነ ወደ መጤቅ <u>H17 ይሂዱ</u>	H12
104	ከዚህ በፊት የኮሌስትሮል መጠንዎ በደምዎ ውስጥ እንደጨመረ በህኪም ወይም በሎሎች የጤና ባለሙያዎች እማካኝነት ተነግርዎት ያውቃሉ?	1. አዎ 2. አይደለም, አይደለም ከሆነ ወደ መጤቅ <u>H17 ይሂዱ</u>	H13a
105	ባለፉት 12 ወራቶች ውስጥ የኮሌስትሮል መጠንዎ በደምዎ ውስጥ እንደጨመረ የተነግርዎት የውቃሉ?	3. አዎ 4. አይደለም	H13b
106	ባለፉት ሁለት ሳምንታቶች ውስጥ የኮሌስትሮል መጠንዎ በደምዎ ውስጥ በመጨመሩ ምክንያት በህኪምም ወይም በሎሎች የጤና ባለሙያዎች እማካኝነት ታክመው በእፍ የሚወሰድ መድኃኒት ወስደው ነበር?	1. አዎ 2. አይደለም	H14
107	ከዚህ ቀደም የኮሌስትሮል መጠንዎ በደምዎ ውስጥ በመጨመሩ ምክንያት በባህል ህኪም ዘንድ ታይተው ነበር?	1. አዎ 2. አይደለም	H15
108	በእሁኑ ጊዜ የኮሌስትሮል መጠንዎ በደምዎ ውስጥ በመጨመሩ ምክንት እየወሰዱት ያለ ማንኛውም እይነት የባህል መዲሀኒት አለ ?	1. አዎ 2. አይደለም	H16
ክልብ በሽታ ጋር ተያያዥኸኝነት ስላላቸው የጤና ሁኔታዎችን የተመለከቱ ታሪኮች (Hx.Cardiovascular Diseases) መጠይቆች			
109	ከዚህ ቀደም ያጋጠምዎ የልብ ችግር ወይም ክልብ በሽታዎች ጋር ተያይዞ የሚከሰት የደረት ውጋት ህመም አልያም ድንገት እራስን የመሳት የጭንቅላት ውስጥ ደም መፍስ ችግር (እስትሮክ) ነበረብዎ?	1. አዎ 2. አይደለም	H17
110	በእሁኑ ሰዓት የልብ ችግርዎን ለመከላከልም ሆነ ለማከም በማለት በየጊዜው(በየቀኑ) የሚወስዱት እስፕሪን መድሀኒት አለ?	1. አዎ 2. አይደለም	H18
111	በእሁኑ ሰዓት የልብ ችግርዎን ለመከላከልም ሆነ ለማከም በማለት በየጊዜው የሚወስዱት (Lovastatin/Simvastatin/Atrovastatin or any other) እስታቲንና ሌሎች ተመሳሳይ መድሀኒት አለ?	1. አዎ 2. አይደለም	H19
የእሥር ዘይቤን የተመለከቱ መጠይቆች (Lifestyle Advice)			
112	ባለፉት 3 ዓመታት ውስጥ በህኪምም ሆነ ወይም በሎሎች የጤና ባለሙያዎች እማካኝነት ከዚህ በታች በተዘረዘሩት ጉዳዮች ላይ ምክር ተሰጥቶዎ የነበረ መሆን አለመሆንን በተመለከተ የሚጠይቅ መጠይቅ ነው ::		
113	ሲጋራ መጨስ ማቆም / ማጨስ አለመጀመር	1. አዎ 2. አይደለም	H20a
114	የጨው መጠን በምግብ ውስጥ መቀነስ	1. አዎ 2. አይደለም	H20b
115	ቢያነስ በትንሹ 5 ጠቀሜታ ያለቸውን አትክልትም ሆነ ፍራፍሬ መመገብ	2. አዎ 2. አይደለም	H20c
116	በምግ የሚኖረውን የቅበት መጠንን መቀነስ	1. አዎ 2. አይደለም	H20d
117	የሰውነት እንቅስቃሴ መጀመር አልያም የእንቅስቃሴ መድረግ መጠንን መጨመር	1. አዎ 2. አይደለም	H20e
118	ጤናማ የሆነ ተክለ ሰውነትን የመጠበቅና ክበደትን መቀነስ	3. አዎ ; 4. አይደለም ለመጠይቅ C1 =1 ከሆነ ወደመጠይቅ <u>M1 ይሂዱ</u>	H20f
ደረጃሁለት፤			
የሰውነት ልኬትን (Physical Measurements) የተመለከቱ መጠይቆች			

