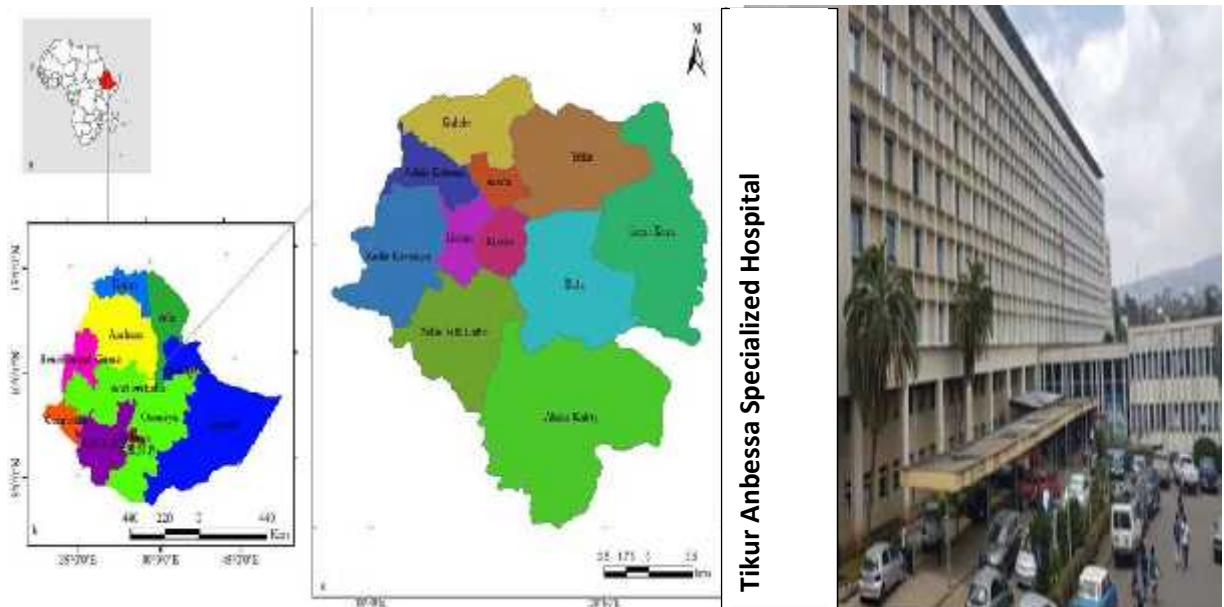




CARDIOVASCULAR DISEASE RISK REDUCTION BEHAVIORS, KNOWLEDGE AND RISK PERCEPTION OF ADULT HYPERTENSIVES IN ADDIS ABABA

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**Dissertation for the Degree of Doctor of Philosophy (PhD) in Nursing, Addis
Ababa University-Emory University PhD Collaboration Program, Addis
Ababa, Ethiopia**

March 2023



**ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES**

**CARDIOVASCULAR DISEASE RISK REDUCTION
BEHAVIORS,
KNOWLEDGE AND RISK PERCEPTION OF ADULT
HYPERTENSIVE PATIENTS IN ADDIS ABABA, ETHIOPIA**

**A Dissertation submitted to the School of Graduate Studies of Addis Ababa
University in Partial Fulfillment of the Requirements for the Degree of Doctor
of Philosophy (Ph. D.) in Nursing**

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March 2023

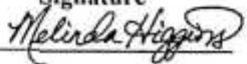
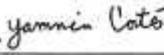
Dissertation Approval
Addis Ababa University
School of Graduate Studies

**Dissertation title: Cardiovascular Disease Risk Reduction Behaviors,
Knowledge and Risk Perception of Adult Hypertensives in Addis Ababa,
Ethiopia**

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1. **Low subjective cardiovascular disease risk perceptions among hypertensive patients in Addis Ababa, Ethiopia. Dovepress: Integrated Blood Pressure Control 2022:15 81–96**
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2. **Low cardiovascular risk reduction behaviors among hypertensives attending follow-up care at a tertiary level hospital in Addis Ababa, Ethiopia. International Journal for Research in Health Sciences And Nursing; Green Publication. ISSN: 2208-2670 Volume-8 | Issue-11 | Nov, 2022.**
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Abbreviations and Acronyms

AA: Addis Ababa
AAU: Addis Ababa University
ABCD: Attitudes and Beliefs about Cardiovascular Disease
AMI: Acute myocardial infarction
BMI: Body mass index
BMJ: British Medical Journal
BP: Blood pressure
CARRF-KL: Cardiovascular risk factor-knowledge
SCD: Sudden cardiac death
CDC: Center for international disease classification
CHD: Coronary heart disease
CI: Confidence interval
c-RP: c-reactive protein
CSA: Central Statistical Agency
CV: Cardiovascular
CVD: Cardiovascular disease
DASH: Diet appropriate to stop hypertension
DBP: Diastolic blood pressure
EU: Emory University
ESRD: End-stage renal disease
FBG: Fasting blood glucose
FRS: Framingham risk score
HBM: Health belief model
HDL-c: High density lipoprotein cholesterol
HF: Heart failure
HICs: High income countries
HMICs: High- and middle-income countries
HTN: Hypertension
IHD: Ischemic heart disease
IL: Interleukin

Kg: kilogram
LDL-c: Low-density lipoprotein cholesterol
LICs: Low-income countries
LMICs: Low- and middle-income countries
MI: Myocardial infarction
mm Hg: Millimeter of mercury
MNLR: Multinomial logistic regression
NCDs: Non-communicable diseases
NEFA: Non-esterified fatty acid
NHANES: National health and nutrition examination survey
nl-FRS: nonlaboratory Framingham risk score
OR: Odds ratio
OOP: Out of pocket
PA: Physical activity
PHQ: Patient health questionnaire
PI: Principal investigator
PSS: Perceived stress scale
PVD: Peripheral vascular disease
RVI: Return visit interval
SBP: Systolic blood pressure
SCA: Sudden cardiac arrest
SES: Socio-economic status
SPSS: Statistical package for social sciences
SSA: Sub-Saharan Africa
SD: Standard deviation
TASH: Tikur Anbessa Specialized Hospital
TC: Total cholesterol
TIA: Transient ischemic attack
TG: Triglyceride
USA: United State of America
WHO: World Health Organization

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Abstract

Background: Adverse cardiovascular disease (CVD) outcomes among hypertensives are determined by several key patient factors such as knowledge, self-risk perception of CVD outcomes, and patients' risk reduction behaviors. Cardiovascular disease remains the leading cause of death and disabilities worldwide. Uncontrolled hypertension is a major and well-established risk factor for adverse CVD outcomes resulting in high morbidity and mortality. These outcomes could largely be prevented if the patients possess good working knowledge, accurate risk-perception, and consistently engage in risk reduction behaviors. However, despite the widely prevalent behavioral risks for adverse CVD outcomes among hypertensives in Ethiopia, the patients' risk reduction behavioral status, knowledge, and risk-perception are largely unknown. Therefore, the purpose of this study was to examine CVD risk reduction behaviors and their determinants among adult hypertensives.

Objective: The general objective of the study was to determine the status of CVD risk reduction behaviors and its associations with sociodemographic and clinical profiles, knowledge, and risk perception of adult hypertensives attending follow-up at a tertiary hospital in Addis Ababa, Ethiopia.

Method and Materials: A cross-sectional design was used. A sample of 384 hypertensives was selected using a systematic random sampling technique from the hypertension clinic registry. Epi data version 3.10 was used for managing the data, and SPSS version 25.0 was used for analysis. Descriptive statistics were used to determine participants' CVD risk reduction behavioral status. Bivariate chi-square tests and ordinal logistic regression analyses were run to identify variables associated with participants' ranked CVD risk reduction behavioral status at the p-value < .05 cutoff for statistical significance.

Result: Of the total of 384 study participants, 377 (98.18%) were included in the analysis. The mean age ($\pm$ SD) was 53.61 ± 12.80 -year, range (30-82 years), 51.2% were males, Three-fourths (75.3%) were married, and 42.7% had less than high school education. The mean ($\pm$ SD) duration of HTN was 8.01 ± 6.07 years. Nearly three-quarters (72.1%) of them were attending bi-monthly follow-up care for HTN. Less than half (45.1%) achieved target BP control.

Fewer than half (58.62%) of the participants had adequate knowledge of CVD risk factors (mean [$\pm$ SD], 19.92 ± 3.40 , range: 7-26). The majority (58.62%) of the participants had a low subjective risk perception of CVD events. Approximately three-fourths (72.4%) had a moderate nl-FRS 10 year CVD risk estimated. Agreement between participants perceived-risk and the nl-FRS was poor ($\kappa = 0.0002$, standard error = 0.023, $p = 0.99$) with a high (76%) CVD risk-perception inaccuracy primarily due to underestimation. The majority (56.5%) of them were at low CV risk reduction practices. The absence of comorbidities ($p < .001$), clinic visits every 3 months for hypertension ($p = .041$), normal body mass index ($p = .008$), hypertension duration of 5–9 years ($p = .034$), and young age adults ($p = .041$) were the characteristics statistically significantly associated with the high CVD risk reduction practice.

Conclusion: Participants' CVD risk reduction practice was low with a variety of unmanaged risk factors and few cardioprotective behaviors. The absence of co-morbidities, maintaining a healthy weight, having HTN for 5–9 years, scheduled clinic visits every three months, and being a young adult were predictive of high-risk reduction behaviors. Target blood pressure control was lower, particularly among overweight and obese hypertensives, and with comorbid diabetes and chronic kidney disease. Although about half of participants had adequate knowledge of CVD risk factors most had inaccurate and low subjective risk perceptions of CVD events compared to moderate objective risks identified using the nl-FRS. Planned education on HTN and CVD risk factors is essential to improve patients' CVD risk perception and behavioral adoption to reduce adverse CVD events.

Keywords: Hypertension, blood pressure control, clinical profile, comorbidity, body mass index, risk perception.

CHAPTER I: STATEMENT OF THE PROBLEM

1.1. Background

Adverse cardiovascular disease (CVD) outcomes such as stroke and acute myocardial infarction (AMI) are serious and often life-threatening occurrences related to uncontrolled hypertension (HTN). Cardiovascular diseases encompass HTN, coronary heart diseases (CHD), stroke, and peripheral vascular diseases (PVD). Cardiovascular disease is the major contributor to non-communicable diseases (NCDs) and remains the single largest cause of death and disabilities worldwide with over 17 million deaths each year, representing nearly 30% of all deaths and 10% of the global disease burden (GDB), and this figure is projected to rise to over 23 million by 2030 (1–4). Over 80% of these deaths occur in low and middle income countries (LMIC) (3,5,6). Of the 17 million CVD worldwide deaths each year, HTN is estimated to cause 9.54 million deaths, which accounts for 13% of the total of all deaths (4,6–8). Hypertension is the strongest contributor of adverse CVD outcomes (such as stroke, CHD, heart failure [HF], end-stage renal disease [ESRD], PVD, and vision impairment) (9–15). Of the major CV events; 51% and 45% of stroke and CHD deaths, respectively, occurred due to HTN (6). The prevalence of HTN has remained high and approximately 30% of the world adult population live with HTN currently (16). According to the Framingham Heart Study individuals with a normal BP at the age of 55 years (men) and 65 years (women) have a 90% life time risk for developing HTN (17), which suggests that there will be an increase in the number of persons with hypertension and with improving longevity an increase in the number of elderly adults at risk for adverse CVD outcomes.

While there were downward trends of 12% in CVD mortality in most affluent nations, the mortality trends in LMICs have spiked to an epidemic from the 4th leading risk factor in 1990 to the top leading risk factor in 2019 and as a result, have imposed a huge disease burden (3,18,19). In fact, the mortality associated with CVD was much higher in LICs than high and middle income countries (HMICs) (6.43 events vs 3.99 per 1000 persons-years, respectively; $p < 0.001$) (20).

Epidemiological and pathophysiological studies have identified several well-established non-modifiable and modifiable risk factors contributing to CVD. The four characteristically modifiable individual behavioral risk factors: physical inactivity, tobacco use, unhealthy diet, and heavy alcohol use explain 80% or greater of the CVD burden. These risk factors can also lead to four major risk factors including overweight/obesity, high BP, raised blood sugar and raised blood

lipids (3,21). In addition, CVD can be caused from the interplay of complex and multi-factorial reasons, and include an individuals' non-modifiable risk factors, physiological, and socioeconomic status.

In Sub-Saharan Africa (SSA), CVD is the most rapidly growing non-communicable disease (NCD) (22–24) and accounted for more than 38% of the NCD deaths or more than 10% of all deaths, and is anticipated to escalate in the future (25). HTN, that currently affects over 20 million people in SSA, is the leading CVD risk factor and is the most common reason for hospitalizations with poor clinical outcomes (5,6,26,27).

In Ethiopia, the magnitude of CVD risk factors is already considerable. Behavioral risk factors of CVDs such as excessive alcohol consumption, unhealthy diet and physical inactivity are prevalent in the Ethiopian population (28). The prevalence of HTN is estimated to be between 13–30% (28–31) and is directly linked to higher CVD morbidity and mortality (23,27,32,33). Even though there is a dearth of CVD mortality records in Ethiopia, a study conducted in Addis Ababa (AA) showed that CVD emergencies accounted for 11% of all medical emergency admissions to specialized hospitals with a 25% mortality outcome (27). Similarly, 24% of the 51% NCD deaths that occurred in the past decade in adults ≥ 20 years in AA were CVD deaths (33). Furthermore, among persons diagnosed with HTN in Ethiopia, up to 40% were reportedly non-adherent to pharmacological therapy and in some studies up to 80% had uncontrolled blood pressure (BP) (34–36) indicating a high risk for adverse CVD outcomes. Among hypertensive adults in the Addis Ababa population, only one third were aware of their BP measurements and only 15 % of them were receiving antihypertensive treatment (28).

Ethiopia is demonstrating a steady shift and a declining pattern from causes of death due to communicable diseases and maternal, prenatal and nutrition conditions from 69% in 2000 (37) to 60% as the WHO estimate of 2000–2012 (32) and a rising epidemic of NCDs. According to the WHO (2014) NCD countries profile, NCDs accounted for 30% total deaths in Ethiopia of which CVDs accounted for 9% of the deaths (32). In Addis Ababa, NCDs has already become the leading cause of adult deaths and accounted for 51% of total deaths of with CV deaths accounted for 24% with most of the deaths occurred in young and middle age adults (33). However, HTN was the leading risk factor and associated with most of the CV deaths (38) indicating that with the rise of CVD that the country has continued to bear the double disease burden (39,40).

1.1.1. Behavioral risk factors

Individuals who adopted healthy behavioral practices (such as high BP control, body weight control, regular physical activity, heart healthy diet, moderation of alcohol, smoke cessation, and stress management) were effective in reducing adverse CVD outcomes (41). Accumulating evidence however, reveals a wide prevalence of risk factors and unsatisfactory CVD outcomes risk reduction behavioral practices among hypertensives in Africa and other developing countries (23,42–45). Similarly, studies of healthy lifestyle behaviors among survivors of CVD events such as CHD or stroke across a number of countries worldwide found low levels of risk reduction behavior and was lower in patients from poor countries (46).

Behavioral risks for adverse CVD outcomes are widely prevalent among hypertensives in Ethiopia (35,44,47,48) and patients' risk reduction behaviors are largely unknown in Ethiopia. Various factors are known to influence behavioral practices in hypertensives including knowledge and awareness of CVD, medication side effects (45,49,50), health insurance (51,52), demographic and clinical characteristics (53,54), socioeconomic status (SES) (55), attendance to scheduled appointments (52), perceptions of risk (52,56,57), and sources of cues for behavioral actions (45,58).

1.1.2. Knowledge of CVD

Evidence shows that effective and tight BP control was positively correlated with the patients' CVD knowledge level (45,59), and a major contributing factor for CVD clinical outcomes. In contrast, hypertensives with uncontrolled BP were found to suffer from a greater number of co-morbidities which have a large negative effect on clinical outcomes (45,60). The few studies conducted in Ethiopia show that hypertensives had inadequate knowledge of CVD (61–64) and were not aware of potential complications (61). Some studies in Ethiopia reported that having higher knowledge of CVD was significantly associated with adherence to recommended treatment of HTN (AOR=6.21, 95% CI: 3.22, 11.97; AOR=8.86, 95% CI:4.67,16.86) (36,64). Similarly, studies of hypertensives regarding CVD knowledge in Africa have illustrated that a significant number of patients had low level of knowledge and awareness about CVD and its outcomes (50,65–67). Poor knowledge of CVD and its consequences was recognized as one of the patient-related barriers for HTN control in Africa (67) although one study found a lack of association between CVD risk factors and CVD knowledge (68). Studies have also

reported that a low level of CVD knowledge was associated with a low educational level and lack of health literacy (66,69).

1.1.3. Risk perception

Studies of self-risk perception of CVD outcomes among hypertensives are currently non-existent in Ethiopia. There is also paucity of research on CVD risk perception in Africa. However, a study by Ajayi (2007) in Nigeria showed poor perception of stroke among the at the risk hypertensives (70). Similarly, several studies reported that hypertensives often had inadequate risk perception of even fatal CVD outcomes (such as stroke, CHD and HF) (71–73). Moreover, risk perception studies demonstrated discrepancies between patients' perceived risk of CVD and their calculated FRS, which showed a greater likelihood of underestimating the risk of adverse CVD outcomes (74,75). Some studies also suggest that risk perception is associated with sociodemographic characteristics such as age and sex, as well as their clinical characteristics (41,70,76). Evidence also indicates that hypertensives who were not concerned about their stroke risk were significantly less likely to be concerned about BP control (73) indicating a greater behavioral risk for adverse CVD outcomes. Despite the higher stroke mortality for women than men (76,77), women who had a higher number of risk factors were more likely to underestimate their risk for CVD outcomes (78). These patients' perceptions could also add to the already existed compounding problem of secondary prevention of CVDs (early detection and treatment) and hinder behavioral adoptions for the control of high BP resulting in a higher CVD mortality rate.

1.2. Significance of the study

Essential HTN is incurable and requires life-time pharmacological and lifestyle management. To prevent or avoid adverse CVD outcomes in individuals with established risk factors such as HTN, adoption of a healthy lifestyle is essential and necessitates patients have a working knowledge and a good self-risk perception of CVD outcomes.

In Ethiopia, the few studies that have examined knowledge of CVD complications reported inconsistent and inadequate knowledge and awareness of the necessary lifestyle modifications to reduce risks of adverse outcomes (62,63,79,80) and that knowledge was a predictor for adherence to recommended therapies (44,64). However, to our knowledge no study has examined self-risk perception of CVD outcomes among hypertensive adults using predictive tools such as the FRS. The FRS is predictive of future adverse CVD outcomes but its ability to estimate risks are largely

unknown in Ethiopia. In addition, little evidence exists concerning CVD risk reduction behaviors among hypertensives in Ethiopia and in SSA.

For the first time, the 2016 Ethiopian National Guidelines on major NCDs provided evidence-based guidelines on the management of HTN. Primary prevention such as lifestyle modifications are recommended for those with risk factors but who have not developed clinical manifestations of CVD. Among those with established CVD, a target BP goal of <140/90 mmHg is recommended using a combination of lifestyle and pharmacological management (81). To implement these guidelines effectively, it is essential that self-care behaviors extend beyond medication knowledge but also lifestyle behaviors (82). In Ethiopia, no study has examined the relationships among knowledge of CVD, self-risk perceptions and CVD risk reduction behaviors in the hypertensive population. This study will fill an important void in the literature by examining the CVD outcome risk reduction behaviors of hypertensives receiving care in local clinics in Addis Ababa. Specifically, the study will provide critical information on CVD risk factor knowledge, self-risk perception of CVD outcomes and their risk reduction behaviors. Findings from this study have the potential to be highly significant for guiding future interventions to reduce the growing adverse CVD outcomes related to HTN. Furthermore, from a broader perspective, knowledge gleaned from this study has the potential to impact HTN management and policy development for reducing CVD morbidity and mortality at a national level.

1.3. Research Question

Main Research Question: What are the relationships among the CVD risk reduction behaviors, knowledge, and self-risk perception of CVD outcome among hypertensive patients attending CV follow ups at tertiary hospital in Addis Ababa?

1.4. Research objective

General objective:

The general objective of the study was to determine the associations among CVD outcome risk reduction behavior, knowledge and risk perception of adult hypertensive patients attending CV follow ups at tertiary hospital in Addis Ababa.

Specific objectives were to:

1. Describe the demographic and clinical characteristic of adult hypertensive patients attending CV follow ups at tertiary hospital in Addis Ababa.

2. Determine the knowledge of CVD risk of adult hypertensive patients attending CV follow ups at tertiary hospital in Addis Ababa.
3. Compare the perceived and actual 10-years risk of CVD outcomes of adult hypertensive patients attending CV follow ups at tertiary hospital in Addis Ababa using the FRS.
4. Determine the status of CVD outcome risk reduction behavioral of adult hypertensive patients attending CV follow ups at tertiary hospital in Addis Ababa.
5. Determine the associations among CVD outcome risk reduction behaviors status, and demographic and clinical profiles, knowledge, and risk perception scores of adult hypertensive patients attending CV follow ups at in tertiary hospital Addis Ababa.

CHAPTER II: REVIEW OF THE LITERATURE

This chapter includes a review of the literature related to study variables and concepts. The review of the literature in this study are organized as knowledge of CVD risk factors, self-risk perception of CVD outcomes, and CVD risk reduction behaviors of adult hypertensive patients.

2.1. Knowledge of Cardiovascular Disease Risks

Application of knowledge is vital in shaping an individuals' behavior and ability to deal with problems in life. Knowledge is a base to perceive ourselves and the world in which we live. Knowledgeable patients have power to judge their own situations and remain more autonomous in making decisions concerning their health. In this research, it is deemed as utmost priority of importance to determine the knowledge of CVD risk among hypertensive adults residing in Addis Ababa, Ethiopia through which their self-risk perception and risk reduction behaviors will also be mirrored.

Several studies conducted in Ethiopia showed that hypertensive patients had inadequate knowledge about CVD as only 52% - 78% of the patients had good knowledge (62–64,79) and only about half (52%, n=60) (63) and 59% (n=130) (62) of hypertensive patients knew normal BP level. Knowledge of susceptibility to complications of HTN was also inadequate (61). Knowledge was significantly associated with adherence to recommended therapies (36,80,83). Similarly, studies of hypertensive patients about CVD knowledge in many African countries have found that a significant number of patients had low levels of knowledge and awareness about CVD and its outcomes (45,50,66,67,84,85). For example, a study conducted on 101 hypertensive patients by Abd EL-Hay and Mezayen (2015) in Egypt regarding the knowledge about risk factors for CVD found that only 62%, 54%, and 82% of the patients were aware of family history, smoking, and excess salt intake, respectively, as risk factors. This study also found that 43%, 52%, and 63% of the patients did not know that overweight, inactivity and stress, respectively, as risk factors. And yet 42%, 66%, and 93% were not aware of older age, drinking alcohol, and some drugs, respectively as risk factor for CVD. Furthermore, only 13% of them had a good level of knowledge of the symptoms and complications of HTN and the remaining 67% and 20% of them had fair and poor knowledge, respectively. Almost all (99%) of the patients didn't know that high cholesterol was a risk factor for CVD (50) though evidence suggested that hypercholesterolemia ≥ 250 mg/dl

was associated with poor BP control (86). However, in a study by Holdsworth et al. (2006) in Senegal over two-thirds of participants knew high blood cholesterol level was a risk factor for CVD (87). Patients of low education and health literacy were also found to lack knowledge about CVD risk factors (50)

A study conducted by Iyalomhe and Iyalomhe (2010) in Nigeria among 108 hypertensive patients found that only 61% knew HTN to be high BP and only 53% claimed HTN was hereditary, while 42% knew some of the risk factors such as excessive alcohol consumption, smoking or obesity. Although, the majority (91%) were aware of its dangerous complications (such as stroke), only 10% knew HTN was asymptomatic disease. Furthermore, about 70% thought HTN was curable which meant cessation of pharmacological management. However, 46% were aware that HTN requires lifetime treatment to be controlled (85). Low educational status was the main reason for low HTN knowledge. However, Uchenna et al's. (2012) study of the awareness of heart disease prevention among patients attending a specialist clinic in Nigeria found that there was no significant difference between level of education of respondents and awareness of heart disease ($p=0.561$) or education on heart disease prevention. ($p=0.251$) There was also no significant gender difference in the awareness of heart disease prevention ($p=0.650$) (88).

Similarly, a study of HTN knowledge and its management among 253 hypertensive patients by Rampamba et al. (2017) in South Africa showed that only 19% of the patients knew normal BP levels, however the majority of patients had high level of knowledge about lifestyle modifications such as exercise (96%), the dangerous effect of alcohol (95%), the dangerous effect of smoking (96%), that HTN is a serious disease (87%), that uncontrolled high BP could end up with dangerous outcomes (90%). In contrast, lifestyle factors known to help control BP varied in response rates with only 51% being aware of reduced salt intake, 31% stress reduction, 10% eating adequate amounts of vegetables, and 21% identified adequate amounts of exercise (66). The study also found a higher rate of uncontrolled HTN among the illiterate which is a consistent finding across populations in general.

Studies demonstrate that adequate knowledge of CVD contributes to successful control of high BP and reduces adverse CVD outcomes (89–91). Accumulating evidence consistently indicates that effective HTN control is positively linked to the knowledge level of patients, where as poor BP control was strongly correlated with lack of knowledge about the target BP goal (89–91).

Studies of hypertensive patients' knowledge revealed low levels of knowledge and awareness of CVD risk were related to negative behavioral practices (58,92–94), including no differences in knowledge level among hypertensive patients with and without a history of MI (92). Although patients with a prior MI did report a higher family history of CVD, it was unclear whether they knew family history was a known risk factor for CVD (92). Similarly, being at high risk for adverse CVD outcomes, patients with history of CHD also had a lack of knowledge about CVD risk factors and targeted BP control (90).

Miglares et al. (2007) reported that older patients who survived an AMI had significantly (57% vs. 66%, $p < 0.009$) less knowledge about lifestyle modifications to prevent CVD than younger age adults. The same investigators also reported that having a MI at a younger age was associated with low educational attainment and was more prevalent among lower SES participants (92). However, a meta-analysis finding conflicts with Miglares et al.'s findings and reported better knowledge of HTN among older age adults (65). A study of the knowledge of risk factors by Zafar et al. (2008) showed that more than 70% of hypertensive patients knew that stress, obesity, excess salt intake, smoking and sedentary life were CV risks. While a similar proportion (>70%) of their counterparts were able to identify only stress, obesity, and excess salt intake as risk factors. However, both the hypertensive and their counterpart groups lacked knowledge of non-modifiable risks and excess alcohol intake and a co-morbidity of diabetes as CV risk factors. Although participants were aware of major CVD outcomes like stroke and HF, most of them lacked the knowledge of other major complications of the uncontrolled HTN such as renal failure, atherosclerosis, and vision impairment (59).

A study conducted in Kenya reported compelling findings of much higher and more serious CVD events (stroke and/or CHD) occurring in much younger (in the age range of 36-50 years) hypertensive patients who had predominantly low/no formal education. Notably, approximately 40% of these patients were unaware of the link between HTN as a risk for CVD (95). Similar studies also reported that low levels of CVD knowledge was more commonly associated with low educational levels (66,69). In addition, patients who were lower in SES had a poorer understanding of the causes of both HTN and increased cholesterol level (71), which was thought to be due to lower education level.

Although there is strong evidence that knowledge is the first crucial step for adoption of risk reduction behaviors, there is also conflicting evidence. For example, among 74% (n=5000) of

individuals who knew smoking was a CVD risk, 65% of them continued smoking despite this knowledge. (93). This indicates that having a high knowledge level alone couldn't be a grant for adoptions of a healthy behavior.

Sabouhi et al. (2011) conducted a cross-sectional, correlation-descriptive study of knowledge, awareness, attitudes and practice about hypertension using a questionnaire developed by the researcher among 234 hypertensive patients attending public health care centers in Isfahan, Iran. Findings showed that although the overwhelming majority (85%) acknowledged the importance of keeping SBP under control, less than half (49%) had moderate knowledge. Fewer than 25% of the patients were aware of the asymptomatic nature of HTN. Less than half (42%) of the respondents were aware of the importance of dietary intake for effective BP control. Only 40% acknowledged that HTN may be hereditary. Approximately 42% indicated that HTN is related to advanced age. Regarding the behavioral control of HTN such as: lowering stress level (64%), healthy diet (62%), quitting smoking (58%), losing weight (55%) and doing physical exercise (46%) of patients knew the importance of such measures. The study observed no significant relationship between knowledge and behavior. However, there was a significant relationship between knowledge score and age ($p = 0.002$). In addition, a significant relationship was observed between length of HTN, knowledge and the behavioral practice score ($p < 0.05$). Although there was no significant relationship between educational level and behavioral practice score ($p = 0.001$), there was a significant relationship between the knowledge score and respondents' educational level ($p < 0.05$). In addition, the study found no statistically significant difference between men and women's knowledge or behavioral practice scores ($p > 0.05$) (96).

A study conducted by Mugure et al. (2014) on correlates for cardiovascular diseases among 206 diabetic/hypertensive patients attending outreach clinics in Nairobi reported that regardless of positive medication taking behavior (78%), only 47% of them knew the link between diabetes and CVD. Study findings indicated that CVD risks were present in the majority (78%) of participants who were consuming salty foods and 38% of them were not aware that diabetes and hypertension are preventable.

Studies examining knowledge of CVD behavioral risk factors among hypertensive patients report variation in levels of knowledge. Two-thirds ($N=319$) of hypertensive patients in one study had knowledge of HTN, but only about 20% were aware of the risk factors with consumption of fatty foods and stress, the most commonly reported (97). However, many studies reported that

most (>60%) of hypertensive patients were aware that chronic salt intake was associated with HTN (98–100). Of this population-based study, the majority (88%) (N=301) of the participants also knew that obesity was a risk factor for CVD and 75% of them were aware that eating too much food could cause obesity. However, only about 55% and 60% of the respondents were aware of the contribution of sugary and fatty diets to obesity, respectively. Smoking was recognized by 74% of participants to be a risk factor to CVD (109). Despite the fact that obesity is associated with poor BP control, nearly 43% (N=101) did not know that being overweight is a risk for CVD (100). Regarding alcohol consumption, 66% of hypertensive adults were unaware it was a risk factor (100). More than 70% of heavy drinkers, both aware and unaware of hypertension were aware of alcohol's detrimental effect on health and the majority ($\geq 93\%$) of participants reported that smoking causes high BP (98). However, only 58% of hypertensive patients (N=101) were aware of smoking as a risk factor for HTN (100). Other studies showed that over one-third of physically inactive hypertensive patients failed to recognize their risk (71) and about half 52% (N=101) did not know that inactivity was a risk factor for developing HTN (100).

2.2. Self-Risk Perception of CVD Outcomes

Risk perception can be seen as an index of determinant of behavior and behavioral outcomes (such as adherence to recommended therapeutic/preventive measures and functional recovery). Furthermore, illness perception holds the identity component of the illness that entails name of the illness along with patients' beliefs of range of symptom experiences, cause of the illness, duration the illness, consequences that follow due to the illness/condition and locus of the illness control (101).

According to Botterill & Mazur (2004) risk refers to a “combination of the probability or frequency of occurrence of a defined hazard and the magnitude of the consequences of the occurrence.” (102). Risk perception is the primary and fundamental concept in the health belief model (HBM). However, studies have reported that hypertensives had inadequate risk perception of adverse CVD outcomes (72,103). For example, despite the high stroke mortality in women (76) their self-risk perception was low (76,77). In addition, studies demonstrated discrepancies between hypertensives perceived risk of CVD outcomes and their calculated FRS with higher numbers underestimating their risk and there was also less concern about BP control (73,104). Similarly, hypertensives with co-morbid diabetes who are at high risk for CVD events were unable

to provide any risk estimate (72). Studies also showed when smoking was the prevailing risk behavior two-thirds (N=2676) of hypertensive adults perceived the behavior harmful but only one-third had attempted to give up it (71). However, in one study slightly more than half (N=234) of hypertensives perceived HTN as a serious disease with only one-third showing concern about their high BP (105)

Aubert et al. (1998) reported that of 1067 hypertensives only 11% perceived their health as bad, and only 10% perceived themselves as less healthy than persons of their age and at risk for MI and stroke. The study also reported the lack of significant correlation between the perceived risk of stroke and the calculated risk of male hypertensives using the FRS (73).

Barnhart et al. (2009) conducted a study on coronary risk perception and its association with cardiac risk and health behaviors of 250 minority urban adults in New York. The result showed that risk perception was inversely associated with small-to-moderate effect sizes (106) with healthy eating behaviors and exercise ($r = -0.17$; $p = 0.007$ and $r = -0.19$; $p = 0.003$), respectively, which indicated participants' who had healthy behaviors (i.e., physically active, low-fat/high-fiber diet) perceived themselves to be at lower risk for CHD. The study also showed that participants' risk perception and their actual risk of CHD were significantly associated ($r = 0.22$; $p < 0.001$). Being male ($t = -2.7$; $p = 0.008$) and college educated ($t = 2.0$; $p = 0.04$) were associated with higher physical activity levels. The study also found that men exercised more often than women, and men with the lower risk perception scores exercised the most. However, men with higher risk perception scores had diets higher in fat or lower in fiber, compared to all others (107).

2.3. Cardiovascular Disease Outcome Risk Reduction Behaviors

Despite the enormous development in the area of drug treatment for CVD, patients' awareness of primary and secondary preventive measures for the reduction of known risk factors and healthy behavioral adoption among hypertensive adults are suboptimal (108). Goethe said that "Knowing is not enough; we must apply." And "Willing is not enough; we must do." (109,110). The necessity of workable prevention strategies demands specifically prioritizing to target the at-risk community groups if CVD and its adverse outcomes are to be prevented or deterred, especially in countries with few resources.

The Institute of Medicine's Committee on Preventing the Global Epidemic of CVD: Meeting the Challenges in Developing Countries recommended that actions needed to prevent and

treat CVD at individual levels are of paramount importance and that individuals should follow healthful nutrition, remain active throughout their lives, abstain from smoking, and attend health care regularly (110). Similarly, Struat-shor et al. (2012) emphasized the need to have a framework for addressing multiple behavioral changes that are fundamental for the prevention and reduction of CV risk factors including those mentioned above and the reduction and control of high BP, stress management, and improving national policies on SES through provision of education and employment opportunities (111).

Although the concept of risk reduction has been in existence since the time of Hippocrates (112), to optimize strategies to reduce the risk of adverse CVD outcomes using the recommended measures among at risk population requires broader recognition of the prevailing individual patient's behavior/ lifestyle risk reduction status (113). Accordingly, the reviews of literature are organized under the known CVD risk reduction measures.

2.3.1. Alcohol consumption and CVD

Accumulated scientific knowledge revealed both the beneficial effects and potential health harms related to alcohol intake. The link between alcohol consumption and its health consequences depends on the average volume and patterns of consumption (114). Although a small to moderate amount of alcohol intake may have a cardio-protective effect, there is strong evidence that alcohol unfavorably modulates the pathophysiological effect on existing CV risk factors (115). It was suggested that the cardio-protective effect of alcohol can be achieved with 1-2 drinks/day for men and one drink/day for women (116,117)

On the contrary, a higher average intake may have a negative effect on the heart and negative outcomes in many diseases (117). Though alcohol has the desired effect on the high density lipoprotein (HDL) cholesterol, it cannot hinder the transient postprandial decline in HDL-cholesterol, but a moderate amount of alcohol intake after evening meals has been recommended because it suppresses the potentially toxic non-esterified fatty acids (NEFA) and exhibits its cardio-protective effects (115). However, a study by Foss et al. (1995) showed that half of the excess alcohol users had signs of alcohol related CVD, but only 47% of them had attempted to quit drinking. In one study recently diagnosed hypertensive patients were more likely to recognize the risks associated with alcohol intake than patients with long history of use (71).

Several studies have reported greater alcohol consumption among male patients (71,118) and those with higher SES were found to be less likely to reduce their alcohol intake even if they

received advice to do so from a health professional (71). The lack of this behavioral termination could be due to the addictive nature of alcohol among chronic users. In fact, men with controlled BP were found to be lower alcohol consumers than those with poorly controlled BP, and the risk of poor BP control associated with alcohol use was statistically significant for consumption greater than 5g/day (OR=1.8, $p<0.004$) (with a small-to-moderate effect size) and increased with increasing consumption to greater than 30g/day ($p<0.001$) (86). In one study about 30% (N=319) of hypertensive adults were drinking alcohol regularly (97).

2.3.2. Diet, obesity, physical activity, and CVD

Diet and CVD

It is well recognized that a high consumption of fats (trans-fats and saturated fats), salt, processed carbohydrates and consumption of low servings of fruits and vegetables increases the risk of having CVD while polyunsaturated fats are known to have protective effects (119,120). However, accumulating evidence suggests several dietary strategies for both the prevention and reduction of adverse CVD outcomes. Some of these strategies are the Mediterranean diet that emphasize an increase consumption of fruits and vegetables, whole grains, and olive oil, with moderate intake of fish, seafood, dairy, and wine. Another is the Dietary Approaches to Stop Hypertension (DASH) plan that emphasizes high intake of fruits and vegetables, low-fat dairy products, whole grains, poultry, fish, and nuts, and low intake of total and saturated fat and cholesterol (116,121). The effect of such strategies when combined with other lifestyle practices such as physical activity has a greater influence on reducing CVD risk in hypertensive patients (121).

Approximately 1.7 million (2.8%) of deaths worldwide are attributed to low fruit and vegetable consumption (3). Three dietary habits with high intake of saturated fat, trans-fats and salt were linked to higher rates of CVD (3). On the contrary, elimination of trans and saturated fats and replacement with polyunsaturated vegetable oils and adequate consumption of fruit and vegetables were found to reduce the risk of CVD (3,121).

A healthy diet combined with other low-risk behavioral practices were more likely to reduce the risk for an acute MI (122). A meta-analysis of cohort studies by He et al. (2007) showed that increased consumption of fruits and vegetables were related to a reduced risk of CHD. Compared to those who had less than three servings of fruit and vegetables/day, having more than

five serving per day was related to a 15%-17% reduction in CHD risk (123,124). An increased intake of three-five serving/day was associated with a smaller and borderline significant reduction in CHD risk (7% reduction) (123).

A meta-analysis of prospective cohort studies showed that increased adherence to a Mediterranean diet reduced CVD outcomes (such as MI and stroke) and all-cause mortality (125). Similarly, according to Salehi et al's. (2010) meta-analysis of six cohort studies, adherence to DASH-like diet could significantly protect against overall CVD risk by 20% and CHD by 21% stroke by 19%, and HF risk by 29%. (126).

Large scale studies suggest specific benefits of dietary management for patients with HTN. Findings from a DASH clinical trial by Appel et al. (1997) confirmed BP reductions by 11.4/5.5 mm Hg in hypertensive and by 3.5/2.1 mm Hg in normotensive participants (127,128). Similarly, a randomized trial study reported BP reductions by 14.4/ 9.7 mmHg from using the DASH dietary approach in the experimental group, compared with 6.7/4.6 mmHg in the control group, respectively (129). The BP reading difference between the groups may be explained by the fact that hypertensive patients are more sensitive to dietary salts. A population based study of CV risk reduction behavior/ practice towards heart diseases reported that about 60% of participants attempted to reduce their consumption of unhealthy foods and 25% were willing to engage in higher physical activity levels to lose weight (58).

Salt and CVD

The amount of salt in naturally occurring food (such as meat, milk, fruits, and vegetables) is low, and human beings in the past had less salt intake (<1g/day) for several million years (130). However, modernization and advances in technologies that lead to more processed foods has resulted in an increasingly high consumption of salt rich foods. Processed foods use large amount of salt and over 75% of the daily salt intake comes from these foods (130). By the 19th century, the consumption of salt had already reached 9-12g/day in most part of the world (130). Moreover, excess salt consumption also comes through discretionary use of salt in home-cooking or at the table (131). Studies support that high salt intake (>6gm/day) is associated with an increased risk of CVD (130,132–135). In humans, salt primarily affects BP (130). Salt is ionic compound of sodium chloride (40% sodium and 60% chloride) (130). In fact, salt is essential to live. Physiologically, it has crucial roles such as maintaining the electrolyte and water balance of the body; the

transmission of electrical impulses through nerves facilitating muscular contraction; and many other functions. However, long-term excess salt intake primarily leads to water gain in excess of the renal fluid elimination capacity with ultimate extracellular fluid volume expansion resulting in HTN (136).