የደም ግፊት መጠን (Blood Pressure)			
	ጥያቄ	መልስ	ኮድ
119	መጠይቁን ለሚያቀርበው ሰው የተሰጠው መ.ቁጥር	(እነዚህን መረጃዎች ለመስጠት ለበዛኛውን ጊዜ ተመሳሳይ ጠያቂ መጠቀሙ አስፈላጊ ነው)	M1
120	የግፊት መለኪያው መሳሪያ ስምና መለያ ቁጥር		M2
121	የግፊት መለኪያው መጠን (Cuff size)	1. ትንሽ 2. መካከለኛ 3. ከፍተኛ	M3
122	የመጀመሪያው የደም ግፊት ንባብ (የመጀመሪያውን የደም ግፊት ልኬት የሚወሰደው በሽተኛው ለ 15 ደቂቃ እረፍት ካደረግ በኋላ)	1. ሲስቶሊክ (mmHg) _____ 2. ዲያስቶሊክ (mmHg) _____	M4a M4b
123	ሁለተኛው የደም ግፊት ንባብ (2ኛው የ 3ኛው ልኬት ከመካሄዱ 3 ደቂቃ ቀደም ብሎ ይሆናል)	1. ሲስቶሊክ (mmHg) _____ 2. ዲያስቶሊክ (mmHg) _____	M5a M5b
124	የሶስተኛው ልኬት	1. ሲስቶሊክ (mmHg) _____ 2. ዲያስቶሊክ (mmHg) _____	M6a M6b
125	ባለፉት 2 ሳምንታት ውስጥ ለደም ግፊት ተብለው በህኪም ወይም በሌሎች የጤና ባለሙያዎች እማካኝነት መዳኒት ተዘለዎት የታከመብት ሁኔታ ነበረ ?	3. አዎ 4. አይደለም	M7
ቁመትና ክብደት (Height and Weight) ልኬትን የሚመለከት			
126	ለሴቶች ብቻ : በአሁኑ ወቅት እረጉዝ ነዎት? (ለእርጉዝ እናቶችን ክብደት ቁመት የወገብ ስፋትን መለካት አያስፈልግም)	1. አዎ, አዎ ከሆነ ምላሽዎ ወደ መጠይቅ <u>አዚህ ጋር ያቁሙ!</u> 2. አይደለም አይደለም ከሆነ ብቻ ቀጣዩን መጠይቅ ይሙሉ	M8
127	መጠይቁን ለሚያቀርበው ሰው የተሰጠው መ.ቁጥር	_____	M9
128	የቁመትና ክብደት መለኪያዎች መሳሪያ ስምና መለያ ቁጥር	1. ቁመት: _____ 2. ክብደት: _____	M10a M10b
129	የቁመት መጠን	የቁመት መጠን (በሴ.ሜ./CM) ____/____/____. /____/____/____	M11
130	የክብደት መጠን (የክብደት መጠን ከመለኪያው እስከል በላይ ከሆነ ናይ 666.6 ብለው ይመልሱ)	የክብደት መጠን (በ ኪ.ግ/Kg): ____/____/____. /____/____/____	M12
የወገብና ዳሌ መጠን (Waist and Hip)(Use non-stretch tape measure) ልኬትን የሚመለከት መጠይቅ			
131	የወገብ/ዳሌ መለኪያው መሳሪያ ስምና መለያ ቁጥር	_____ A non-stretch tape measure	M13
132	የወገብ መጠን(ሲመዝግቡ በ2 ነጥብ ደሲማል በማጠጋጋት ይጻፉት)	የወገብ መጠን በሴ.ሜ ሲሰላ ____/____/____. /____/____/____	M14
133	የዳሌ መጠን(ሲመዘግቡ በ2 ነጥብ ደሲማል በማጠጋጋት ይጻፉት)	የዳሌ መጠን በሴ.ሜ ሲሰላ ____/____/____. /____/____/____	M15

Annex 12: Qualitative English questionnaire

English version In-depth interview guide adopted from PEN-3 model

4. Knowledge of Health Behavior

4.1. Knowledge

- **Person.** Health education should be a personal responsibility. What aspects of your life enable you to take responsibility for your health? Do you know what MS is (Dyslipidemia, T2DM, CO, hypertension) (probe)? What are some risks for MS? What are long-term outcomes for MS? How do you gain knowledge about health matters? How have you gained knowledge about MS risks, prevention, and long-term outcomes?

- **Extended Family.** What roles have members of your extended family played in your health education about MS risks, prevention, and long term outcomes?
- **Neighborhood.** What role does the community (political, religious, educational, and governmental) play in health education? To what extent has the community provided information on MS risks, prevention, and long term outcomes?

4.2. Attitudes.

- **Person.** Health education should be a personal responsibility. What aspects of your life enable you to adopt an attitude of responsibility for your health? How do you feel about having MS?
- **Extended Family.** What roles have members of your extended family played in your adoption of your current attitude about your health, particularly in regards to MS risks, prevention, and long term outcomes?
- **Neighborhood.** What role has the community (political, religious, educational, and governmental) played in shaping your attitudes about MS risks, prevention, and long-term outcomes?

4.3. Practices.

- **Person.** Do you believe practices that prevent disease or improve health should be a personal responsibility?
- **Extended Family.** What roles have members of your extended family played in encouraging practices that prevent disease or improve your health particularly in regards to MS risks, prevention, and long term outcomes?
- **Neighborhood.** What role has the community (political, religious, educational, and governmental) played in encouraging practices that prevent disease or improve your health particularly in regards to MS risks, prevention, and long term outcomes?

5. Attitudes of Health Behavior

5.1. Knowledge

- **Perceptions.** What perceptions (knowledge, beliefs, and values) do you (including extended family or community) have about MS risks, and long term outcomes? (Probe)
- **Enablers.** What are cultural, societal, systemic, or structural systems that may enhance gaining knowledge about MS risks, and long-term outcomes? What are cultural, societal, systemic, or structural barriers to gaining knowledge about MS risks, and long-term outcomes?
- **Nurturers.** What is the role of extended family, kin, peers, and community in helping you gain a correct knowledge about MS risks, and long-term outcomes?

5.2. Attitudes.

- **Perceptions.** What is your attitude about MS risks, and long-term outcomes? Why? (Probe – is it a concern? Why or Why not? Should you be concerned?)
- **Enablers.** Who or what enables your current attitude (negative or positive) about MS risks and long-term outcomes? How? To what extent? Why?

- **Nurturers.** Who or what encourages you to care about MS risks, and long-term outcomes? How? Why?

5.3.Practices.

- **Perceptions.** What beliefs do you have about dietary, physical exercise, or other practices designed to prevent MS? What beliefs do you have about dietary, physical exercise, or other practices designed to reduce risks for MS and its long-term outcomes?
- **Enablers.** What in your life serves to encourage you to engage in dietary, physical exercise, or other practices designed to reduce risks for MS and its long-term outcomes? What in your life serves to discourage you from engaging in dietary, physical exercise, or other practices designed to reduce risks for MS and its long-term outcomes?
- **Nurturers.** To what extent do extended family, relatives, and community influence you to engage in dietary, physical exercise, or other practices designed to reduce risks for MS and its long-term outcomes? To what extent do extended family, relatives, and community influence you to engage in dietary physical exercise, or other practices designed to reduce risks for MS and its long-term outcomes?

6. Practices of Health Behavior

6.1.Knowledge.

- **Positive.** What knowledge do you have about MS risks, prevention, and long-term outcomes you believe to be positive?
- **Existential.** What knowledge do you have about MS risks, prevention, and long-term outcomes you believe to be existential?
- **Negative.** What knowledge do you have about MS risks, prevention, and long-term outcomes you believe to be negative?

6.2.Attitudes.

- **Positive.** What attitudes do you have about MS risks, prevention, and long-term outcomes you believe to be positive?
- **Existential.** What attitudes do you have about MS risks, prevention, and long-term outcomes you believe to be existential?
- **Negative.** What attitudes do you have about MS risks, prevention, and long-term outcomes you believe to be negative

6.3.Practices.

- **Positive.** What positive practices do you engage in to reduce MS risks, prevention, and long-term outcomes?
- **Existential.** What existential practices do you engage in to reduce MS risks, prevention, and long-term outcomes? **Negative.** What practices do you engage in that do not reduce MS risks and long term outcomes, and are not preventive?