Population based studies have shown a direct relationship between the amount of salt intake and the prevalence of HTN. Accordingly, among people whose salt intake was less than 2g/day, only 1% of them had HTN. Whereas, among people whose intake was 3-8g/day and 9-15g/day, 3% and 8% of them had HTN, respectively (130). There was a slight rise in BP even with increasing age (0.13/0.23 mmHg/year) among those who consumed a low sodium diet, and BP was found to increase with age only if accompanied by an increased salt intake (132).

To date, a population-based study of dietary salt intake in Ethiopia has not been conducted. As a tradition, salt is usually added when cooking foods, rather than adding to foods once prepared. In addition, salt is added to cups of coffee for flavoring instead of sugar in some localities (39,137). Recent studies have reported a higher (60%) use of added salt on food and its significant association with HTN (138,139); and the behavior was nearly the same in both sexes and the consumption of high salt was greater among urban than rural population in Ethiopia (39). According to the Ethiopian steps survey about 86% of urban and 76% of the rural population were aware of the serious health problem that could happen as a consequence of too much salt intake (39). However, the amount of salt intake did not vary among hypertensive by their level of awareness (140).

Dietary salt restriction is globally promoted as one of the major non-pharmacological interventions in the control of mild hypertension, and as an adjunct to the drug treatment of moderate-to-severe HTN (141). Furthermore, the finding from trials of salt reduction among adults showed that daily sodium intake of 50mmol (about 3gm of salt), which is attainable by moderate dietary salt reduction after a few weeks demonstrated a corresponding average reduction of BP by 7/3.5 mmHg among hypertensive patients and this reduction among hypertensive adults was suggested to lower the incidence risk of stroke by 26% and IHD by 15% (142). Interventions to reduce population-wide salt intake have been found to be highly cost effective to diminish the burden of CVD (134). However, despite the recommendation of less than 5-6gm/day salt intake or <2.0-2.3 g/day sodium (143), a study reported >6gm/day of salt intake or >4.2gm sodium intake in more than 83% adults aged 30-59 years with the exception of men in the age group 55-59 years

of age (134). However, maintenance of salt intake to less than five grams per day was difficult to achieve even after intensive counseling and regular use of low salt bread among individuals with HTN (141). Similarly, other studies also reported a low adherence to dietary salt restriction among hypertensive patients (44,144). Such behaviors contribute to poorly or uncontrolled HTN which may lead to preventable but serious or life-threatening CVD outcomes with high cost on patient/family and health care system. Alternative ways to make diets more palatable without salt using a variety of spices and herbs that are culturally agreeable may help facilitate lower sodium and reduction in adverse CVD outcomes related to HTN (161).

Obesity and CVD

Fatness was considered as a sign of a state of good health for much of the human history prior to the 19th century, and now a century has elapsed since obesity was recognized a disease, with well-defined complications (145). Obesity is well recognized as a worldwide public-health problem and a chronic disease potentially leading to high costs, and poor outcomes due to the vacillating nature of the onset of its complications and its strong association with diabetes and CVD morbidity and mortality (145,146). Unlike that of HTN, ‘the silent killer’ (147), obesity has an apparent external manifestations visible on individuals from its outset with a weight gain and an increase in girth (145).

Obesity may be defined as the degree of fat storage associated with clearly elevated CV risk that marks the intake of energy exceeding its expenditure, with the excess being stored in the form of triglyceride, in adipose tissue (148). In fact, the stored energy is necessary for survival in conditions of food insecurity. In countries where there are frequent food shortages, it is equally predictable that thinness in contrary to fatness may be deemed as a serious sign of medical problems (145,149). In fact, this is the perception shared by many Ethiopians too. Similarly, in some cultures, fatness was regarded as desirable and standard of beauty and set as a criterion for mate selection, e.g., as in custom of “fattening huts” for the seclusion of elite Efik (an ethnic group located primarily in southeastern Nigeria) and other parts of West African countries where pubescent girls being secluded up to two years before marriage for fattening. (149).

The global prevalence of overweight and obesity (as measured by BMI $\geq 25\text{Kg/M}^2$) has greatly increased among adult populations in both developed and developing countries (36.9%, men, and 38.0% women) (150). In SSA, urbanization was linked to an increased risk of obesity and chronic disease and obesity was more prevalent among populations with a high SES in urban

areas (151). However, according to the review by Moterio et al (2004) obesity was no longer limited to higher SES (152). More recently in developing countries, the prevalence of obesity has tripled (153). Similarly, the study by Haregu et al (2016) reported the prevalence of overweight has already reached 22% in SSA (154). In Ethiopia the risk of CVD was considerably greater among obese people and nearly 30% people in AA had overweight or obesity while (40%) of adults in rural Butajira (Ethiopia) had a low BMI ($<18.5 \text{ Kg/M}^2$) (137). Other studies also reported a growing magnitude of overweight and/or obesity with a considerable prevalence rate of 9.4% - 12% in other urban Ethiopian cities (155,156). However, the 2018 Central Intelligence Agency (CIA) world fact book estimated the adult prevalence rate of obesity in Ethiopia was 4.5% (157).

The post-World War II triggered a quest for a practical means to assess the relationship between increased mortality (including CVD) and overweight. The Quetelet's Index was initially accepted as the best index to measure the ratio of weight in kilogram (Kg) divided by the square of height in meter (M^2). Later this became known as Body Mass Index (BMI) and is used today to characterize underweight ($\text{BMI} < 18.5 \text{ Kg/M}^2$), normal weight (18.5 Kg/M^2 - 24.99 Kg/M^2) (158), overweight (25 Kg/M^2 - 29.99 Kg/M^2), and obese ($\geq 30 \text{ Kg/M}^2$) (175)(159,160).

Evidence shows that an increase in body weight is associated with an elevated BP and while weight reduction in hypertensive adults was accompanied by BP reduction (148,161). An experimental study conducted by the Obesity Research Group of the University of Pennsylvania, on the effects of weight reduction on blood pressures in obese patients (N=301; 137 hypertensive patients and 164 normotensive patients) found reduction in SBP and DBP of 2.3-0.2 and 1.8-0.1 mm Hg, respectively, (with the mean BP reduction of 1.25/0.95 mmHg) for each Kg of weight lost (161).

Survivors of an MI were more often overweight than those without a history of MI (162). Men with moderate HTN were found to be more obese than those with a lower BP level (71). A study of 2676 hypertensive patients showed that, regardless of the level of their risk perception and efforts of preventive measures, in the overwhelming majority (98%) of participants who had at least one additional modifiable CVD risk factor, 95% of them were at risk from obesity (71). Although these patients recognized obesity was a health problem, only 85% attempted to lose weight (71). A large sample (n= 29079) of adults (age 18-65 years) in China on predictors of hypertension by different anthropometric indices showed that HTN was statistically significantly related to an increase in BMI ($\beta=.254$, $p<0.001$) (118,163).

Physical Activity (PA) and CVD

Regular aerobic PA is well-recognized as an important non-pharmacologic behavior in maintaining body weight and reducing elevated BP, thereby reducing CVD. Beyond that, aerobic PA has been suggested to have enormous health benefits such as improving cardio-respiratory fitness and skeletal muscle strength, prevents weight gain, reduces biological risks (increases HDL-c and lowers LDL-c levels), decreases insulin sensitivity in type two diabetes and promotes glycemic control, reduces BP in hypertensive patients, and reduces several blood concentration of inflammatory biomarkers (cRP, lipoproteins associated with phospholipase AZ, cytokines IL-1B, IL-6 and TNF alpha) all of which are linked to CVDs (164–171). The cardio-protective effects of moderate and vigorous PA were found to have an inverse relationship with the CVD risks (172,173), which were partly mediated by the biological risk factors (cRP, total cholesterol, HDL, BMI, WC) and HTN.

According to a study by Dumith, Hallal, Reis, and Kohl (2001) 17.4% (95% CI 15.1-19.7), (2.6% in Comoros to 62.43% in Mauritania), and median 18% of the world adult population were physically inactive (174). The prevalence of inactivity was more prevalent for developed countries (27.8%) than developing countries (18.7%) and was higher among women particularly in developing countries including Ethiopia (174). Evidence supports that inactive individuals have higher biological risks factors than those physically active individuals. Individuals who are vigorously active were found to have greatest CV risk reduction with a CV events rate of 1% (172). A meta-analysis of randomized clinical trials of BP ascertained that aerobic PA significantly reduces BP ($p < 0.001$) in both hypertensive and normotensive individuals with an overall pooled reduction effect in SBP and DBP by -3.84mmHg and -2.58 mmHg, respectively (175).

Physical activity was also shown to play important roles in the secondary prevention of CVDs via the reduction of the impact of the disease, slowing its progression, promoting recovery, and lowering risk of death and recurrence in post MI patients' (176,177). Compared to sedentary individuals, physically active individuals had significantly less stiff arteries (measured by pulse wave velocity) and PA was suggested to improve vascular stiffness in older individuals (178).

According to the INTERHEART study (2004), physical inactivity was the 4th major and an established risk factor for CHD mortality worldwide and accounted for 12% of the attributable risk of MI (3,165). The WHO (2004) global strategy on diet, PA and health recommended that adult individuals to engage in adequate levels of different types and intensity PA throughout their

lives to reduce their risk of CVD (179). To achieve the CV protective effect a minimum of 150 min moderate-intensity or 75 min vigorous-intensity aerobic activity or their equivalent combination per week are required (121,179,180). These activities also can be graded by converting them to metabolic equivalent task (MET)-min per week. Accordingly, individuals who engage in activities of less than 600 MET-min/wk were classified as low, 600 to 3000 MET min/wk as moderate, and greater than 3000 MET-min/wk as having a high level of physical activity (181). Similarly, Carnethon (2010) recommended adults to engage in moderate intensity PA (activities that can cause a considerable rapid breathing and heart rate) for at least 30 minutes per day for five or more days per week or alternatively, to engage in vigorous intensity activities, which can cause both rapid breathing and heart rate for 20 minutes per day at least 3 days per week (182). In a meta-analysis study by Lee et al. (2010), a greater energy expenditure was found to substantially reduce the CHD incidence (164). As a principle, the desired PA should represent a combination of both moderate- and vigorous-intensity PA that last for at least 10 minutes per session (182).

The CV benefit of PA was suggested to have dose dependent and linear association. Plenty of evidence from meta-analysis and individual studies showed a significant dose–response relationship between PA and CV risk reduction such as CHD and stroke (168,172,183–185). Similarly, a meta-analysis study found that highly active individuals had a 25% lower risk of stroke incidence and death compared to the less active individuals (186). However, the lack of PA along with advancing age was found to contribute to an increase in body weight and WC, which promote atherogenesis. Currently, atherogenic level risk screening are widely used as a clinical parameter for guiding secondary intervention in CVD outcome risk reduction (184). In Ethiopia, the prevalence of physical inactivity has already reached a considerable level (18.8%). With continued modernization/urbanization, the traditional manual work will likely decrease and maintaining PA may be challenged by the lack of recreational facilities for leisure time exercises in many of the developing countries and may escalate inadequate PA levels.

Studies show that a lack of PA has more impact in contributing to obesity than on a direct development of CVD. However, obesity is an important risk factor for hypertension and CVD (87). Despite this risk, in one study over one-third of physically inactive hypertensive patients did not recognize their risk of adverse CVD outcomes, and 68% of them showed no effort to get more exercise (71). Similarly, in a study conducted on 319 hypertensive patients, only 52% reported

doing some form of physical exercise (97). Women with a controlled BP were found to be more physically active (86). Socioeconomic status was positively associated with increased PA, while higher level of education was significantly associated with a lower attempt of PA ($p<0.01$), though not supported by others' finding (71). Encouragingly, in one study about 70% of participants were engaged in at least one form of exercise to decrease their body weight (89). However, Mendis et al. (2005) found that a quarter ($n=10,000$) of post MI and stroke individuals had held the erroneous belief that such individuals should not engage in PA because it may damage their heart (53).

2.3.3. Medication adherence and CVD

The central objective of HTN management is to reduce adverse CVD outcomes through the reduction of high BP that requires strict adherence to antihypertensive medications. However several previous studies of antihypertensive medication adherence in Ethiopia reported prevalent low adherence rates (89,187–189). Documented evidence shows that poor medication adherence was one of the main reason for suboptimal high BP control and may lead to adverse CV outcomes by accelerating the progression of atherosclerosis and destabilizing the vascular lesion resulting in precipitation of acute coronary events, and by directly leading to myocardial ischemia even in the absence of CHD (190). Evidence also indicates that for adults aged greater than 40 years each 20/10 mmHg rise in BP was found to double the risk of fatal coronary event (191), which indicate the crucial need of BP control with strict adherence to antihypertensive medications and recommended life-style adjustments.

The BP control rate of hypertensive patients remains suboptimal in many countries worldwide. A systematic review by Pereira et al (2009) examined differences in prevalence, awareness, treatment and control of HTN between developing and developed countries and found unsatisfactory BP control rate among hypertensives with low control rates in both developed and developing countries. Specifically, the control rate was at much lower for African hypertensives, mainly due to adherence problems (192). A systematic review of 44 studies of HTN awareness, treatment and control in Africa found an overall suboptimal high BP control rate ($\leq 45\%$) with women having better control rate than men mainly due to the medication adherence difference (65,193).

In Ethiopia, several previous studies found suboptimal high BP control rate among hypertensive patients on treatment and follow-ups in health institutions (35,194,195). Others studies have found that the progression of BP and CV outcomes were similar whether BP was

more controlled or not over a 5-year follow-up period in Ethiopia (206). Poor antihypertensive medication adherence was a major cause of low BP control (196,197). Patients with low SES that was found to affect patient paying capacity for their pills were more likely to be less adherent (196), medication adherence among African hypertensives compared to patients from Asia, Europe, and America, which may be explained from these SES differences suggesting that the cost of medicine coverage with OOP is an important challenge to medication adherence for those patients particularly from LICs (196). Evidence suggested medication adherence is a key to the control of high BP thereby reducing the risk of adverse CV events (187). Studies from all corners of Ethiopia documented poor adherence to antihypertensive medications (187–189,198). Furthermore, poor medication adherence was associated with higher risk of future CVD events, higher risk of hospitalization and death (197). On the other hand, strict adherence to antihypertensive medication was associated with a 38% lower risk for CVD events (197). However, findings from a recent systematic review in Europe showed a pooled prevalence of medication adherence rate of 65.4% among hypertensive which suggests a moderate rate showing some improvement in recent year (44,199). Furthermore, the study indicated a variation in the rate of adherence with tools used to measure adherence with tendency of exaggerated adherence rate with questionnaire compared to standardized tools such as the Morisky Medication Adherence Scale (MMA). Several studies have documented several factors that were associated with low medication adherence rate such as low risk perception CVD outcomes (198), poor knowledge HTN (187,188,199,200), presence of comorbidities (189,197,199), low SES and cost of medication unaffordability (187,196,197), concomitant use of traditional medicine (196), gender male (188) multiple pills (189,201), alcohol intake (189), and being young age adults (197), poor patient-HCPs communication (89,187).

2.3.4. Smoking and CVD

According to WHO (2015) report tobacco use accounted for nearly 6 million deaths worldwide each year and approximately 600,000 people are also estimated to die from the effects of second-hand smoke (202). Most of these deaths occur in LMICs with an estimated further escalation over the next several decades. Without strong intervention the tobacco use was estimated to kill more than 8 million people worldwide by 2030 and 80% of these premature deaths will take place in LMICs (202). According to this report 4% of Ethiopian population (8.0% men and 1% women) were estimated to be smokers. The number of smokers was projected to remain

the same by 2025 with men predominantly in the age group 40-54 years (202) when primary HTN, the leading cause of CV death, is most likely to manifest.

SSA was identified as having countries that reached early stages of cigarette smoking epidemic with the estimated death rate of 5-7% for men and 1-2% for women due to smoking (203). Though epidemiological data on the prevalence of smoking is lacking in SSA, country level demographic and health survey (DHS) showed variation in the prevalence rate of smoking: Nigeria 8.0%, Ethiopia 8.3%, Ghana 8.8%. Mozambique 14.1%, Lesotho 15.6%, Zambia 15.6%, Namibia 17.5%, Zimbabwe 22.0%, Rwanda 14.2%, Uganda 18.1% to 18.7%, Tanzania 21%, Kenya 22.9% and Madagascar being having the highest prevalence rate (27.3%). Generally the prevalence of smoking ranged between 8.0% and 27.3% with a considerable variation as these numbers indicate in Africa (204).

Smoking has long been known to increase the incidence of fatal CVD outcomes such as CHD (205). Though it is recognized as the leading cause of preventable death, it has been associated with increased risk of CVD (203,206) and plays a major role in CVD pathogenesis (203,207). Smoking results in the development of CV events through its roles in the development of several different atherosclerotic changes in vascular beds with acute thrombosis of the narrowed vascular bed that, in turn, precipitates an acute CV event of clinical atherosclerotic syndromes such as stable angina, acute coronary syndromes, sudden death, and stroke (208,209). Tobacco smoke compounds (Nicotine, carbon monoxide, oxidants and cadmium) were linked to the acceleration of atherosclerosis jointly with vascular and endothelial dysfunction leading to organ damage (207).

Review of studies on tobacco and CVD revealed that cigarette smoking among men and women in LMICs was associated with fatal CHD (203) (203)(203)(203)(203)(203)(203)(203)(203)(203)(203) and increase the risk of and increase the risk of AMI from 25% to 31% in countries where smoking prevalence was high (203). Current smoking was found to be a powerful independent predictor for fatal CVD outcomes (210,211), and sudden cardiac death (SCD) in patients with CHD (210), while cessation of smoking resulted in a significant reduction in CHD and SCD ($p=0.01$) similar with patients who had never smoked (206,210–212). However, accumulated evidence suggested that the effects of smoking are reversible. A large sample of the National Health and Nutrition Examination Survey (NHANES) III conducted in USA between 1988 and 1994 found that withdrawal from tobacco exposure and smoking led to a gradual return of inflammatory markers to baseline levels in five years (213). The

strong evidence on the beneficial effect of smoking cessation did come from the WHO monitoring trends and determinants in cardiovascular disease (MONICA) project that had monitored trends and determinants of CV mortality, incidence and case fatality for a decade (mid 1980s to mid-1990s) in 21 countries worldwide found an average 2–3% annually decline in mortality of CHD as a result of a decrease in smoking (214).

Abundant studies showed that smoking is linked with various adverse CVD outcomes such as acute coronary syndrome, MI, stroke, and sudden death. These adverse CV effects of smoking are principally due to the chemical ingredients (nicotine and carbon monoxide) of tobacco that led to an increase in oxidative stress, vascular endothelial damage and dysfunction. Generally, smoking heightens sympathetic activity and invigorates neurotransmitter release resulting in coronary and peripheral vasoconstriction and rise in BP (215–217).

2.3.5. Depression, stress and CVD

Chronic stress and depression were identified as the strongest psychological stressors linked with adverse CVD outcomes (218). Encountering depressive disorders among patients with CVD has become a common clinical finding with an estimated prevalence rate of up to 30% among cardiac patient population (218) and several studies have found that patients with major depression were more likely to suffer from adverse CVD outcomes such as MI with increased mortality (219–221). In spite of this strong co-existence of depression and CVD, available evidence could not single out the causal relationship between them. However, Glassman (2007) suggested that some of the biological changes associated with depression do increase the risk of CVD such as CHD (219), while Rosanski (2016) attributed it to a reciprocal relationship between depression and CVD (218). On the contrary, Stewart et al. (2003) found no evidence of an association between depressive symptoms and CVD outcomes during long-term follow-up study (221).

Evidence from epidemiological and pathophysiological studies show a strong link between the number of psychosocial risk factors with hypothalamic pituitary adrenal (HPA) axis dysfunction and increased risk CVD (218,222,223). Similarly, a considerable number of studies including the international INTERHEART study indicated that chronic psychological stress was linked to the trigger and progression of CVD (224–226). It is ascertained that chronic psychological stress leads to the development of CVD through two mechanisms. First, by directly triggering the patho-physiological pathway that leads to the activation of the HPA axis (with an increased release of the corticotrophin releasing hormone [CRH]) and the dysregulation of the

sympathetic nervous system (218,222,223). Chronic activation of CRH leads to a pervasive systemic effects with pathologic consequences, such as autonomic dysfunction, inflammatory reactivity, oxidative stress, insulin resistance and diabetes, endothelial dysfunction, hyper-reactive heart rate and elevated BP, platelet abnormalities, and telomere erosion with an increase in CVD risks (218,222,223). Second, through promoting maladaptive unhealthy behavioral practices (such as poor diet, overweight, inactivity, and smoking) by individuals as a coping mechanism with the chronic stress that, in turn, lead to the development of CVD (218).

Chronic stress is recognized as one of the important and potentially modifiable risk factors for acute and chronic CV disorders. A mind–body stress intervention is suggested to have clinically useful effects in the secondary prevention of CVD outcome (MI and stroke) and mortality in high risk population, with the effects associated with lowering psychosocial distress and high BP (227). Most of the subcategories of chronic psychological stress disorders (such as, hopelessness, anxiety, residual psychological trauma, low SES, care burden) including depression have been suggested to have a strong link with the adverse CV outcomes (such as CHD, sudden death) and all-cause mortality, and HTN was identified as the main underlying risk factor that correlated with most of these CV outcomes (226). Of the population attributive risk (PAR) with regard to the relative importance of every risk factor for MI, psychological stress was found to be one of the three most important risk factors along with raised lipids and smoking in all regions of the world (165).

The INTERHEART (Case-control) study that examined the association of psychological risk factors with risk of AMI in 11119 cases and 13648 controls from 52 countries worldwide reported that chronic stress at home/work had >2.1 times the risk for developing an MI (224). Similarly, a systematic review and meta-analysis conducted by Liu et al. (2017) to examine the association between psychological stress and HTN on relatively small studies (11 studies that had 5696 participants) found robust association between chronic mental stress and HTN (OR = 2.40, 95% CI = 1.65–3.49, $p < 0.001$) and that hypertensives had a higher incidence of psychological stress compared to their normotensive counterparts (OR=2.69, 95% CI=2.32–3.11, $p < 0.001$) (223). However, Dimsadle (2008) suggested that retrospective assessment of stress after CV events could be problematic as it demands patients strive harder to remember stressors and this could lead to the possibility of introducing bias due to the retrospective distortion, and rather suggested to conduct a prospective assessment of stress with a forward measurement of the CV events using a large sample in the general population or smaller sample in high risk populations (225).

2.4. Summary of the Literature Review

This review of literature was a critical summary of the previous research on CVD risk in relation to knowledge, perception and behaviors associated with risk reduction among Ethiopian adults receiving follow-up care in outpatient clinics. The review has attempted to identify what is known and unknown about the problem, the strength and weakness of previous research which provided justification for the planned dissertation project.

What is known?

Adverse CVD outcomes and higher mortality rates among hypertensives is the leading cause of CV deaths and disabilities in the world with an overwhelming burden in LMICs, including Ethiopia. Well controlled HTN and diabetes along with a healthy lifestyle (physical activity, healthy diet, non-smoking, alcohol moderation, and stress management) are associated with lower CVD risk. It is also well documented that hypertensives in Ethiopia and in Africa generally lack knowledge and awareness of their potential risk for CVD. Studies of risk perception in other countries are inconsistent between perceived risk of CVD and objective risk using the FRS.

What is unknown?

Illness perception as a method of determining behavioral outcomes, CVD outcome behavioral risk reduction and self-risk perception of the hypertensive population attending tertiary care settings in Ethiopia has not been previously examined. Furthermore, the relationships among knowledge, risk perception of CVD and CVD risk reduction behavior among this risky population in Ethiopia is also unknown.

2.5. Conceptual Framework: Health Belief Model

Overview

The Health Belief Model (HBM) was first developed by social psychologists in the USA in the early 1950s to understand the underlying cause of the widespread resistance of people to disease prevention and screening tests for early detection of asymptomatic disease (228), and was later updated in 1980s (229) served as the theoretical foundation for this study. The model combines behavioral and psychological theories to understand that behavioral actions primarily depend on the perceptions an individual has of a certain sickness or risk and the net benefits of a

given action over barriers to that action (228). Given this situation, it was highly appropriate to use the HBM to guide our investigation into the CVD risk reduction behaviors of hypertensives that guided us to examine and determine hypertensives' perceptions of CVD risk, and knowledge of CVD risk factors and their preventive behavioral measures to avoid/lessen the negative CVD events. The HBM is one of the most well-established and tested frameworks for describing and predicting health behaviors (230). It also has been used to explain changes in health-related behavior and in intervention research across a wide range of chronic conditions. In researches that participated hypertensives, the HBM has been used to explain selected CVD lifestyle behaviors (231,232). In Ethiopia, the HBM has been used to explain health behaviors for different health conditions (233). Furthermore, the HBM was selected as the framework for this study because it highlights that perceptions and beliefs regarding CVD events influences health behaviors and actions towards managing it effectively or ineffectively (228). Hence, among adults with hypertension, the association between CVD risk reduction activities, knowledge, and risk perceptions can be best explained by application of the model.

The main HBM constructs include perceived susceptibility and seriousness of a disease/health condition/risk, modifying factors and cues to action, perceived barriers vs perceived benefits of undertaking recommended actions (230).

Conceptual definitions

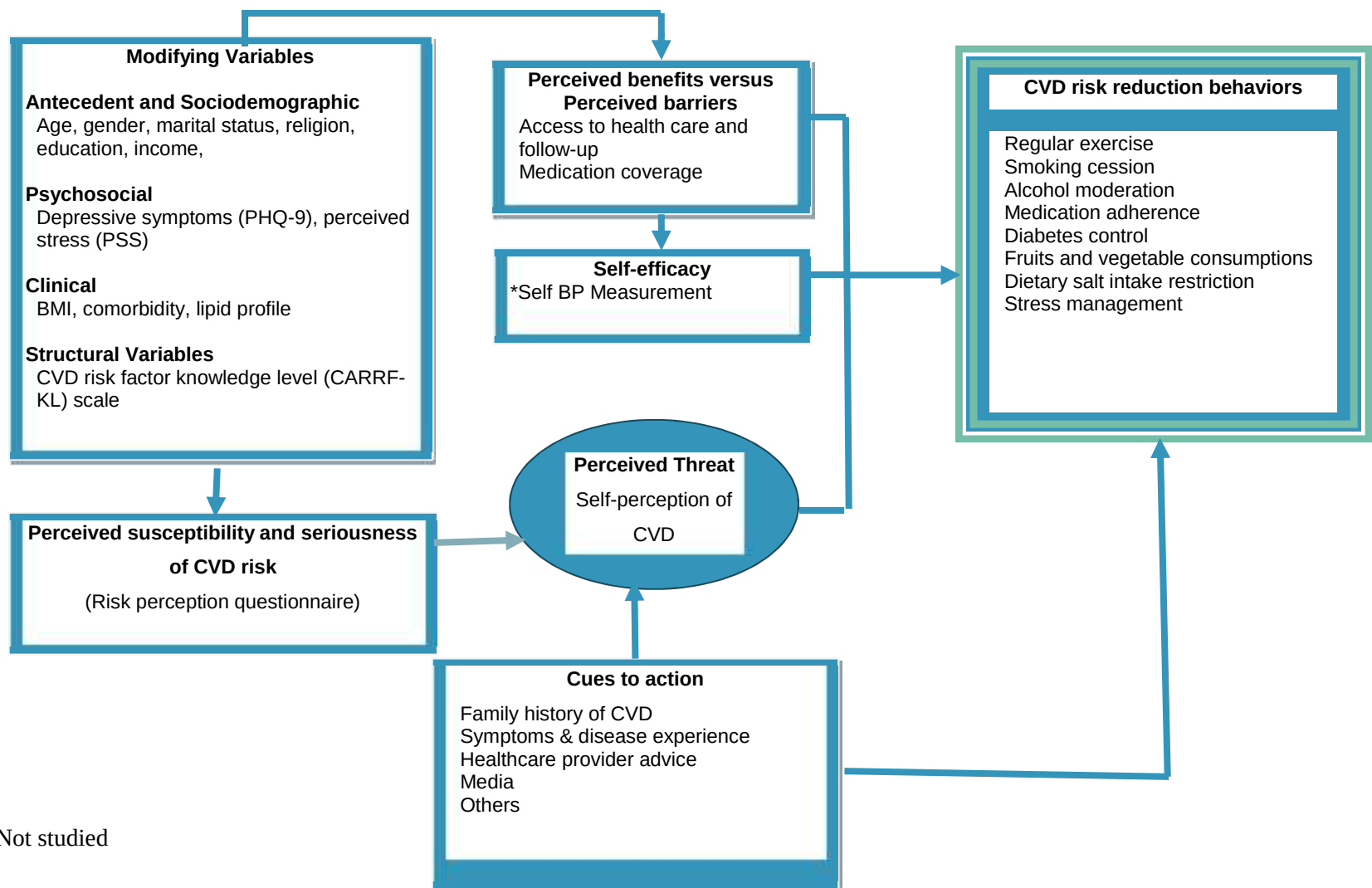
The HBM constructs predicts how and why individuals take action to prevent, detect, and control their own illness or health conditions. Perceived susceptibility is defined as the individual's assessment of his/her risk of experiencing an illness or condition. Perceived seriousness refers to the individual's assessment of the seriousness of the illness or condition and its medical and social consequences. These two perceptions together comprise the perceived threat of the illness/condition. Modifying factors within the model include prerequisites/antecedents (demographic variables such as age, sex, religion, education, marital status, and income), psychosocial variables (such as living situation, prior contact with the disease), and structural variables (such as knowledge about the disease) that influence individual health attitudes into health behaviors (practices) (230,234,235).

Perceived barriers are defined as the individual's assessment of obstacles (such as cost, side effects, accessibility, personal characteristics, and self-efficacy) (57,236). Perceived benefit

reflects the gain of changing the behavior and emphasizes the positive outcome that follows the proposed action (e.g., health benefit, financial improvement and feeling of satisfaction). According to the HBM framework, the potential benefits of reducing the predicted threat of illness are weighted against the potential barriers to perform the health action (229). Self-efficacy is defined as the belief that one can successfully execute the behavior required to produce a desired outcome that may hinder the adoption of desired behavior (237). Cues to action may be internal (symptoms experiences related to the disease) or external (healthcare provider advice, effect on family/job, or social relationship) that may motivate an individual to take action or avoid action related to a health problem.

Conceptual Model

The conceptual model is displayed in Figure 1. In this study, the constructs in the framework (Figure1) show the links/relationships among hypertensives' perceptions of susceptibility and seriousness (perceived susceptibility and seriousness of CVD) and modifying factors (demographic and antecedent, psychosocial, clinical and structural variables). Cues to action such as sources of information: family history of CVD, personal symptom experience (transient ischemic attack [TIA], dyspnea, angina, HF, MI, stroke, and headache) influence perceived threat and CVD risk reduction behaviors. The model also includes the likelihood of health promoting CVD risk reduction behaviors (regular exercise, smoke cessation, alcohol moderation, medication adherence glycemic control, stress management, and dietary consumptions [fruits, vegetable, salt restrictions]). Perceived barriers include medication coverage, income, access to care and follow-up. In the proposed model, hypertensive adults with higher knowledge and perceived susceptibility were speculated to perceive a greater threat of adverse CVD outcomes and participate in more CVD health promoting and risk reduction behaviors than hypertensive patients with low knowledge level and a low perceived susceptibility and threat.



* Not studied

Figure 1. Conceptual model adapted based on HBM (234)

CHAPTER III: METHODS AND MATERIALS

This chapter presents the proposed research method and materials. It will address the research problem, research approach, research design, research setting, sample and sampling techniques, description of instrument development including its validity and reliability, pilot study, data collection procedure, ethical considerations, and the plan for the data analysis.

4.1. Study Setting

The study was conducted at Tikur Anbessa Specialized Hospital (TASH), the largest tertiary level referral and teaching facility in Addis Ababa, Ethiopia. Recruitment of participants took place in the cardiovascular and renal clinics which see approximately 1200 patients annually.

4.2. Study Design.

The study used a cross-sectional design. The important demographic and clinical information, knowledge of CVD, self-risk perception for CVD outcomes, and CVD outcomes risk reduction practices of the study participants were all collected as part of the descriptive component of the research.

Extraneous or confounding variables that could affect the validity and reliability of data were controlled both at the design and analysis stages. At the design stage, extraneous variables were controlled by having a sample of adult hypertensives that met eligibility criteria. To reduce the risk of error in data collection procedures, research assistants were trained to take blood pressure readings, height and weight. Intra-class correlations were conducted during training to ensure a 0.1 margin of error to improve reproducibility within research assistants and reduce measurement biases. In addition, mock interviews were conducted by research assistants to role-play administering the surveys for consistency and reliability.

4.3. Population

Target population: The target population was adult hypertensives (age ≥ 18 years) attending CV and renal clinics in Addis Ababa who met eligibility criteria.

4.4. Eligibility Criteria

Inclusion criteria:

Inclusion criteria included: a) adults 30 years or older with a medical diagnosis of HTN, b) complete medical records available at TASH cardiac and renal follow up clinics to obtain demographic and clinical variables, c) followed in the designated clinics for at least 3-months and, d) able to hear and respond appropriately to questions in the local language (Amharic).

Exclusion criteria:

Individuals with any of the following conditions were excluded from participating in the study: a) pregnant women, b) women with gestational hypertension, c) critically or terminally ill, d) major active Axis I psychiatric condition or cognitively impaired, e) patients with previous history of CVD events, and, f) non-Ethiopian citizenship.

4.5. Sample size determination and Sampling procedure

Calculation of the sample size considered both the descriptive and logistic regression analytic designs and objectives of the study. The final sample size was decided after considering the minimum required sample for each objective to achieve acceptable statistical power and then the largest (most conservative) sample size was taken as the final sample size to conduct the study.

Knowledge of CVD risk

The single population proportion formula was used to address CVD knowledge score. Since there was no prior study on CVD knowledge of hypertensives in Ethiopia 0.5 was used to estimate the minimum sample size required with a confidence interval of 95% and 5% margin of error with plus 10% for potential missing data due to the interview format.

$$n = \frac{z_{\alpha/2}^2 P(1-P)}{d^2}$$

Where

n-minimum sample size

P-estimated proportion (0.5%), since there was no prior study.

d-the margin of sampling error tolerated (5%)

$Z_{\alpha/2}$ - is the standard normal variable at 1- α % confidence level (95%=1.96)

$$n = \frac{(1.96)^2 \times 0.5(1-0.5)}{0.05^2}$$

$$n = \frac{(1.96)^2 \cdot 0.5(0.5)}{0.02} = 384.16 = 385$$

Since the number of hypertensive patients attending the CV and renal follow up clinic is less than 10,000, correction formula was used.

$$n = \left(\frac{n}{1 + \frac{n}{N}} \right) = \left(\frac{385}{1 + \frac{385}{10000}} \right) = 291.48 = 292$$

Considering a 10% non-response rate, $292 + (292 \times 10\%) = 322$

To Compare the CVD risk perception score with the actual 10 years FRS CVD risk

Two-samples t-test was utilized to compare the mean scores of CV risk perception and predicted 10 years CVD risk FRS. The within-subject t-test was considered (as the below formula) with the following assumptions: observations are independent; data fit the normal distribution; and homogeneity of variance. For an approximate sample size for a t-test with the power set at 0.80 ($\beta=0.2$) and α (two-sided) set at 0.05 and standardized effect size of 0.15 (small) (238) and considering a 10% non-response rate (for potential missing data due to the interview format).

$$\text{Sample size, } n = (Z_{\alpha/2} + Z_{\beta})^2 / d^2$$

Where $Z_{\alpha/2} = 1.96$ (from Z table) at type 1 error of 5%

$$Z_{\beta} = Z_{0.20} = 0.842 \text{ (from Z table) at 80\% power}$$

$$ES^2 = \text{effect size (small, 0.15)}$$

$$n = (1.96 + 0.842)^2 / (0.15)^2 = 348.94 + 35 \text{ (10\% non-response)} = 384$$

To determine the status of CVD risk reduction behavioral of adult hypertensives

The single population proportion formula was used. A prevalence of $P=23\%$ (which was the proportion of hypertensive patients who practiced the lifestyle modification from the study in Addis Ababa) (44) was used to estimate the minimum sample size required with a confidence interval of 95% and 5% margin of error with a plus 10% for potential missing data due to the interview format.

$$n = \frac{Z_{\left(\frac{\alpha}{2}\right)}^2 \cdot P(1 - p)}{d^2}$$

Where

n-minimum sample size

P-estimated proportion (23%) from the study in AA (44).

d-the margin of sampling error tolerated (5%)

$Z_{\alpha/2}$ - is the standard normal variable at 1- α % confidence level (95%=1.96)

$$n = \frac{(1.96)^2 \cdot 0.23(1 - 0.23)}{0.05^2}$$

$$n = \frac{(1.9)^2 \cdot 0.2 (0.7)}{0.0^2} = 272.14 = 272$$

Since the number of hypertensive patients attending the CV and renal follow up clinic is less than 10,000, correction formula was used.

$$n = \left(\frac{n}{1 + \frac{n}{N}} \right) = \left(\frac{2}{1 + \frac{2}{1}} \right) = 221.74 = 222$$

Considering a 10% non-response rate, = 222+ (222x10%) = 244.2= 244

Since the estimated sample size to compare the CVD risk perception score with the actual 10 years FRS CVD risk (n=384) was the largest estimated sample size for the study, the sample size **n=384** was used to recruit adult hypertensive patients for the study.

4.5.1. Sample plan and sampling procedure

There were 1200 adult hypertensives receiving follow-up care at the CV and renal clinics annually. The average number of patients attending these clinics weekly was between 20-25 and 80-100 monthly. To recruit the required sample, every third patient leaving the follow-up clinics after having his/her scheduled appointment was randomly informed about the study, and those who agreed to participate were asked to sign a written informed consent before study enrollment. It was anticipated that about 12 weeks (February 2020 – May 2020) were required to recruit the sample however, due to the COVID 19 pandemic, the data collection period was extended to August 2020.

4.6. Data Collection Instrument and Procedures

Data were collected by interviewers who administered all self-report information. The instruments are described below. Permissions to use instruments were obtained (Appendix N, O).

Data collection Instruments.

Back translation.

The study instruments were translated from their original English version to the Amahric language by a professional translator (Appendix K). Another professional translator did retranslate

the Amahric version back to the English version to confirm the accuracy of translation. The translation and back-translation were found to be consistently the same. The Amharic version was used for data collection after pilot testing on 10% (n=40) of the sample size at St Paul's Millennium Medical College Hospital after obtaining the IRB approval of the College.

The data-collection instrument had five sections: sociodemographic and clinical health status profile data; knowledge questionnaire of CVD risk; self-risk perception of CVD outcomes; CVD risk reduction behaviors; and physiological measurement (using Aneroid sphygmomanometers and stethoscope, weight and height measuring devices, and the non-laboratory Framingham Risk Score [nl-FRS] algorithms).

Section I: Sociodemographic and clinical health status profile. Sociodemographic variables included: age, gender, marital status, living arrangements, educational status, and income. Clinical health status profile included: history of previous hospitalization related to HTN, co-morbidities, family history of HTN, antihypertensive and other medication list, laboratory data (total cholesterol, triglyceride, HDL-c and LDL-c values of the last 12 months), current FBG, and creatinine value were collected from the patients' medical record.