Annex 13: Qualitative Amharic questionnaire

በጥልቀት መረጃ ለመስብሰብ የሚረዳ የቃል መጠይቅ ማደረጊያ ቅጽ

1. ከእውቀት ጋር የተያያዙ ባህሪና የተመለከቱ

1.1. እውቀትን

- **ግለሰብ**፡ ስለጤና ማወቅ ብሎም መረጃ ለማግኘት መጣ የግለሰቡ ሀላፊነት ነው። ጤንነትን ከመጠበቅ እንፃር ለሚያስፈልገው እውቀትም ሆነ መረጃ የማሰባሰብ ሂደት በተመለከተ የትኛው ዓይነት የህይወት ገፅታ ነው ሃላፊነት እንዲወስዱ/እንዲሰማ ያስቻልዎ? በእንግሊዘኛው አጠራር (ሚታቦሊክ ሲንድሮም) በመባል የሚታወቁ በተለምዶ በቆይታ ለሚከሰቱ ከሰው ወደ ሰው ለማይተላለፉ በሽታዎች ተጋላጭ እንዲሆኑ በተናጥልም ሆነ በህብረት የሚዳረጉና ነገር ግን በአሁኑ ወቅት ከ ኤች አይ ቪ ቫይረስም ሆነ ከፀረ ኤችአይቪ መድሀኒት ጋር ተያይዞ ከቫየረሱ ጋር የሚኖሩ ሰዎችን እያጠቁ የሚገኙ ህብረ ጤና ትግሮችን ያውቃሉ? እባክዎ እነዚህን ትግሮች እንደሆኑ ሊጠቅሱልን ይችላሉ? በቆይታ እነዚህ ትግሮች ካልተቀረፉ ከቫይረሱ ጋር የሚኖሩ ሰዎችን ለምን እይነት የጤና ትግሮች ሊያጋልጡዎቸው እንደሚችልላቸው ይጠቅሱልናል? በእርስዎ አመለካከት፡ ምንድን ነው እነዚህን ሰዎች ለእነዚህ ዓይነት የጤና ትግሮች ተጋላጭ እንዲሆኑ የዳረጋቸው? እነዚህን ሰዎች ለተጠቀሱት ትግሮች ተጋላጭ እንዲሆኑ የሚያደርጉቸውን ምክንያቶችንም ሆነ ትግሮቹን የመከላከሉን ሂደት ያውቃሉ? አውቃለው ከሆነ? እንዴት ሊያውቁ እንደቻሉ ሊያብራሩልን ይችላሉ? አላውቅም ከሆነ ደግሞ? ለምንድን ነው ያላውቁት? ማወቅ ያልቻሉበትን ምክንያቶችን በዝርዝር ሊነግሩን ይችላሉ?
- **ቤተሰብ/ዘመድ**፡ የቤተሰብዎ አባላት ከላይ የተጠቀሰውን ህብረ ጤና ትግሮች ተጋላጭ እንዲሆኑ የሚያደርጉቸውን ምክንያቶችንም ሆነ ትግሮቹን የመከላከሉን ሂደት በተመለከተ እውቀቱ እንዲኖርዎ ምን ዓይነት ሚና ተጫውተዋል?
- **ማህበረሰብ**፡ ማህበረሰቡ (የት/ተቻማት፤መንግስታዊና መንግስታዊ የልሆኑ ተቻማት፤የእምነት ተቻማት፤ እንዲሁም ፖለቲካው) ከላይ የተጠቀሰውን ህብረ ጤና ትግሮች ተጋላጭ እንዲሆኑ የሚያደርጉቸውን ምክንያቶችንም ሆነ ትግሮቹን የመከላከሉን ሂደት በተመለከተ እውቀቱ እንዲኖርዎ ምን ዓይነት ሚና ተጫውተዋል? ከላይ የተጠቀሰውን ህብረ ጤና ትግሮች ተጋላጭ እንዲሆኑ የሚያደርጉቸውን ምክንያቶችንም ሆነ ትግሮቹን የመከላከሉን ሂደት በተመለከተ ሊፎርሚኸኑ እንዲኖርዎ ምን ያክል ሚና ተጫውተዋል?

1.2. አመለካከትን

- **ግለሰብ**፡ ስለጤና ማወቅ ብሎም መረጃ ማግኘት የግለሰቡ ሀላፊነት ነው። ጤንነትን ከመጠበቅ እንፃር ሊኖርዎ የሚገባውን አመለካከት ከማዳበር ረገድ የትኛው ዓይነት የህይወት ገፅታ ነው ሃላፊነት እንዲወስዱ ያስቻልዎ? የትግሩ ተጋላጭ መሆንዎን ቢረዱ/ ቢያውቁ ምን ይሰማዎታል?
- **ቤተሰብ/ዘመድ**፡ የቤተሰብዎ አባላት ከላይ የተጠቀሰውን ህብረ ጤና ትግሮች ተጋላጭ እንዳይሆኑ የሚያደርጉቸውን ምክንያቶችንም ሆነ ትግሮቹን የመከላከሉን ሂደት በተመለከተ በአሁኑ ወቅት ላለዎት አመለካከት ምን ዓይነት ሚና
- **ማህበረሰብ**፡ ማህበረሰቡ (የት/ተቻማት፤መንግስታዊና መንግስታዊ የልሆኑ ተቻማት፤የእምነት ተቻማት፤ እንዲሁም ፖለቲካው) ከላይ የተጠቀሰውን ህብረ ጤና ትግሮች ተጋላጭ እንዲሆኑ የሚያደርጉቸውን ምክንያቶችንም ሆነ ትግሮቹን የመከላከሉን ሂደት በተመለከተ አመለካከትዎን ከመቅረጽ እንፃር ምን ዓይነት ሚና ተጫውተዋል?