Section II: Knowledge questionnaire of CVD risk. CVD risk factor knowledge (CARRF-KL) scale (Appendix J) is a 28 item instrument developed by Wanger et al. (2005) and tested for validity and reliability by Arikan et al (2014) with a Cronbach alpha of 0.79 (239,240). The scale items one through four are related to characteristic of CVD and their avoidance, and age factor. Fifteen items (5, 6, 9-12, 14, 18-20, 23-25, 27, & 28) are related to risk factors, and nine items (7, 8, 13, 15, 16, 17, 21, 22, 26) are related to the resulting change in risk behavior. Each item on the scale has the response of true, false or I don't know (DK). Each correct response was given 1 point and incorrect and DK responses were given zero point. The highest total score that could be obtained from the scale was 28. Higher scores reflect greater knowledge of CVD risk. Patients with scores of $\geq$ mean were categorized as having adequate knowledge while those with scores of $<$ mean were categorized as having inadequate knowledge of CVD risk factors.

Section III: Self-risk perception of CVD outcomes. The Attitudes and Beliefs about Cardiovascular Disease (ABCD) Risk Questionnaire (Appendix J) is an 8-item questionnaire that was used to measure perceived risk of CVD. The ABCD Risk Questionnaire has satisfactory content and face validity, and reliability (Cronbach alpha of .85). The instrument uses a 4-point Likert scale (ranging from 1=strongly disagree to 4=strongly agree, with the exception of item 5,

which is reverse scored). The highest possible score is 32 with higher scores indicating higher perception of CVD adverse risk outcomes such as a MI or stroke. The close agreement between perceived and predicted CVD risk suggests the tool performs well in assessing perceived CVD risk (241). For interpretation, the patients scores were ordinaly categorized by percentile as low (lowest-33.33%), moderate (33.34%-66.66%), and high risk (66.67 through the highest).

Section IV: CVD outcome risk reduction behaviors (perceived benefit). CVD outcomes risk reduction behaviors was measured using each of the following eight behaviors (regular exercise, current smoking, alcohol consumption, medication adherence, glycemic control (if diabetic), fruits and vegetables consumptions, salt intake, and stress management that have significant effect on CVD outcomes. This tool was adapted from the WHO instrument for stepwise surveillance (WHO STEPS) for chronic disease risk factors (242) and other tools used in previous studies based on a literature search. The physical exercise question judged the patient as active if she/he was regularly involved in moderate (walking for 30' or more/day) or cycling/gardening or strenuous exercise (jogging, swimming, playing football) for four hours or more per week (165,242,243). Current smoking meant any form of tobacco use for at least one day in the previous 12 months including those who had quit within the past year (165,242) and classified as current smoker; yes, or no. Low to moderate alcohol intake of one drink/day or less than four drinks/week (female) and one-to-two drinks/day or less than four drinks /week (Male) within the past 12 months (242–244). Medication adherence was measured by participants self-report (strictly adherence, yes/no response). Fruits and vegetables intake was measured by a dichotomized question of fruit and vegetables consumption of less than five, and five or more times per day, and salt intake was assessed by the patients report of less than five-to-six gram/day, or more than six grams/day or unknown amount/day (241,245). Glycemic control (if diabetic) was determined from fasting whole blood glucos (FBG) check at the time of data collection and deterimed as controlled diabetes if FBG was 70-100 mg/dl or fasting plasma glucose (FPG) 80-130 mg/dl (246). All items one through eight had a response of yes, which was given a score of 1 or no response which was assigned a score of 0.

The 10-item Perceived Stress Scale (PSS) was used to measure stress. The PSS was originally developed by Cohen, Kamach, and Mermelstein in 1993 and remains widely in use. The scale has a reported Cronbach's alpha reliability of 0 .85 (247). Each question is provided with five alternative responses (0 – never, 1 - almost never, 2 – sometimes, 3 - fairly often, and 4 - very

often). For scoring, first item number 4, 5, 7, and 8 were reversed as 0 = 4, 1 = 3, 2 = 2, 3 = 1, 4 = 0, and then adding up the total score. Scores on the PSS range from 0 to 40 with higher scores indicating higher perceived stress. The scores are interpreted as: 0-13 low stress, 14-26 moderate stress, 27-40 high or severe stress. The scores then categorized as managed stress (low stress) and were given a score of 1, and unmanaged stress (moderate and high stresses) and were given a score of 0. Then the total score for the CVD risk reduction instrument was determined by adding the seven behavioral questions and the PSS. The possible score that could be obtained ranges from zero to eight.

Finally, patients' CVD risk reduction behaviors were determined by computing the composite scores of all the eight items. Thus, the highest total score that can be obtained from the CVD outcome risk reduction questionnaire is 8. Higher scores indicate that the patients have adopted CVD risk reduction behaviors (perceived benefits of recommended preventive actions) and lower scores indicate that the patients have not adopted CVD risk reduction behaviors (at risk for potential CVD outcomes). The scores were then divided by percentile for distributing the participants to low, moderate, and high groups for their CV risk reduction behaviors.

Depressive symptoms screening was assessed by the patient health questionnaire nine (PHQ-9) Amharic language version (248). The tool has an internal consistency of Cronbach's alpha 0.85 and has been previously used in Ethiopia. Scores range from 0 to 27. A score of 10 or higher reflects moderate depressive symptoms while a score of 20 or higher indicates severe symptoms. If a patient scores 15 or higher on the PHQ-9 he/she was advised to seek mental health counseling.

Section V: Physiological measurement

Materials

- Aneroid sphygmomanometers
- Stethoscope
- Alcohol swab
- Weight measuring scale (adult)
- Height measuring tape

Standardized aneroid sphygmomanometer was used to measure SBP and DBP using the right brachial artery five minutes after patients' arrival in the data collection room; two readings were taken five minutes apart with patients in a sitting position and feet flat on floor using the BP

measurement protocol (Appendix M) based on the 2018 European Society of Cardiology/European Society of Hypertension Guidelines for the management of arterial HTN (249). If the two readings were varying by >5 mmHg then a third reading was obtained. The average of last two readings was used for the analysis. For this physiological measurement, the aneroid sphygmomanometer was selected because its sensitivity and specificity is higher (86.7% and 98.7%) than digital devices (80% and 67.7%) for both SBP & DBP as compared to mercury sphygmomanometer (250). Aneroid sphygmomanometers are equally or more accurate than mercury devices. (251). Values were recorded as controlled BP: SBP < 140 mmHg (<120 mmHg for patients with diabetes and CKD comorbidities) and uncontrolled SBP ≥ 140 mmHg (≥ 120 mmHg for patients with diabetes and CKD comorbidities).

Height and weight were measured at the time of interview and BMI was calculated. Height was measured using a portable stadiometer with no shoes, heels together and against the back board, knees straight and look straight forward and the reading were recorded to the nearest 0.5 cm. Weight was measured using a calibrated weight scale. Participants took off their shoes, any heavy belts and empty their pockets of heavy items. The weight was recorded to the nearest 0.1 kg. Body mass index was calculated from the weight divided by height (Kg/M^2). Values were categorized as underweight ($\text{BMI} < 18.5 \text{ Kg}/\text{M}^2$), normal ($18.5 \text{ Kg}/\text{M}^2$ - $24.99 \text{ Kg}/\text{M}^2$), overweight ($25 \text{ Kg}/\text{M}^2$ - $29.99 \text{ Kg}/\text{M}^2$), and obese ($\geq 30 \text{ Kg}/\text{M}^2$) (159,160).

4.7. Variables

In quantitative studies variables represent concepts that are studied (252).

4.7.1. Independent Variables

Independent variables are the variables that are presumed to influence or be associated with the dependent variables (252). Independent variables for this study included:

- Socio-demographics (age, gender, education, marital status, income)
- Clinical and laboratory profiles (family history of HTN, medical care coverage, clinic visit for HTN, BP, weight, height, BMI, traditional medicine use for HTN, list of current BP and other medications, depressive symptoms, comorbidity, sources of information on seriousness of HTN, lipid profile and FBG).
- Knowledge of CVD risk
- Self-risk perception of CVD outcomes

4.7.2. *Dependent Variables*

Dependent variables are the outcome variable of interest (252).

Dependent variables were CVD outcome risk reduction behaviors and included:

- Regular exercise
- Current smoking
- Alcohol moderation
- Medication adherence
- Diabetes control
- Fruits and vegetables consumptions
- Dietary salt intake
- Stress management

4.8. **Conceptual and Operational Definitions**

A conceptual definition states the scientific meaning of a concept/variable whereas the operational definition denotes how a concept is operationalized or measured in a particular instance. Operational definition is the definition of a concept or variable in terms of the procedures by which it is to be measured (252). In this study, variables under study are both conceptually and operationally defined.

Risk reduction behavior is a “comprehensive approach to an individual wellness through prevention and rehabilitation of lifestyle diseases such as heart disease and diabetes.” (253). Behavioral risk reduction refers to behavioral practices, actions undertaken by hypertensive patients to reduce or prevent the likely occurrence of adverse CVD outcomes/events. The CVD Outcomes Risk Reduction Behavioral Practice questionnaire was used to measure this concept. The scores were divided by percentile for distributing the participants to low, moderate, and high groups for their CV risk reduction behavioral practices. Higher scores indicate that the patients have adopted CVD risk reduction behaviors (perceived benefits of recommended preventive actions) and lower scores indicate that the patients have not adopted CVD risk reduction behaviors (at risk for potential CVD outcomes).

Knowledge is a highly valued state in which an individual is in cognitive contact with reality; knowledge is typically divided into propositional knowledge and knowledge via acquaintance (254). Propositional knowledge is what a person knows to be a true proposition about the universe and can be either true or false, but only true propositions link the knower with reality in the desired

way whereas knowledge via acquaintance is acquired through experiential contact with the component of reality (254). In this study, it refers to the number of correct responses given by adult hypertensives as measured by CARRF-KL scale. Higher scores indicate greater knowledge of CVD risks (patients were categorized as having adequate or inadequate knowledge by summarizing the overall scores with the mean value).

Risk perception can be rational or irrational belief held by an individual, group, or society about the chance of occurrence of a risk or about the extent, magnitude, and timing of its effect (s) (255,256). In this study, it refers to the hypertensive s' self-rated perceived risk of CVD outcomes as measured by the ABCD Risk Questionnaire. Higher scores indicate that the patients perceive themselves as having a higher risk of adverse CVD outcomes (a heart attack and stroke). Scores were summarized by the percentile distribution (0-100), calculated with the SPSS V-25.0 software, and were categorized as low, moderate and high CVD risk perception. Patients' subjective CVD risk perceptions were compared with nl-FRS 10-year estimated and then patients were placed onto underestimated, corresponding estimated, or overestimated their risks.

nl-FRS participants' 10-year CVD event risk was categorized using the conventional threshold of CVD risk stratifications as low (<10%), moderate (10%-19%), and high risks ($\geq 20\%$) (257,258), which is consistent with the original FRS instrument.

4.9. Data Quality Assurance

To ensure the quality of data collected the following mechanisms were employed.

4.9.1. Content validity

Polit and Beck (2012) stated content validity as “the degree to which an instrument has an appropriate sample of items for the construct being measured and adequately covers the construct domain.” In this study, it was applicable to the cognitive (knowledge questionnaire), and affective (self-risk perception questionnaire) and risk reduction behavioral practice domain questionnaires (252).

4.9.2. Pre-testing

The study instrument was pre-tested on 10 adult hypertensives at St Paul's Millennium Medical College Hospital (after obtaining the IRB approval, Appendix D) to assess the clarity, any ambiguity, increase validity and reliability, and estimate the time required for completing the

questionnaire. None of the ten patients had difficulty to understand the set of instrument items. The average time taken to complete it was 45 minutes.

4.9.3. Pilot study

A pilot study is a small-scale version or trial run designed to test the methods and procedures planned for a larger study (252). The whole set of questionnaires were piloted on 10% (n=40) of the sample of adult hypertensives, after obtaining IRB approval from St Paul's Millennium Medical College Hospital (Appendix D) to test for the feasibility, comprehension and time to complete the questionnaires and to test the reliability of the tool. The Hospital is located in AA and is a Tertiary Referral and Teaching Hospital run by the Federal Government, and is typical with TASH where the main study was conducted. The test was conducted on hypertensives attending hypertensive clinic follow-up by a trained data collector. The average time taken to complete the questionnaire was 45 minutes.

4.9.4. Reliability

An instrument's reliability is the consistency with which it measures the target attribute and is a major criterion for assessing its qualities (252). After conducting the pilot-test on the whole sets of questionnaires, the CVD risk reduction behavioral set questionnaire was tested for the internal consistency and found to have a composite reliability of 0.715.

4.9.5. Training of data collectors and supervisors

Recognizing the importance of generating high-quality data and obtaining both reliable and accurate responses, three professional nurses (two data collectors and one supervisor) were trained for two days on data collection procedures. The training was provided by the PI of the study project. The training was designed to foster a common understanding of the terms, definitions, and concepts present in the questionnaires. In addition, there was mock patient interview sessions for the data collectors to practice administering the questions as well as order and protocols. Data collectors also practiced taking the physiological measures of BP, height and weight and that had 0.98 agreement between raters.

4.9.6. Identifying subject and introducing the study

Prior to the scheduled date of commencement of the data collection the PI and data collectors had identified two private and quiet rooms at the CV clinics. At all times of the data collection, the trained data collectors identified themselves to the study participants, identified the language participants spoke, explained the purpose of the study to participants, acknowledged

participants contribution to this research and its potential benefit to the patient population and community at large. Participants were screened for eligibility using a pre-prepared checklist and thorough chart review, maintaining anonymity, confidentiality and privacy of participants. After determining eligibility, data collectors read the content of the consent to participants, or gave the paper to them if they wished to read it themselves and requested written informed consent.

4.10. Study challenges

The major unanticipated challenge for data collection was the COVID 19 pandemic. The lack of available lipid profiles made risk assessment challenging since for almost half of them none were reported in the medical records.

4.11. Ethical consideration

Ethical clearance and approval of the project to conduct the study was obtained in writing from the College of Health Sciences (CHS) Institutional Review Board (IRB) of Addis Ababa University (Appendix C). All clinical and academic staff working in the CV and renal follow up clinics were informed in writing from the Head, Department of Internal Medicine, CHS for cooperation (Appendix F).

Participants were told that any information they provided remains strictly confidential and the information will be used only for the requested research purpose. They were told that during the interview their privacy would be maintained by having the interview in a private room dedicated for the interview (the Unit Head Nurse room), and not overhead by anyone else. For parts of information obtained from the participants' clinical record, the participants' clinical records were reviewed only during the data collection time at the follow up clinics and handled according to research ethics. The completed questionnaires were kept in locked cabinet and available only to the PI.

4.12. Data Analysis

The ongoing data were monitored and checked every day for clarity and completeness by the supervisor and cleaned by the PI before entry into the computer for analysis. Accordingly, the data from 377 (98.18%) participants were coded and entered into Epi Data Version 3.1 for data cleaning and then exported to SPSS version 25.00 statistical software package for analysis. All

variables were assessed for outliers using the normality plot. Data normality, skewness, and kurtosis were evaluated for scale-level data. The main statistics used in this study were frequency, percentage, mean, standard deviation, median, range, chi-square, t-test, Kappa, correlation, and regression (ordinal and multinomial). The specific statistical techniques used to address the specific objective are discussed below (section 4.14). The level of statistical significance was set at alpha level $< .05$ and the odds ratio with their 95% confidence interval (CI) was considered to declare that there exist independent variables effect on CVD risk reduction behavioral practices. The results of the data analyses for each specific objective are presented as appropriate with the use of figures, tables, charts, graphs, and texts in the next chapter.

4.13. Summary of Study Objectives and Methods

Specific Objective 1: Describe adult hypertensive patients attending TASH CV and renal clinics follow up by their socio-demographic and clinical profiles. The goal of this objective was to produce typical socio-demographic and clinical profiles of these patients. Descriptive univariate statistical analysis was used to describe data using mean, median, standard deviation (SD), frequency, percentage and were presented in tables, graphs, charts.

Specific Objective 2: Determine the patients' level of CVD risk factors knowledge using the CARRF-KL Scale. To achieve this objective, the patients' CVD risk knowledge score was analyzed using descriptive statistic for (mean, SD, median, minimum, maximum, range, skewness and kurtosis).

Specific Objective 3: Compare the patients' perceived and nl-Framingham 10-year CVD risk predicted. To achieve this objective, adult hypertensives' self-risk-perception of CVD outcome was assessed on eight items ABCD Questionnaire rating scale (Annex J). Then, the scores were analyzed using descriptive statistic for mean, SD, median, minimum, maximum, range, skewness and kurtosis and then the scores were computed into a composite score (Chapter 4). From the computed composite scores, the percentiles were determined using the SPSS statistical software. Accordingly, the patients were placed onto three ordinal risk status based on their score's percentile category ranges. Scores that range lowest through 17.00 were assigned to low- risk perception of CVD events, scores from 17.10 through 19.00 were assigned to moderate risk perception of CVD events, and scores that range from 19.10 through the highest were assigned to the high-risk perception of CVD events (Refer to result section). To estimate the hypertensives'

actual 10-year CVD risk, the non-laboratory-based Framingham 10-years CVD risk was calculated using the participants' sex, age, BMI, SBP, diabetes, and current smoking as an input.

There are many proposed CVD risk prediction methods available in literature such as the FRS (being most common) and the WHO risk scoring to ascertain an individual actual CVD risk. In clinical practice, CVD risk predictions are used to support clinicians to base their clinical decision making. The Framingham 10-year CVD risk estimation uses both the laboratory and non-laboratory-based risk estimations. Since the CVD risk of an individual depends on the his/her overall risk profile, the FRS laboratory-based method has a better predictive accuracy as it uses a number of parameters such as sex, age, serum lipid measures (TC and HDL-C), SBP, diabetes, current smoking to get total risk point. Whereas the FRS non-laboratory-based uses the same parameters except where the BMI replaces the lipid data. Alternatively, the WHO 2019 technical package for CVD management for clinicians for the risk-based CVD patients management provides region specific management. It also uses both the laboratory based and non-laboratory-based parameters for the total risk point calculations. The WHO laboratory-based method, which is used for treatment decision in a clinical setting with laboratory facilities for TC and FBG additionally uses parameters such as age, sex, smoking status, SBP to calculate the total CVD risk point of patients. However, the WHO non-laboratory-based approach is aimed to guide clinicians working in low resource setting where facilities for carrying out patients' biochemical data (lipid profile and FBG) is unavailable for decision on referral of patients to higher levels of care. It uses limited risk factors as an input for the CVD risk estimation such as age, sex, smoking status, SBP, and BMI. In the present study, we have opted for the FRS 10-year non-laboratory-based CVD risk estimation because 1) only 57% (n =215) of the sampled patients had their lipid profile checked. 2) Compared to the nl-FRS 10-year non-laboratory-based CVD risk estimation, the WHO non-laboratory method CVD risk estimation uses limited parameters, and considers age 40-74 years only that if we used it, could have led to sample loss due to the age < 40 exclusion, and the patients have HTN, which is an independent CVD risk factors despite the age exclusion by WHO method. Finally, the level of agreement between patients perceived and nl-Framingham 10-year predicted CVD risk was determined by Cohen's Kappa statistics and the patients were placed onto three categories: under-estimation (perceived their CVD risk lower compared to the actual CVD risk), correspondence (perceived their CVD risk agree with the actual CVD risk), and over-estimation

(perceived their CVD risk higher compared to the actual CVD risk) and their predictors were determined by running the multinomial logistic regression analysis.

Specific Objective 4: Determine hypertensive patients' CVD outcome risk reduction behaviors using structured behavioral practice questionnaire. To achieve this aim descriptive categorical binary outcome analysis of the patients risk reduction behavioral variables (regular physical activity, smoking cessation, glycemic control [if diabetes co-morbidity], medication adherence, dietary salt intake, fruit and vegetables consumption, alcohol moderation, and scale measure analysis of stress level were done and the patients' responses for the occurrence of the behavior coded as 1= for the yes; and 0= for the no responses and the findings are summarized using descriptive statistic (frequency and percentage) and the risk reduction status was determined by percentile and patients were placed onto ordinal level as low, moderate and high risk CVD risk reduction adopters.

Specific Objective 5: Determine the associations among the patients' CVD outcome risk reduction behavior and their demographic and clinical profile, knowledge score, and perceived risk score. A multivariable ordinal logistic regression analyses were employed using stepwise regression. The unique contribution of each independent variable to CVD outcome risk reduction behavior were determined after adjusting for other variables using logistic regression and the odds ratio.