1.3. ተግባርን

- **ግለሰብ**፡ ጤናን የመጠበቅም ሆነ በሽታን ቀድሞ መከላከል ተግባር የግል ውሳኔ/ሃላፊነት ነው ብለው የምናሉ?
- **ቤተሰብ/ዘመድ**፡ የቤተሰብዎ አባላት ጤናን ከመጠበቅ ብሎም በሽታን ከመከላከል እንፃር የሚጠቅሙ ምን ዓይነት አበረታች ተግባራቶችን ተቻውተዋል? በተለይም ከላይ የተጠቀሰውን ህብረ ጤና ትግሮች ተጋላጭ እንዲሆኑ የሚያደርጉቸውን ምክንያቶችንም ሆነ ትግሮቹን የመከላከሉን የመከላከሉን ሂደት በተመለከተስ?
- **ማህበረሰብ**፡ ማህበረሰቡ (የት/ተቻማት፤መንግስታዊና መንግስታዊ የልሆኑ ተቻማት፤የእምነት ተቻማት፤ እንዲሁም ፖለቲካው) ጤናን ከመጠበቅ ብሎም በሽታን ከመከላከል እንፃር የሚጠቅሙ ምን ዓይነት አበረታች ተግባራቶችን ተጫውተዋል? በተለይም ከላይ የተጠቀሰውን ህብረ ጤና ትግሮች ተጋላጭ እንዲሆኑ የሚያደርጉቸውን ምክንያቶችንም ሆነ ትግሮቹን የመከላከሉን የመከላከሉን ሂደት በተመለከተስ?

2. ከአመለካከት ጋር የተያያዙ ባህሪን የተመለከቱ

1.1. እውቀትን

- **እውቀት፤እምነት፤እሴት**፡ ከላይ የተጠቀሰውን ህብረ ጤና ትግሮች ተጋላጭ እንዲሆኑ የሚያደርጉቸውን ምክንያቶችንም ሆነ ትግሮቹን የመከላከሉን የመከላከሉን ሂደት በተመለከተ እርስዎም ሆኑ ቤተሰብዎ ብሎም ማህበረሰቡ ምን እይነት አመለካከት (እውቀት፤እምነት፤እሴት) አላቸው (በተጨማሪ ቀስቅስ)?
- **የሚያስችል/የማያስችል**፡ ከላይ የተጠቀሰውን ህብረ ጤና ትግሮች ተጋላጭ እንዲሆኑ የሚያደርጉቸውን ምክንያቶችንም ሆነ ትግሮቹን የመከላከሉን የመከላከሉን ሂደት በተመለከተ እርስዎም ለሁሉ ያለዎትን እውቀት እንዲያገኙ የስቻልዎት ባህላዊ፤ማህበረሰባዊ፤ማውቅራዊ ወይም የአሰራር ሁኔታዎች ምንድናቸው? በተለይም ከላይ የተጠቀሰውን ህብረ ጤና ትግሮች ተጋላጭ እንዲሆኑ የሚያደርጉቸውን ምክንያቶችንም ሆነ ትግሮቹን የመከላከሉን የመከላከሉን ሂደት በተመለከተ እርስዎም ለሁሉ ያለዎትን እውቀት እንዲያገኙ እንቅፋት የሆኑበት ባህላዊ፤ማህበረሰባዊ፤ማውቅራዊ ወይም የአሰራር ሁኔታዎች ምንድናቸው?

- **እገዛ፡** ከላይ የተጠቀሰውን ህብረ ጤና ችግሮች ተጋላጭ እንዲሆኑ የሚያደርጉባቸውን ምክንያቶችንም ሆነ ችግሮቹን የመከላከልን የመከላከልን ሂደት በተመለከተ እርስዎ ትክክለኛ እውቀት እንዲኖርዎ ከማድረግ በፊት በቤተሰብዎ፤ ዘመድዎ ብሎም ማህበረሰቡ የተጫወቱት ሚና/እገዛ ምንድን ናቸው ?

1.2. አመለካከት

- **እውቀት፤እምነት፤እሴት፡** ከላይ የተጠቀሰውን ህብረ ጤና ችግሮች ተጋላጭ እንዲሆኑ የሚያደርጉባቸውን ምክንያቶችንም ሆነ ችግሮቹን የመከላከልን የመከላከልን ሂደት በተመለከተ ያለዎት አመለካከት ምንድን ነው? ለምን እንዲህ ሊሆን ይችላል? ትኩረት የሚሻ ጉዳይ ነው? ለምን እንዲህ ሊሆን ይችላል? ለምን አልቻልንም ? ሊያሳስብዎ/ሊያስጨንቅዎ ይገባል?
- **የሚያስችል/የማያስችል፡** ከላይ የተጠቀሰውን ህብረ ጤና ችግሮች ተጋላጭ እንዲሆኑ የሚያደርጉባቸውን ምክንያቶችንም ሆነ ችግሮቹን የመከላከልን የመከላከልን ሂደት በተመለከተ እርስዎ አሁን ያለዎትን አመለካከት(ጥሩም ሆነ መጥፎ) እንዲኖርዎ ያስቻልዎት እነማን ናቸው ዋይም ምንድን ናቸው ነው? እንዴት? እስከምን ድረስ? ለምን
- **እገዛ፡** ከላይ የተጠቀሰውን ህብረ ጤና ችግሮች ተጋላጭ እንዲሆኑ የሚያደርጉባቸውን ምክንያቶችንም ሆነ ችግሮቹን የመከላከልን የመከላከልን ሂደት በተመለከተ እገዛ የደረጉልዎ እነማን ናቸው ምንድናቸው? እንዴት? ለምን ?

1.3. ተግባር

- **እውቀት፤እምነት፤እሴት፡** ከላይ የተጠቀሰውን ህብረ ጤና ችግሮች ተጋላጭ እንዲሆኑ የሚያደርጉባቸውን ምክንያቶችንም ሆነ ችግሩን ከመከላከል አንፃር የአመጋገብ ልማድ ፤ እስፓርታዊ እንቅስቃሴ የማድረግ ልማድ፤ እና ሌሎች መጥፎ ልማዶችን ከመከወን መቆጠብ ያላቸውን ሚናን በተለከተ እምነትዎ ምን ይመስላል? ከላይ የተጠቀሰውን ህብረ ጤና ችግሮች ተጋላጭ እንዲሆኑ የሚያደርጉባቸውን ምክንያቶችንም ሆነ ችግሩን ከመከላከል አንፃር የአመጋገብ ልማድ ፤ እስፓርታዊ እንቅስቃሴ የማድረግ ልማድ፤ እና ሌሎች መጥፎ ልማዶችን ከመከወን መቆጠብ ያላቸውን ሚናን በተለከተ እምነትዎ ምን ይመስላል?
- **የሚያስችል፡** ከላይ የተጠቀሰውን ህብረ ጤና ችግሮች ተጋላጭ እንዲሆኑ የሚያደርጉባቸውን ምክንያቶችንም ሆነ ችግሩን ከመከላከል አንፃር የአመጋገብ ልማድን ማስተካከል ፤ እስፓርታዊ እንቅስቃሴ የማድረግ ልማድን ማዳበር ፤ እና ሌሎች መጥፎ ልማዶችን ከማድረግ መቆጠብ ላይ ትኩረት ሰጥተው እንዲያከናውኑ በህዎትዎ ተነሳሽነቱ እንዲኖርዎ ያስቻልዎ/የረዳዎት ምንድን ነው ? ከላይ የተጠቀሰውን ህብረ ጤና ችግሮች ተጋላጭ እንዲሆኑ የሚያደርጉባቸውን ምክንያቶችንም ሆነ ችግሩን ከመከላከል አንፃር የአመጋገብ ልማድን ማስተካከል ፤ እስፓርታዊ እንቅስቃሴ የማድረግ ልማድን ማዳበር ፤ እና ሌሎች መጥፎ ልማዶችን ከማድረግ መቆጠብ ላይ ትኩረት ሰጥተው እንዲያከናውኑ በህዎትዎ ተነሳሽነቱ እንዳይኖርዎ ያደረገው እንቅፋት የሆነበዎት ምንድን ነው ?
- **እገዛ፡** ከላይ የተጠቀሰውን ህብረ ጤና ችግሮች ተጋላጭ እንዲሆኑ የሚያደርጉባቸውን ምክንያቶችንም ሆነ ችግሩን ከመከላከል አንፃር የአመጋገብ ልማድን ማስተካከል ፤ እስፓርታዊ እንቅስቃሴ የማድረግ ልማድን ማዳበር ፤ እና ሌሎች መጥፎ ልማዶችን ከማድረግ መቆጠብ ላይ ትኩረት ሰጥተው እንዲያከናውኑ ከማድረግ አንፃር በቤተሰብዎ፤ ዘመድዎ ብሎም ማህበረሰቡ ተፅኖ ምን ያክል ይሆናል?

2. ከድርጊት ጋር የተያያዙ ባሪትን የተመለከቱ

2.1. እውቀት

- **በጎ/ጥሩ ፡** በእነግሊዘኛው አጠራር (ሚታቦሊክ ሲንደሮም) ጋር ተያይዞ በቆይታ ለከሰቱ የሚችሉ ችግሮችንም ሆነ የችግሮቹ አጋላጮች ከማከላከል አንፃር ምን ዓነት በጎ/ጠቃሚ እውቀት አለዎት?
- **ጎጂ ያልሆነ ግን የግድ ጠቃሚ ያልሆኑ፡** ከላይ የተጠቀሰውን ህብረ ጤና ችግሮች ተጋላጭ እንዲሆኑ የሚያደርጉባቸውን ምክንያቶችንም ሆነ ችግሩን ከመከላከል አንፃር ምን ዓነት ጎጂ ያልሆነ ግን የግድ ጠቃሚ ያልሆኑ፡ እውቀት አለዎት?
- **ጎጂ ፡** ከላይ የተጠቀሰውን ህብረ ጤና ችግሮች ተጋላጭ እንዲሆኑ የሚያደርጉባቸውን ምክንያቶችንም ሆነ ችግሩን ከመከላከል አንፃር ምን ዓነት ጎጂ እውቀት አለዎት?