4.14. Dissemination of the Study's Findings

The final project report will be presented and submitted to Addis Ababa University, School of Graduate Studies. The findings of the study will be further disseminated to TASH, Addis Ababa Health Bureau, and Federal Ministry of Health (FMOH), Ethiopia. The findings of the study will be disseminated to the scientific community through conference presentations both at local and international levels. Many of the findings of this study have already been published on international peer-reviewed journals and disseminated to the scientific community.

Titles of papers published and to be published

1. *Low subjective cardiovascular disease risk perceptions among hypertensive patients in Addis Ababa, Ethiopia
2. *Low cardiovascular risk reduction behaviors among hypertensives attending follow-up care at a tertiary-level hospital in Addis Ababa, Ethiopia

3. Knowledge of CVD risk factors and associated factors among adult hypertensive patients attending tertiary hospital in Addis Ababa, Ethiopia
4. *Target blood pressure control and its association with the sociodemographic and clinical profiles of hypertensives attending a tertiary level hospital in Addis Ababa, Ethiopia

*- published

CHAPTER IV: RESULTS

This study determined CVD risk reduction behavioral status and examined its relationships with sociodemographic, clinical, knowledge, and self-risk perception of CVD outcome variables among hypertensives attending CV follow up at tertiary hospital in Addis Ababa, Ethiopia. This chapter presents the result of the analyses based on each specific objective. Key findings related to the research question and specific objective are summarized and presented in tables, figures, charts, and described narratively.

The following sections present the results of the analyses of data for the specific objective one through five.

Objective 1: Describe the demographic and clinical characteristics of adult hypertensives attending CV follow-ups at a tertiary outpatient clinic in Addis Ababa, Ethiopia.

Demographic characteristics of adult hypertensives attending CV follow-up clinic at the tertiary hospital in Addis Ababa, Ethiopia included age, gender, religion, educational status, marital status, living situation, monthly income in ETB, and modes of medical care coverage. The clinical variables included family history of HTN, frequency of clinic visit for HTN, history of hospitalization due to HTN and HTN related medical diagnosis, current BP and other medications, history of comorbidities, lipid profile, BMI, participants' beliefs of whether their high BP is controlled, patients' understanding of measures that helped keep BP controlled (for those who believe their BP was controlled), patients' reasons why the BP was not controlled (for those patients who believe their BP was not controlled), history of traditional medicine use (type and mode of use; for those who used the traditional medicine), assessment of depressive symptoms, and stress level. The analyses of these data are summarized and depicted in/by the Table 1, 2, 3, and Figure 2 that follow.

Table1. Socio-demographic characteristics of adult hypertensives attending follow-up at TASH CV clinic in Addis Ababa, Ethiopia, 2020, n =377

Characteristics	n (%)
Age in year (Mean $\pm$ SD)	53.61 $\pm$ 12.8 years
30-39	56 (14.9)
40-59	188 (49.87)
≥ 60	133 (35.2)
Gender	
Male	193 (51.2)
Female	184 (48.2)
Religion	
Orthodox	291 (77.2)
Muslim	35 (9.3)
Protestant	46 (12.2)
Others	5 (1.3)
Marital status	
Single	52 (13.8)
Married	284 (75.3)
Divorced	21 (5.6)
Widowed	18 (4.8)
Separated	2 (0.5)
Living situation	
Live alone	46 (12.2)
With spouse	195 (51.7)
With parents	128 (34)
Other	8 (2.1)
Educational status	
Cannot read and write	26 (6.9)
Elementary	135 (35.8)
High school	133 (35.3)
Diploma & above	83 (22)
Monthly income in ETB	
<1000	118 (31.3)
1000-3000	179 (47.5)
3001-6000	60 (15.9)
>6000	20 (5.3)

Note: n (number), % (percentage), SD (standard deviation), ETB (Ethiopian Birr)

The mean age of participants was 53.61 ± 12.34 -year (Table 1) and the median age was 55 years, range (30-82 years). The mean age of the male participants was higher than their female counterparts (56.72 ± 11.95 years), median 58 years vs 50.36 ± 11.92 years, median 50 years, respectively. The mean age at the diagnosis of being hypertensive was 45.60 years (95% CI: 44.33 - 46.87). The mean age at the diagnosis of being hypertensive for male patients was 48.16 years (95% CI: 46.45 - 48.26), and for female patients was 42.92 years (95% CI: 41.08 -44.76) with males being significantly older than females ($t(375) = 4.971$, $p < .001$ with the mean difference of 6.36 years (95% CI: 3.84 - 8.87). Based on the literature (259), the participants were classified into three age categories including: young adult (18-39 years), middle-age adults (40-59 years), and older adults (60+ years) with approximately half (49.87%, $n= 188$) middle-aged adults. The adult hypertensives' developmental stages contrasted by gender is depicted by Figure 2 below.

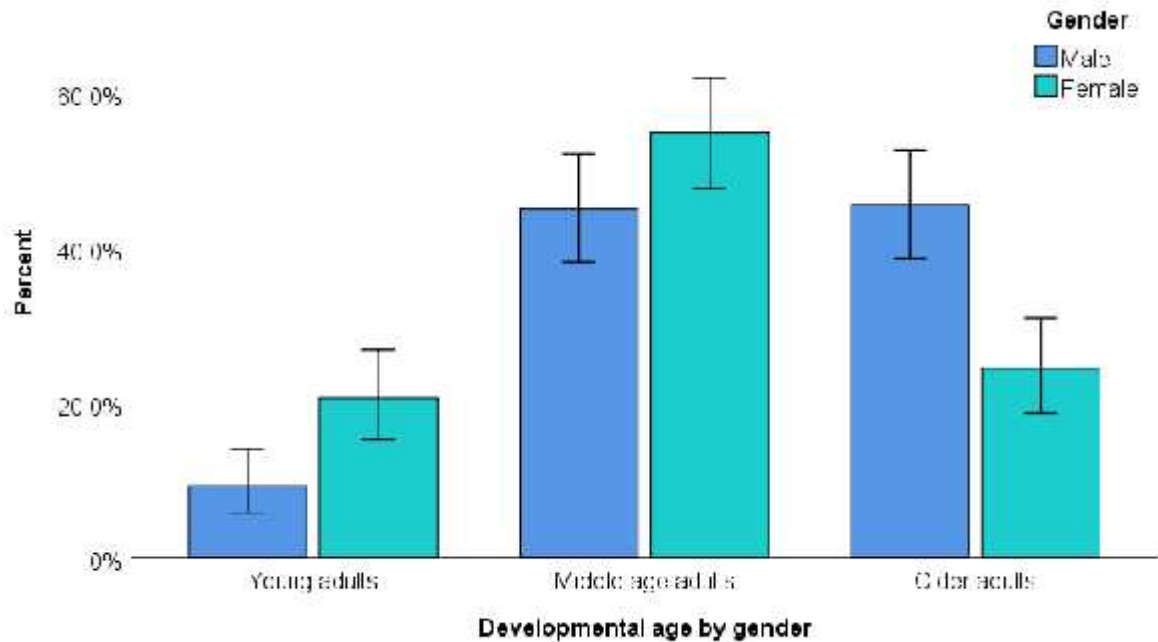


Figure 2. Bar graph showing the HTN developmental age category (by gender) of adult hypertensives attending follow-up at TASH CV clinic in Addis Ababa, Ethiopia, 2020, n = 377

Table 2. Clinical profile of adult hypertensives attending follow-up at TASH CV clinic, Addis Ababa, Ethiopia, 2020, n = 377

Characteristic	n	%
Family history of HTN		
Yes	144	38.20
No	233	61.80
Total	377	100
Medical care coverage		
Self	177	46.90
Free/government	188	49.90
Third party	12	3.20
Total	377	100
HTN clinic visit Fx		
Every month	20	5.3
Every 2 months	272	72.1
Every 3 months	53	14.1
Every 4 months	14	3.7
When sick only	18	4.8
Total	377	100
Target BP controlled		
Yes	170	45.1
No	207	54.9
Total	377	100
Hospitalized due to HTN related illness		
Yes	93	24.7
No	284	75.3
Total	377	100
BMI		
Under weight	10	2.7
Normal weight	141	37.4
Overweight	171	45.4
Obese	55	14.6
Total	377	100
Pts' believe of their BP controlled		
Yes	352	93.4
No	25	6.6
Total	377	100
Pts' measure that helped BP controlled		
Strict adherence to HCPs' advice	347	98.6
Self-treatment	3	0.9
Total	2	0.6
	352	100
Pts' reason why BP was not controlled		
Due life challenges	8	32.0
Because comorbidity	4	16.0
Not taking my medicine properly	6	24.0
Others	7	28.0
Total	25	100

Note: n (number), % (percentage), HTN (hypertension), BP (blood pressure), BMI (body mass index), Pt (patient)

Table 2 (continued).

Characteristics	n	%
Traditional medicine use		
Yes	52	13.8
No	325	86.2
Total	377	100
Mode of traditional medicine use		
As additive to Drs prescription	49	94.20
Switching to traditional medicine	3	5.80
Total	52	100
Type of traditional medicine used		
Moringa/Shiferaw	23	44.23
Thyme/Tosign	22	42.30
Others	7	13.61
Total	52	100
Current BP medications		
Diuretics	10	2.7
ACEI/ARB	67	17.8
CCB	53	14.1
Adrenergic blockers	8	2.1
Two drugs combination	172	45.6
More than two drugs	67	17.8
Total	377	100
Antihypertensive medication adherence		
Yes	347	92
No	30	8
Total	377	100
Currently additional medications		
Yes	226	59.95
No	151	40.05
Total	377	100
Depressive symptoms		
None-mild depression	102	27.10
Moderate-moderately severe depression	275	72.90
Total	377	100
Comorbidity list		
Diabetes	102	48.11
HHD	28	13.20
CKD	23	10.80
≥ 2 diseases	37	17.50
Others	22	10.40
Total	212	100
Information sources on seriousness of HTN		
Physicians	289	76.7
Nurses	65	17.2
Mass/social media	7	1.9
2 and more sources	11	2.9
Other	5	1.3
Total	377	100

ACE (angiotensive converting enzyme), ARB (angiotnsive receptor blocker), CCB (calcium channel blocker, HHD (hypertensive heart disease), CKD (chronic kidney disease)

As shown in Table 2 above half (n=188, 49.9%) of them received free medical care from the government for HTN. Nearly three-quarters (n= 272, 72.1%) of them had been visiting clinic bimonthly for the HTN. A great proportion (n= 226, 60%) of them were overweight or obese by BMI. The majority (n= 352, 93.4%) of the participants believe that their high BP was controlled. A considerable proportion (n=52, 13.8%) of them had used traditional medicine for the control of high BP. Moringa and thyme were the main traditional medicine used by the patients. The other important finding of the present study was that nearly three-quarters (n= 275, 72.9%) of the patients had moderate-to-moderately severe depressive symptoms based on PHQ-9. More than half (n=212, 56.23%) of them had comorbidities. Diabetes was the common comorbidity (n= 102, 48.11%) observed, and one in tenth of them (n=37) had ≥ 2 comorbidities.

Table 3. Clinical profile of adult hypertensives attending follow-up at TASH CV clinic, Addis Ababa, Ethiopia, 2020, n = 377

Variable	n	Median	Mean $\pm$ SD	95% CI
SBP (mmHg)	377	130.00	134.18 $\pm$ 16.02	132.56, 134.80
Body weight (Kg)	377	70.00	69.97 $\pm$ 11.71	68.78, 71.15
Height (Cm)	377	165.00	164.02 $\pm$ 9.04	163.10, 164.94
BMI (Kg/M ²)	377	25.71	26.02 $\pm$ 4.09	25.61, 26.44
TC (mg/dl)	215	182.00	193.16 $\pm$ 83.39	181.95, 204.37
TG (mg/dl)	215	142.00	167.65 $\pm$ 103.16	153.78, 181.52
HDL-c (mg/dl)	215	42.00	44.58 $\pm$ 12.64	42.88, 46.27
LDL-c (mg/dl)	215	114.00	116.51 $\pm$ 43.08	110.72, 122.30
FBG (mg/dl)	102	140.00	152.78 $\pm$ 53.92	142.19, 163.37
Clinical Status	n	%		
BMI	377			
Overweight	171	45.1		
Obese	55	14.6		
TC	215			
>200mg/dl	80	37.2		
TG	215			
>150mg/dl	90	41.9		
HDL-c male	113			
<40mg/dl	49	43.4		
HDL-c female	102			
<50mg/dl	63	61.8		
HDL- both sexes	215			
>60mg/dl	20	9.3		
FBG	102			
>100mg/dl	87	85.3		

SBP (systolic blood pressure), TC (total cholesterol), TG (triglyceride), HDL-c (high density lipoprotein cholesterol), LDL-c (low density lipoprotein cholesterol), FBG (fasting blood glucose)

The mean ($\pm$ SD) SBP (134.18 ± 16.02 mmHg) indicated that overall patients had the SBP level within the recommended limit. The mean ($\pm$ SD) BMI (26.02 ± 4.09 Kg/M²) suggested that overall patients were overweight. Only 57.03% of the patients had a medical record report of their lipid profile. The mean ($\pm$ SD) (44.58 ± 12.64 mg/dl) good cholesterol (HDL-c) level was in the lower normal limit. However, the mean ($\pm$ SD) (116.51 ± 43.08 mg/dl) bad cholesterol (LDL-c) level exceeded the normal range. The mean ($\pm$ SD) FBG (152.78 ± 53.92 mg/dl) indicated uncontrolled glycemic level among patients with a comorbid diabetes. The next table (Table 4) presents the results of gender-based independent t-test clinical variables of participants.

Table 4. Analysis of the gender based independent t-test clinical variables of adult hypertensives attending follow-up at TASH CV clinic, Addis Ababa, Ethiopia, 2020, n = 377

Variable	N	Med	M ± SD	95% CI	df	t	p-value	M. dif	95%CI
SBP (mmHg)					375	1.837	.067		
Male	193	130.00	135.65(±14.71)	133.56, 137.74					
Female	184	130.00	132.63(±17.19)	130.13, 135.13					
Body weight (Kg)					375	4.436	.000	5.22	2.91,7.54
Male	193	73.00	72.52(±11.12)	70.94, 74.09					
Female	184	68.00	67.29(±11.74)	65.59, 69.00					
Height (Cm)					375	11.408	.000	9.17	7.59, 10.75
Male	193	170.00	168.50(±8.24)	167.33, 169.68					
Female	184	160.00	159.33(±7.11)	158.26, 160.39					
BMI (Kg/M²)					375	-2.496	.013	-1.04	-1.87, -.22
Male	193	25.62	25.51(±3.39)	25.03, 25.99					
Female	184	25.93	26.56(±4.66)	25.88, 27.23					
TC (mg/dl)					213	1.228	.221		
Male	113	174.00	186.54 (±95.74)	168.69, 204.34					
Female	102	192.00	200.50 (±66.83)	187.38, 213.63					
TG (mg/dl)					213	.719	.473		
Male	113	146.00	172.46 (±112.29)	151.53, 193.39					
Female	102	146.00	172.46 (±112.29)	151.53, 193.39					
HDL-c (mg/dl)					213	1.537	.126		
Male	113	41.00	43.32 (±12.21)	41.04, 45.59					
Female	102	44.00	45.97 (±13.02)	431.41, 48.52					
LDL-c (mg/dl)					213	-2.295	.025	-13.37	-24.85, -1.82
Male	113	105.00	111.17 (±40.34)	102.65, 117.69					
Female	102	122.10	123.54 (±45.09)	114.68, 132.40					
FBG (mg/dl)					100	.368	.713		
Male	68	135.00	154.18 (±59.10)	139.87, 168.48					
Female	34	149.00	149.98 (±42.36)	135.20, 167.76					

Note: Med (median), M (mean), SD (standard deviation), 95% CI (95% CI for mean), t (t-statistic), M.dif (mean difference)

The maximum duration of HTN was 30 years as shown by below bar graph (Fig.3) below.

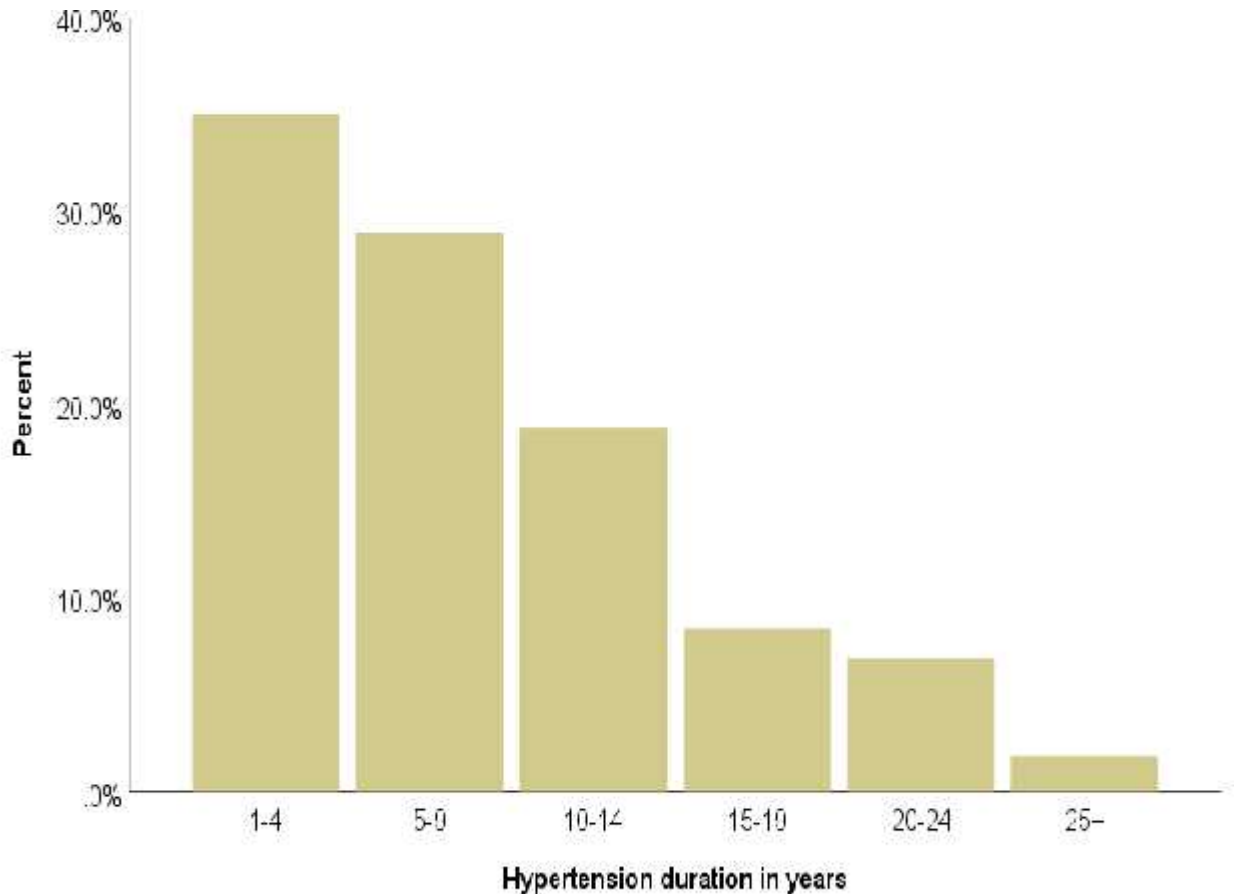


Figure 3. Bar graph showing duration of years lived with HTN since diagnosis adult hypertensives attending follow-up at TASH CV clinic in Addis Ababa, Ethiopia, 2020, n = 377

The mean ($\pm$ SD) and median duration of HTN were 8.01 ± 6.07 and 6.00 years, respectively, range (1-30 years). There was a decline in number of years participants lived with HTN since diagnosis. In particular, the number of patients being followed for HTN beyond 14 years was remarkably low.

Objective 2: Determine the knowledge of CVD risk of adult hypertensives attending CV follow-ups at a tertiary clinic in Addis Ababa, Ethiopia.