2.2. አመለካከት

- **በጎ/ጥሩ ፡** በእነግሊዘኛው አጠራር (ሚታቦሊክ ሲንደሮም) ጋር ተያይዞ በቆይታ ለከሰቱ የሚችሉ ችግሮችንም ሆነ የችግሮቹ አጋላጮች ከማከላከል አንፃር ምን ዓነት በጎ/ጠቃሚ አመለካከት አለዎት?
- **ጎጂ ያልሆነ ግን የግድ ጠቃሚ ያልሆኑ፡** ከላይ የተጠቀሰውን ህብረ ጤና ችግሮች ተጋላጭ እንዲሆኑ የሚያደርጉባቸውን ምክንያቶችንም ሆነ ችግሩን ከመከላከል አንፃር ምን ዓነት ጎጂ ያልሆነ ግን የግድ ጠቃሚ ያልሆኑ፡ እምነት አለዎት?
- **ጎጂ ፡** ከላይ የተጠቀሰውን ህብረ ጤና ችግሮች ተጋላጭ እንዲሆኑ የሚያደርጉባቸውን ምክንያቶችንም ሆነ ችግሩን ከመከላከል አንፃር ምን ዓነት ጎጂ እምነት አለዎት?

2.3. ተግባር

- **በጎ/ጥሩ ፡** በእነግሊዘኛው አጠራር (ሚታቦሊክ ሲንደሮም) ጋር ተያይዞ በቆይታ ለከሰቱ የሚችሉ ችግሮችንም ሆነ የችግሮቹ አጋላጮች ከማከላከል ብሎም ከመቀነስ አንፃር ምን ዓይነት በጎ/ጠቃሚ ተግባራትን እያከናወኑ ይገኛሉ?

- **ጎጂ ያልሆነ ግን የግድ ጠቃሚ ያልሆኑ፡** ከላይ የተጠቀሰውን ህብረ ጤና ችግሮች ተጋላጭ እንዲሆኑ የሚያደርጉባቸውን ምክንያቶችንም ሆነ ችግሩን ከመከላከል አንፃር ምን ዓነት ጎጂ ያልሆነ ግን የግድ ጠቃሚ ያልሆኑ፡ ተግባራቶችን እያከናወኑ ይገኛሉ?
- **ጎጂ፡** ከላይ የተጠቀሰውን ህብረ ጤና ችግሮች ተጋላጭ እንዲሆኑ የሚያደርጉባቸውን ምክንያቶችንም ሆነ ችግሩን ከመከላከል አንፃር ምን ዓነት ጎጂ ተግባራቶችን እያከናወኑ ይገኛሉ?

Annex 14: Different picture of the data collection methods and materials

1. Picture of study sites



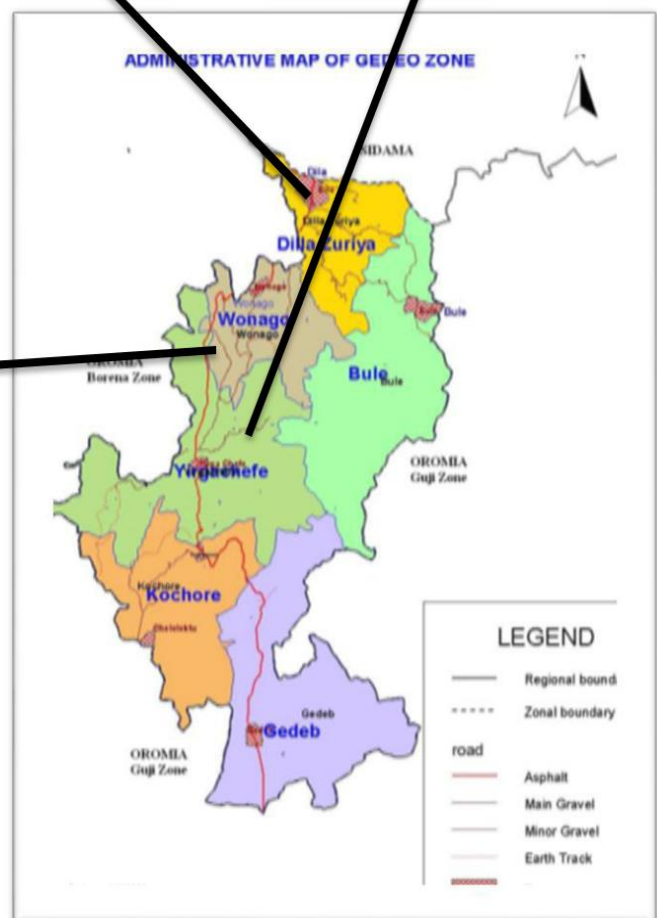
Picture of Dilla University Referral hospital



Picture of Yirga-Chaffe primary hospital



Picture of Wonago HC



Administrative MAP of Gede zone

2. Picture of data collection instruments



NUTEC Automatic digital blood pressure measurement apparatus



Secca 220 Height and weight measurement apparatus



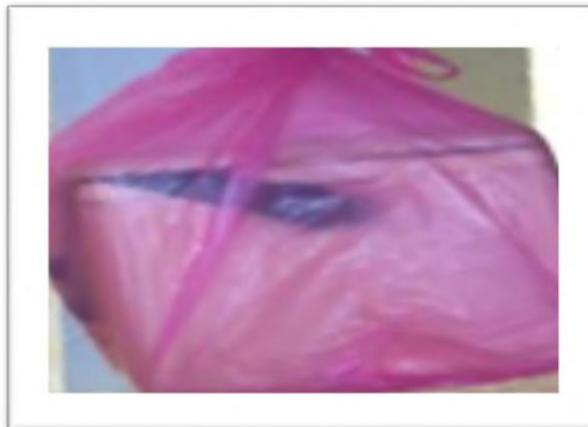
Centrifuge machine



Mindray BS-200E blood chemistry analyzer machine

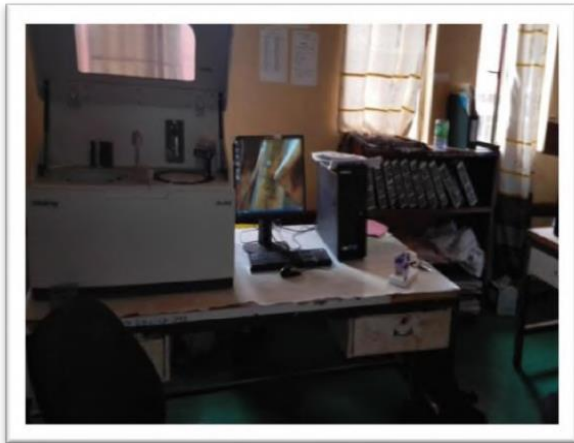


SS-Tube for blood sample collections



Cold-box for blood serum sample transportation

3. Picture representing quantitative data collection events



Picture of centralized biochemistry laboratory unit in DURH



Sample picture on site training provided in DURH



Picture of serum sample centrifugation



Sample Picture of serum sample carrying



Sample Picture of serum sample transportation



Sample picture of supervision of data collection sites

4. Picture representing qualitative data collection events



Picture of DURH site



Picture of Wonago HC site



Picture of focus group discussion
among male groups in DURH



Picture of focus group discussion
made among female groups in
Wonago HC

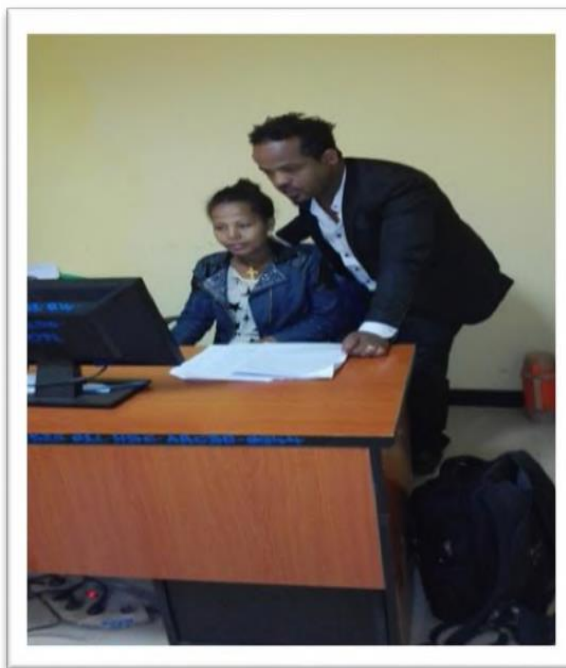


Picture of in-depth interview with the
late comer female individual in DURH



Picture of in-depth interview with the
Latecomer male individual in DURH

5. Picture of research team and data encoder



Picture of data encoder with the main author



**Picture of research team members the main author
in the middle**

13. Declaration form

I, the undersigned, declare that this is my original work, has never been presented in this or any other University, and that all the resources and materials used for the dissertation, have been fully acknowledged.

Name _____

Signature _____

Date _____

Place _____

Date of submission _____

This dissertation has been submitted for examination with my approval as University supervisor.

Supervisor (Primary) name: _____

Signature: _____

Date: _____

Supervisor (secondary) name: _____

Signature: _____

Date: _____