To address this study objective, the study participants were asked to complete the CARRF-KL Scale Questionnaire. Patients' knowledge scores were analyzed for the total scale, and each of

the 3 subscales including: characteristics of CVD and their avoidance, and age; risk factors for CVD; and resultant behavioral changes (Table 5). Total questionnaire scores are presented in Table 5. Knowledge subscale scores are presented in Table 6. Total knowledge level of participants is depicted in Figure 4 below.

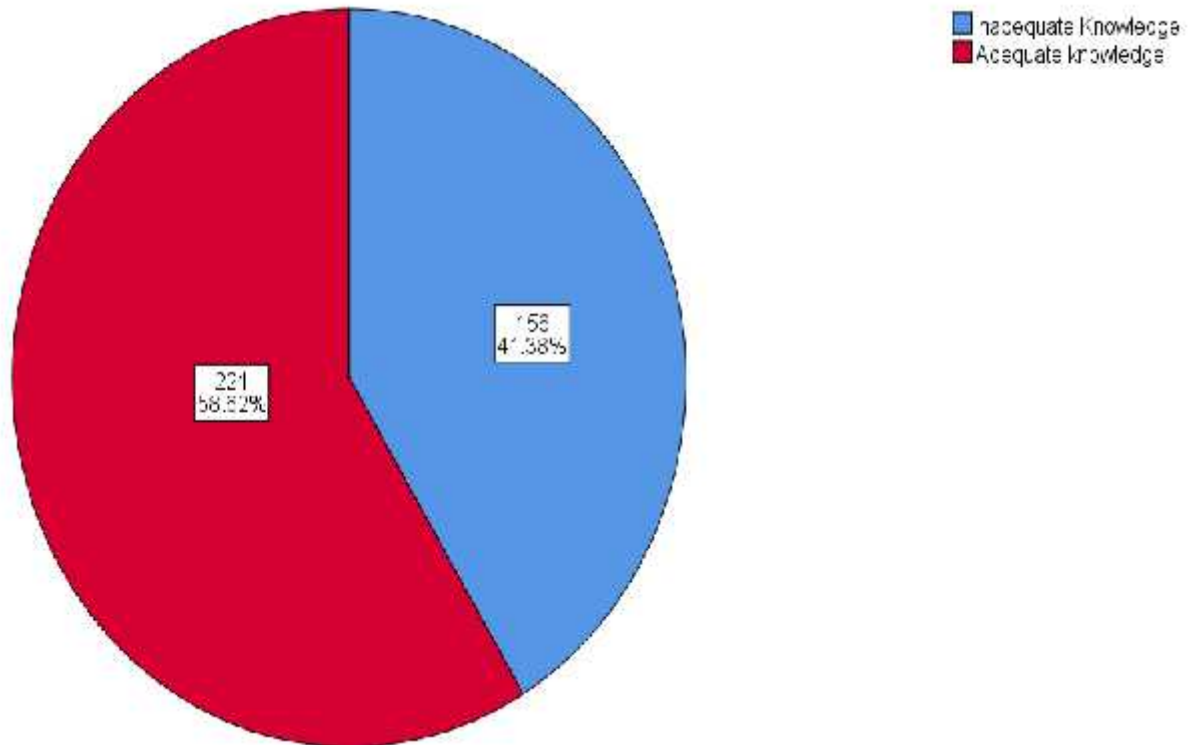


Figure 4. Total CVD risk factors knowledge level of adult hypertensives attending follow-up at TASH CV clinic in Addis Ababa, Ethiopia, 2020, n = 377

The mean ($\pm$ SD) CVD risk factors knowledge score of study participants was 19.92 ± 3.40 , scores ranges (7- 26). Fewer than half (58.62%) of them had adequate knowledge Figure 4 of CVD risk factors. There was no statistically significant mean knowledge score differences based on gender; two-sample t (375) =1.1, p=.267. Knowledge sub-scale scores of CVD risk knowledge are summarized in the Table 6.

Table 5. CVD risk factors knowledge scores of adult hypertensives attending follow-up at TASH CV clinic in Addis Ababa, Ethiopia, 2020, n = 377

Item NO	Characteristics of CVD and their avoidance and age questionnaire items	Correct response	
		n	%
1	A person always realizes if he/she has heart disease.	196	49.3
2	A family history of CVD increases your risk of having heart disease.	262	69.5
3	Elderly people are at a higher risk for heart disease.	312	82.8
4	Coronary heart disease can be prevented.	294	78.0
Risk factors for CVD questionnaire items			
5	Smoking is a preventable cause of death and disease in Ethiopia.	339	89.9
6	Smoking is a risk factor for heart disease.	330	87.5
9	It is harmful to eat red meat more than 3 times a week.	162	43.0
10	Eating salty meals leads to increases in BP.	342	90.7
11	Fatty meals do not increase the cholesterol level in the blood.	187	49.6
12	Fats that are solid at room temperature are beneficial for heart health.	291	77.2
14	Overweight individuals have a higher risk of heart disease.	328	87.0
18	Stress, sorrow, and burden increase the risk of heart disease.	335	88.9
19	Blood pressure increases under stressful conditions.	348	92.3
20	High BP is a risk factor for heart disease.	331	87.8
23	High cholesterol is a risk factor for heart disease.	283	75.1
24	There is a risk of heart disease if good (HDL) cholesterol is high.	60	15.9
25	There is a risk of heart disease risk if bad (LDL) cholesterol is high.	198	52.5
27	Diabetes is a risk factor for heart disease.	260	69.0
28	The risk can be reduced in diabetic patients with glucose control.	194	51.5
Resultant behavioral changes			
7	The risk of developing heart disease is reduced when smoking is stopped	303	80.4
8	It is beneficial to eat 2-3 portions of fruit and 2 portions of vegetables daily.	318	84.4
13	A low-carbohydrate and low-fat diet are beneficial for heart health.	215	57.0
15	Regular exercise reduces the risk of heart disease.	331	87.8
16	Risk can be reduced by exercising only in a gym.	234	62.1
17	Slow walking and wandering are also considered exercises.	326	86.5
21	Blood pressure control reduces the risk of heart disease.	341	90.5
22	Hypertension medications should be used for a lifetime.	230	61.0
26	Every person with high cholesterol levels is given medicine.	207	54.1

Note: n (number of sample), % (percentage)

Correct responses are presented in Table 5 which illustrate percentage of correct responses. Participants had reasonably good knowledge around CVD and old age, smoking risk, salty food, being overweight, stress, high BP, fruit and vegetables health benefits and exercise (all >80%). However, despite participants attending a tertiary level clinic, they had inadequate knowledge in dietary intake and factors influencing serum cholesterol level. Behavioral change items related to CVD risk showed 57% were aware of the health benefits associated with a diet low in carbohydrates and fat. A little over one-third (37.9%) of them considered regular physical exercise as exercise done in the gym only. Regarding antihypertensive medications, less than two-thirds (61%) of them knew that the medications should be taken for the rest of their life for BP control.

The 3 subscale CVD risk knowledge scores were analyzed to determine mean differences as shown in Table 6 below.

Table 6. Content area sub-scales CVD risk factors knowledge mean percentage adult hypertensives attending follow-up at TASH CV clinic in Addis Ababa, Ethiopia, 2020, n = 377

Knowledge content area	Max score	M ($\pm$ SD)	M %
Characteristics of CVD and their avoidance and age	4	2.70 (0.97)	67.50
Risk factors for CVD	15	10.59 (2.21)	70.60
Resultant behavioral changes	9	6.60 (1.38)	73.33

Note: Max score (maximum possible score), M (mean), SD (standard deviation), M% (mean percentage).

Participants had higher mean percentage score on resultant behavioral changes compared to the other subscales.

Objective 3: Compare the perceived and 10-year nl-Framingham Risk Score of CVD among adult hypertensives attending follow-up care at a tertiary outpatient clinic in Addis Ababa, Ethiopia.

To achieve this objective, adult hypertensives' self-risk-perception of CVD outcome was assessed by the ABCD Questionnaire rating scale (1 = strongly disagree, 2 = disagree, 3 = agree or, 4 = strongly agree) (Appendix J). The mean ($\pm$ SD) CVD risk-perception was 17.79 ± 3.51 , range (8-32) that suggests the majority (58.62%) of participants had a low self-risk-perception of CVD events. There were no statistically significant risk-perception differences based on gender; two-sample t (375) = .397, $p = .69$, although female participants had a higher self-risk perception score compared to their male counterparts (16.98% vs 14.32%). The proportions of participants self-risk perception status determined by percentile and categorized as low, moderate, and high for the CVD event is depicted in the bar graph below (Figure 5).

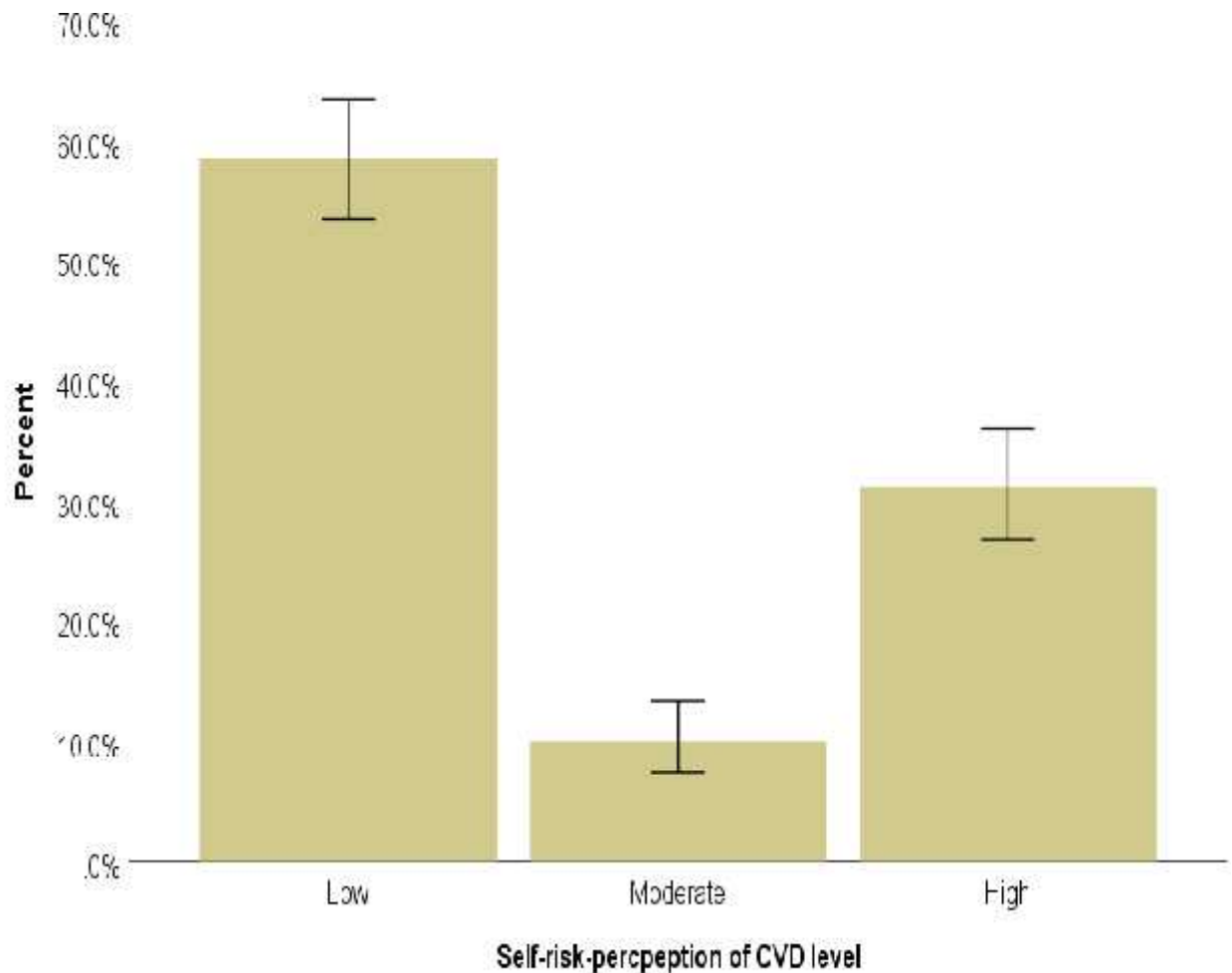


Figure 5. Self-risk perception of CVD event level of adult hypertensives attending follow-up at TASH CV clinic in Addis Ababa, Ethiopia, 2020, n = 377

The nl-FRS CVD risk was employed to compute the patients' total risk points and showed that the mean ($\pm$ SD) score was 13.84 ± 4.82 , range (1-25). Accordingly, nearly three-fourths (72.4%) of them had moderate 10-year CVD risk scores. There were no significant mean differences based on gender; two-sample $t_{(375)} = .144$, $p = .15$ despite males attaining higher mean score ($14.19, \pm 5.07$) than females (13.48 ± 4.52). The patients' nl-FRS 10-year CVD estimated risk ordinal levels (low, moderate and high) for the CVD event is depicted by the below bar graph (Figure 6).

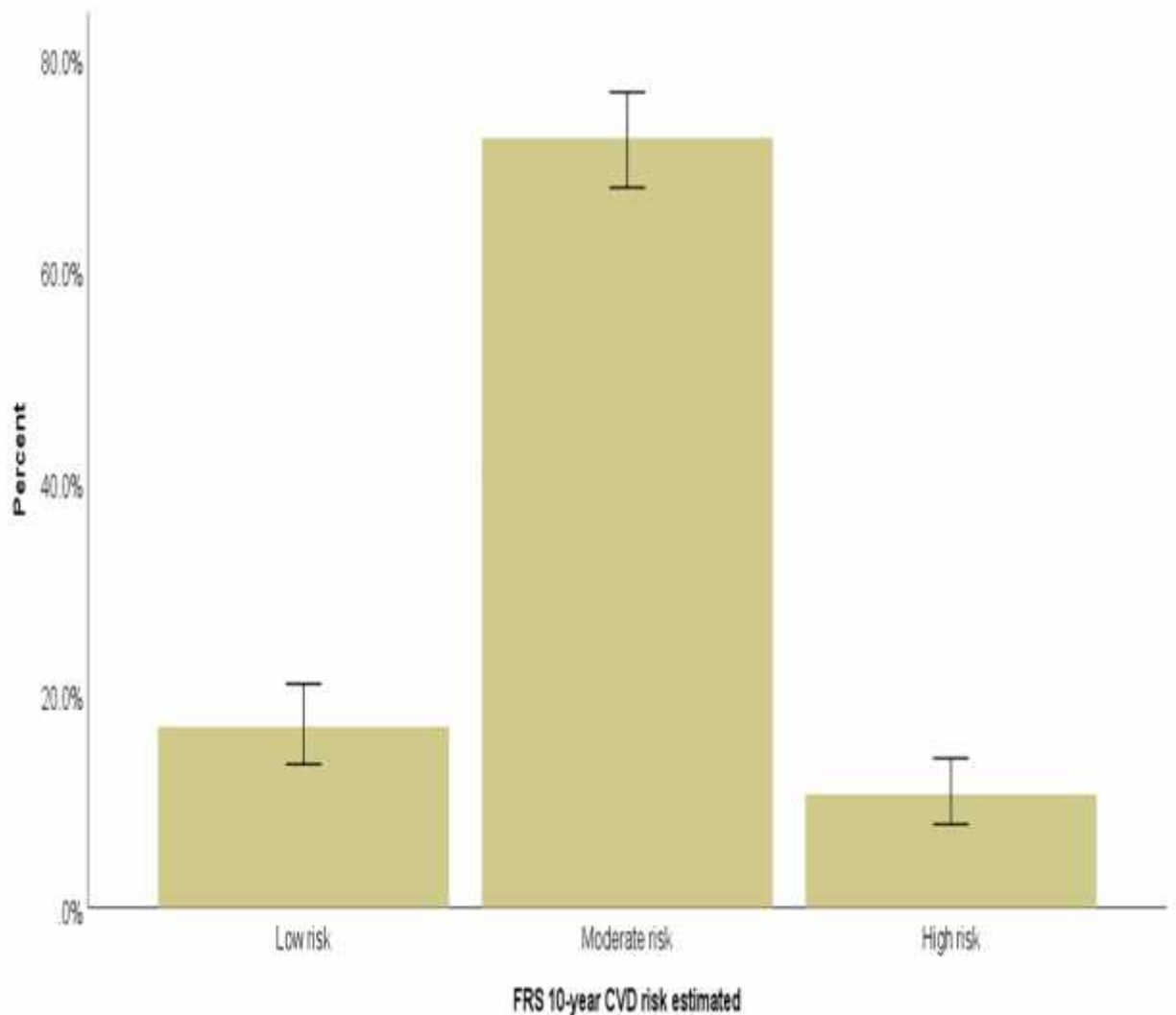


Figure 6. Bar graph showing nl-FRS 10-year CVD risk level (estimated) of adult hypertensives attending follow-up at TASH CV clinic in Addis Ababa, Ethiopia, 2020, n = 377

An inter-observation reliability of Cohen's Kappa statistical test was performed to determine the extent of agreement between patients' perceived CVD event risk and the nl-FRS 10-year CVD risk estimated. The observation was found to be less than chance agreement $k = .0002$, $p = .99$. The proportion of patients observed and expected (given in the parenthesis) agreement and the overall agreement levels for the CVD risk is depicted in Table 7 below.

Table 7. Crosstabulation showing Cohen's Kappa agreement between the self- perceived CVD outcome risk and nl-Framingham 10-year CVD risk estimated for adult hypertensives attending follow-up at TASH CV clinic in Addis Ababa, Ethiopia, 2020, n = 377

		nl-FRS 10-year CVD risk estimated, n(%)				Agreement N (%)				
		Low	Moderate	High	Total	Corresponded	UE	OE	K	p-value
Perceived CVD risk	Low	36 (56.25)	162 (59.35)	23 (57.5)	221 (58.62)	88 (23.34)	189 (50.13)	100 (26.53)	.0002	.99
	Moderate	12 (18.78)	39 (14.29)	4 (10)	55 (14.59)					
	High	16 (25)	72 (26.37)	13 (32.5)	101 (26.79)					
Total		64 (100)	273 (100)	40 (100)	377 (100)					

UE (underestimated), OE (overestimated), K (Kappa), **nl-FRS (non-laboratory)** Framingham Risk score)

Table 7 shows the crosstabulation comparison of the Cohen's Kappa statistic performed on the hypertensives' perceived CVD risk and the nl-FRS estimated. The Kappa value of - k = .0002, p = .99 suggests no agreement between the patients' perceived CVD risk and nl-FRS. Less than 25% of participants perceived their 10-year CVD risk accurately compared to the nl-FRS calculation. While over 75% of them misconstrued their risk, with just half of them underestimated their CVD risk. However, when the Kappa statistic was computed separately for gender there was slight K value difference that showed the female patients had disagreement (worse than expected), K = -.003, p = .92. Although there were no significant risk-perception agreement differences observed based on gender, compared to male hypertensives, the female patients tended to overestimate their CVD risk (28.41% vs 24.87%) (not shown).

Further analyses of risk perception categories were performed to determine whether participants had accurate, underestimated, or overestimated their CVD risks. A cross-tabulation and chi square test was conducted to examine for bivariate relationship between the patients' self-risk-perception categories (i, e., accurate, overestimated, or underestimated) and the independent variables as depicted in Table 8. Finally, variables with p-value of <0.3 were exported to the multinomial logistic (MNL) regression analyses (Tables not shown) to determine their association and the strength of the associations.

Table 8. Crosstabulation and chi square test showing the association between risk perception category (Kappa agreements: accurate, OE, and UE) and independents variables (IV) of adult hypertensives attending follow-up at TASH CV clinic in Addis Ababa, Ethiopia, 2020, n = 377.

IV			Kappa agreement (KA)				χ^2	df	p	Inference
			Accurate	OE	UE	Total				
Marital status	Single	Count	10	10	32	52	4.916	4	0.296	NS
	Married	Count	67	76	141	284				
	Others	Count	11	14	16	41				
	Total	Count	88	100	189	377				
HTN clinic visit	Every month	Count	3	3	16	22	13.78	6	.032	S
	Every 2months	Count	63	78	131	272				
	Every 3 months	Count	9	15	29	53				
	Every 4+ months	Count	13	4	13	30				
	Total	Count	88	100	189	377				
History of comorbidity	No	Count	32	47	86	165	2.616	2	.27	NS
	Yes	Count	56	53	103	212				
	Total	Count	88	100	189	377				
Regularly engaged to PA	No	Count	9	14	39	62	5.326	2	.07	NS
	Yes	Count	79	86	150	315				
	Total	Count	88	100	189	377				
Diabetes controlled? if diabetes	No	Count	21		21	40	8.105	4	.088	NS
	Yes	Count	9		1	14				
	no diabetes	Count	58		78	135				
	Total	Count	88		100	189				

S (signficant), NS (not significant), KA (kappa agreement). OE (overestimated), UE (underestimated).

Table 8. Continued

HTN Duration in years	1-4	Count	34	30	68	132	18.371	8	.019	S
	5-9	Count	23	29	57	109				
	10-14	Count	8	21	42	71				
	15-19	Count	10	13	9	32				
	20+	Count	13	7	13	33				
Total		Count	88	100	189	377				
Age category	Young adults	Count	12	12	32	56	5.153	4	.272	NS
	Middle age adults	Count	46	58	84	188				
	Old age adults	Count	30	30	73	133				
	Total	Count	88	100	189	377				

S (significant), NS (not significant), KA (kappa agreement). OE (overestimated), UE (underestimated).

The bivariate chi square test-analyses of independent variables (Table 8; only the variables with $p < .3$) were shown. HTN clinic visit frequency in months, and duration of HTN were significantly associated with risk perception category. However, there were no observed associations between independent variables (not shown in Table 8 here): marital status ($\chi^2_{(4)} = 4.916$, $p = 0.296$), educational status ($\chi^2_{(6)} = 2.307$, $p = 0.889$), monthly income ($\chi^2_{(6)} = 4.445$, $p = 0.751$), family history of HTN, previous history of hospitalization ($\chi^2_{(2)} = .555$, $p = 0.758$), SBP control ($\chi^2_{(2)} = .129$, $p = 0.937$), BMI status ($\chi^2_{(2)} = .725$, $p = 0.696$), age ($\chi^2_{(2)} = 5.153$, $p = 0.272$), and knowledge of CVD ($\chi^2_{(2)} = 1.838$, $p = 0.339$). However, all independent variables with p-values < 0.3 were considered and exported to the final model; multinomial logistic regression (MNLR) analysis to test for their association and strength of the association with the risk perception category. All the model data assumptions were checked for no violations and presented as follows.

1) The model fitting information. The model fitting information yielded a significant p-value indicating that the final model represented a significant improvement in fit over the null model ($\chi^2_{(30)} = 60.964$, $p = .001$).

2) Goodness of fit. A finding of non-significance is an indicator of model fit. Both Pearson χ^2 and deviance's tests indicated that the model does fit the data well; Pearson [$\chi^2_{(346)} = 367.365$, $p = .203$], deviance [$\chi^2_{(346)} = 357.034$, $p = .330$].

3) Likelihood ratio test. The likelihood ratio test showed the overall contribution of each independent variable to the model, with omnibus test of factors at the alpha value of < 0.05 threshold. The independent variables: HTN duration and engagement to PA were significant predictors in the model ($p = .009$, $p = .043$, respectively). However, frequency of physician visits and diabetes control approached significance as predictors in the model ($p = .057$, $p = .063$, respectively).

4) Parameter estimates. The result in the parameter estimates table shows information on the independent variables compared to the accurate CVD risk perception of hypertensive participants. More specifically, the regression coefficient of each independent variable that indicated which independent variable statistically discriminate between variables associated with overestimated compared to the reference category (accurate) and those underestimated as compared to the reference category (accurate) risk perception of CVD, the result is depicted in Table 9 below with concise table summary.

5) Classification statistic table. The classification table determined the risk perception category best predicted by the model. Accordingly, CVD risk underestimated was correctly predicted by the model [$84.7\% = 160/(160+12+17)$].

Table 9. Parameter Estimates of the MNL analyses of predictors of CVD risk perception category (accurate, UE, and OE) of adult hypertensives attending follow-up at TASH CV clinic in Addis Ababa, Ethiopia, 2020, n = 377

KA ^a		95% CI							
		B	Std. Error	Wald	df	Sig.	AOR	Lower Bound	Upper Bound
OE	Intercept	-1.946	.891	4.770	1	.029			
	HTN clinic visit- every month	1.331	1.037	1.646	1	.200	3.783	.495	28.892
	HTN clinic visit - every 2 months	1.467	.618	5.637	1	.018	4.338	1.292	14.566
	HTN clinic visit - every 3 months	1.846	.741	6.211	1	.013	6.331	1.483	27.029
	HTN clinic visit - every 4months & beyond	Ref	.	.		.	.	.	.
	Marital status-single	-.457	.667	.469	1	.493	.633	.171	2.341
	Marital status-married	-.175	.480	.133	1	.716	.839	.327	2.152
	Marital status-others	Ref	.	.		.	.	.	.
	No Hx of comorbidity	.245	.358	.466	1	.495	1.277	.633	2.579
	Have Hx of comorbidity	Ref	.	.		.	.	.	.
	Not engaged to PA	.411	.485	.719	1	.396	1.509	.583	3.904
	Engaged to PA	Ref	.	.		.	.	.	.
	Diabetes-not controlled	-.152	.432	.124	1	.725	.859	.368	2.004
	Diabetes controlled	-2.302	1.099	4.389	1	.036	.100	.012	.862
	No Hx of diabetes	Ref	.	.		.	.	.	.
	HTN duration 1-4 yrs	.453	.571	.630	1	.427	1.574	.514	4.820
	HTN duration 5-9 yrs	.861	.589	2.138	1	.144	2.366	.746	7.505
	HTN duration 10-14 yrs	1.463	.661	4.907	1	.027	4.320	1.184	15.769
	HTN duration 15-19 yrs	.863	.657	1.728	1	.189	2.370	.655	8.584
	HTN duration 20+ yrs	Ref	.	.		.	.	.	.
	Young adults	.033	.553	.004	1	.952	1.034	.350	3.054
	Middle age adults	.226	.349	.421	1	.517	1.254	.633	2.486
	Elders	Ref	.	.		.	.	.	.

a. The reference category is: Accurate. b. This parameter is set to zero because it is the reference category. OE (overestimated), UE (underestimated). Ref (reference category).

Table 9 (continued).

KA ^a		95% CI							
		B	Std. Error	Wald	df	Sig.	AOR	Lower Bound	Upper Bound
UE	Intercept	-1.498	.752	3.963	1	.047			
	HTN clinic visit -every month	1.538	.791	3.783	1	.052	4.656	.988	21.934
	HTN clinic visit - every 2months	.633	.453	1.950	1	.163	1.883	.774	4.579
	HTN clinic visit - every 3months	1.167	.581	4.035	1	.045	3.211	1.029	10.023
	HTN clinic visit - every 4months & beyond	Ref	.	.		.	.	.	.
	Marital status-single	.887	.604	2.156	1	.142	2.429	.743	7.938
	Marital status-married	.525	.462	1.287	1	.257	1.690	.683	4.182
	Marital status-others	Ref	.	.		.	.	.	.
	No Hx of comorbidity	.414	.326	1.607	1	.205	1.512	.798	2.867
	Have Hx of comorbidity	Ref	.	.		.	.	.	.
	Not engaged to PA	.950	.424	5.011	1	.025	2.585	1.125	5.939
	Engaged to PA	Ref	.	.		.	.	.	.
	Diabetes- not controlled	.282	.385	.535	1	.464	1.326	.623	2.821
	Diabetes - controlled	-.140	.519	.073	1	.788	.870	.315	2.404
	No hx of diabetes	Ref	.	.		.	.	.	.
	HTN duration 1-4yrs	.851	.487	3.050	1	.081	2.342	.901	6.088
	HTN duration 5-9yrs	1.156	.508	5.180	1	.023	3.176	1.174	8.590
	HTN duration 10-14yrs	1.849	.589	9.864	1	.002	6.354	2.004	20.145
	HTN durationn15-19yrs	-.077	.639	.014	1	.905	.926	.265	3.242
	HTN duration 20+yrs	Ref	.	.		.	.	.	.
	Young adults	-.228	.479	.227	1	.634	.796	.311	2.037
	Middle age adults	-.416	.309	1.808	1	.179	.660	.360	1.210
	Elders	Ref	.	.		.	.	.	.

a. The reference category is: Accurate. b. This parameter is set to zero because it is the reference category. OE (overestimated), UE (underestimated), 0 (reference group), KA (kappa agreement), Ref (reference category).

The MNL analysis (Table 9) where the outcome variable was risk perception category (accurate, underestimated, and overestimated), the Omnibus Wald F-test analyses indicated that CVD risk perception category was statistically significantly associated with HTN clinic visit frequency; diabetes control status; HTN duration, and engagement in PA status. However, CVD risk perception was not associated with marital status, history of comorbidity, and adult age category.

The risk perception category (Table 9): accurate (reference category) vs inaccurate (overestimated) analyses indicated that CVD risk overestimated was significantly associated with patients': HTN clinic visit frequency of every 2 months, HTN clinic visit frequency of every 3 months, controlled diabetes, and HTN duration of 10-14 years. Similarly, CVD risk perception category (Table 9): accurate (reference category) vs inaccurate (underestimated) analyses indicated that CVD risk underestimated was significantly associated with participants': frequency of clinic visit of every 3 months, not engaged in PA, HTN duration of 5-9 years, and HTN duration of 10-14 years.

In the CVD risk OE category (Table 9), the first set with the coefficient (b) represented comparison between the accurate and overestimated CVD risk for the independent variable; frequency of clinic visit. It was noted that HTN clinic visits of every two and three months were significant predictors ($b = 1.467$, $SE = .618$, $p = .018$) and ($b = 1.846$, $SE = .741$, $p = .013$), respectively in the model. The relative odds of being overestimated CVD risk increased by 1.467 times and 1.846 times than being in accurate CVD risk perception category for hypertensives with clinic visits every two and three months, respectively compared to those of patients with the clinic visits every four and beyond months. When participants moved from the clinic visits every four or longer months to every two- and three-months clinic visits, the OR were 4.338 times and 6.331 times high, respectively for CVD risk perception. Thus, patients who had visited the clinic every two- and three- months tended to overestimate their CVD risk compared to those patients who had visited the clinic every four and beyond months.

Controlled diabetes was a significant predictor ($b = -2.302$, $SE = 1.009$, $p = .036$) in the model. The relative odds of being overestimated CVD risk decreased by 2.302 times than being in accurate CVD risk perception category for hypertensives who controlled their diabetes compared to those patients with no history of diabetes. Hypertensives with controlled diabetes were 90% less likely to overestimated their CVD risk compared to those with no history of diabetes. However,

compared to hypertensives with no history of diabetes, hypertensives who had uncontrolled diabetes were 14.1% less likely to be in the OE CVD risk category than in the accurate category, which was not statically significant ($p = .725$)

The HTN duration of 10-14 years was a significant predictor ($b = 1.463$, $SE = .661$, $p = .027$) in the model. The relative odds of being overestimated CVD risk increased by 1.463 times than being in accurate CVD risk perception category for hypertensives with HTN duration of 10-14 years compared to those patients with HTN duration of 20+ years. Participants with a HTN duration to the 10-14 years were 4.320 times more likely to perceive higher CVD risk than those with the duration of 20+ years.

In the underestimated CVD risk category (Table 10), HTN clinic visits every three months was a significant predictor ($b = 1.167$, $SE = .581$, $p = .045$) in the model. The relative odds of being underestimated CVD risk increased by 1.167 times than being in accurate CVD risk perception category for hypertensives with the frequency of clinic visits every three months compared to those patients with the frequency of clinic visit of every four and beyond months. Participants with clinic visits every three months were 3.21 times more likely to perceive lower CVD risk. Overall, it was observed that as the frequency of clinic visit intervals got longer (moving from every month onward to every three months, the OR showed an increasing pattern though not significant.

Not regularly engaged in PA was a significant predictor ($b = .950$, $SE = .424$, $p = .025$) in the model. The relative odds of being underestimated CVD risk increased by 0.950 times than being in accurate CVD risk perception category for hypertensives who did not engage in regular PA compared to those patients engaged in regular PA. This means, when patients moved from the regularly engaged in PA to the not regularly engaged in PA, the OR was 2.585 times high. Thus, patients who did not engage in regular PA tended to underestimate their CVD risk compared to those patients engaged in regular PA.

The HTN duration of 5-9 years and 10-14 years were significant predictors ($b = 1.156$, $SE = .508$, $p = .023$; ($b = 1.849$, $SE = .589$, $p = .002$) in the model. The relative odds of being underestimated CVD risk increased by 1.156 times and 1.849 times than being in accurate CVD risk perception for patients with HTN duration of 5-9 years and 10-14 years, respectively compared to those of patients with HTN duration of 20+ years. This means, when patients move from the HTN duration of 5-9 years and 10-14 years to HTN duration of 20+ years, the OR are 3.166 times

and 6.354 times high, respectively. Thus, patients with HTN duration of 5-9 years and 10-14 years tend to underestimate their CVD risk compared to those patients with HTN duration of 20+ years.

Objective 4: Determine the CVD risk reduction behavioral status among adult hypertensives attending follow-up care at a tertiary outpatient clinic in Addis Ababa, Ethiopia.

The mean ($\pm$ SD) CVD risk reduction behavioral practice score was 5.23 ± 1.16 , range (2-8), and there were no significant mean differences based on gender; two-sample $t(375) = -1.245$, $p = .214$. The specific CVD risk reduction behavioral practice of participants is shown in the table that follows (Table 10).

Table 10. Adopted CVD risk reduction behavioral practice of adult hypertensives attending follow-up at TASH CV clinic in Addis Ababa, Ethiopia, 2020, $n = 377$

Behavior	Yes Fx (%)	No Fx (%)	p-value
Engaged in regular PA			.365
Male	163 (84.45)	30 (15.54)	
Female	152 (82.61)	32 (17.39)	
Total (N = 377)	315 (83.55)	62 (16.44)	
Current smoking			.030
Male	16 (9.29)	177 (91.7)	
Female	6 (3.26)	178 (96.74)	
Total (N = 377)	22 (5.83)	355 (94.16)	
Controlled diabetes			.019
Male	9 (13.64)	57 (86.36)	
Female	8 (20)	32 (80)	
Total (N = 106)	17 (16.04)	89 (83.96)	
Dietary salt intake (<5 to 6 gm/d)			.449
Male	82 (42.49)	111 (57.51)	
Female	76 (42.31)	108 (58.69)	
Total (N = 377)	158 (41.91)	219 (58.09)	
Fruit and vegetables (>5 servings/d)			.517
Male	56 (29.01)	137 (70.98)	
Female	54 (29.34)	130 (70.65)	
Total (N = 377)	110 (29.18)	267 (70.82)	
Medication adherence			.892
Male	178 (92.20)	15 (7.80)	
Female	169 (91.80)	15 (8.20)	
Total (N = 377)	347 (92.00)	30 (8.00)	
Alcohol moderation			.035
Male	20 (10.36)	173 (89.64)	
Female	9 (4.89)	175 (95.11)	
Total (N = 377)	29 (7.69)	348 (92.31)	
Managed stress			.021
Male	27 (13.99)	166 (86.01)	
Female	13 (7.06)	171 (92.93)	
Total (N = 377)	40 (10.61)	337 (89.39)	

Note: Engaged in regular moderate physical exercise (walking for ≥ 30 minutes per day or cycling, gardening ≥ 5 times/week; or strenuous exercise: jogging, swimming, playing football for ≥ 4 hours/week). Currently smoke any form of tobacco (Current means smoking at least one cigarette per day during the previous 12 months including those who had quit smoking within the past year). Have diabetes currently controlled (glycemic control: FBG < 100 mg/dl or Hgb A1c $< 7\%$). Have < 5 to 6 gm salt per day add to diet. Have > 5 servings (400-500gm) of fruits and vegetable per day (one serving is equivalent to one orange or one apple or one banana and three tablespoons of cooked

vegetables). Have low to moderate alcohol intake within the past 12 months (1drinks/day or <4 drinks/week for female, 1-2 drinks/day or < 4 drinks /week for male). Have managed stress.

As shown in Table 10, interestingly, greater than three-quarters (83.6%) of participants were engaged in regular moderate physical exercise. Over nine in tenth (94.20%) of them were not current smokers. The majority (92%) were adherent to antihypertensive medications. A very small proportion (7.7%) of them had low-to-moderate alcohol intake in the past year that indicated the overwhelming majority of them had no alcohol intake of what is recommended for health. Few (10 %) reported managing their stress. Based on overall percentile scores of participants' CVD risk reduction behaviors, the majority (56.5%, n = 213) of them were at low CVD risk reduction practices. The participants' ranked CVD risk reduction behaviors status is depicted in Figure 7 below.

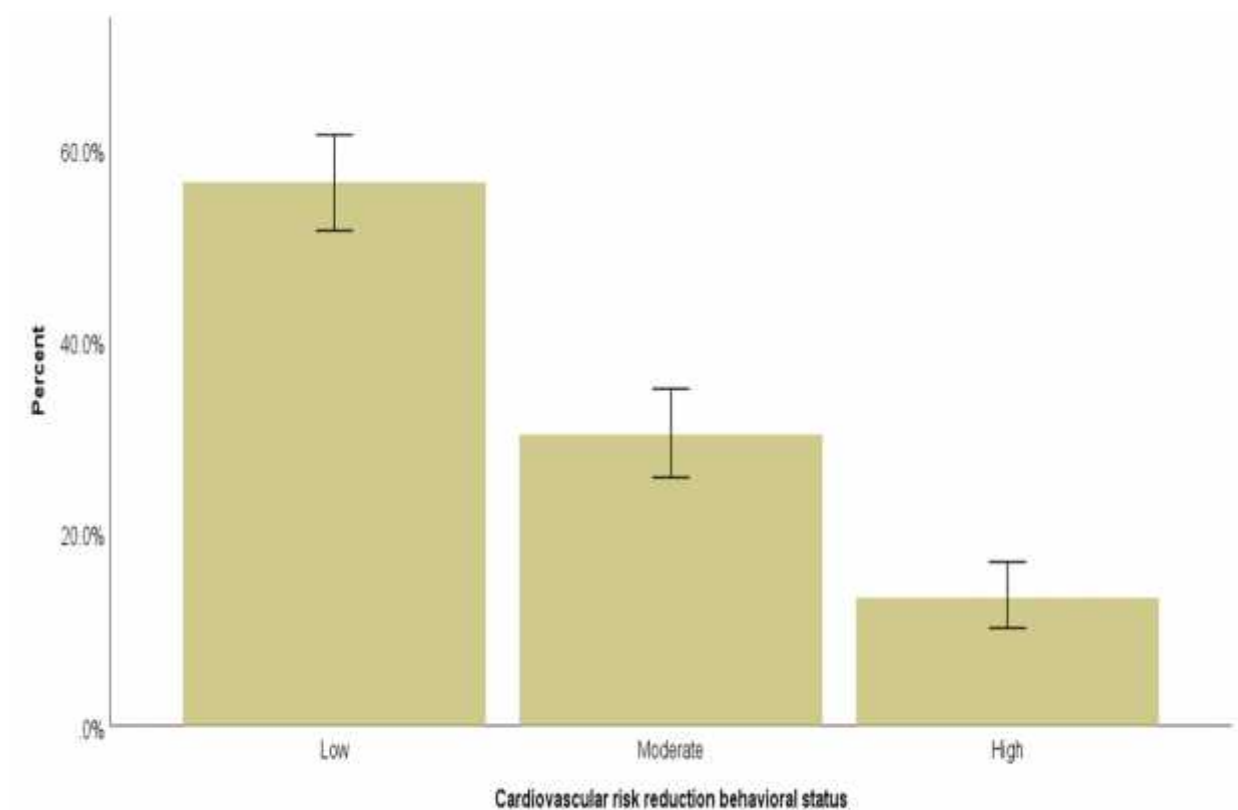


Figure 7. Bar graph showing CVD risk reduction behavioral practice status of adult hypertensives attending follow-up at TASH CV clinic in Addis Ababa, Ethiopia, 2020, n = 377

Gender wise stratification of CVD risk reduction behavior practice status is depicted in Fig 8.

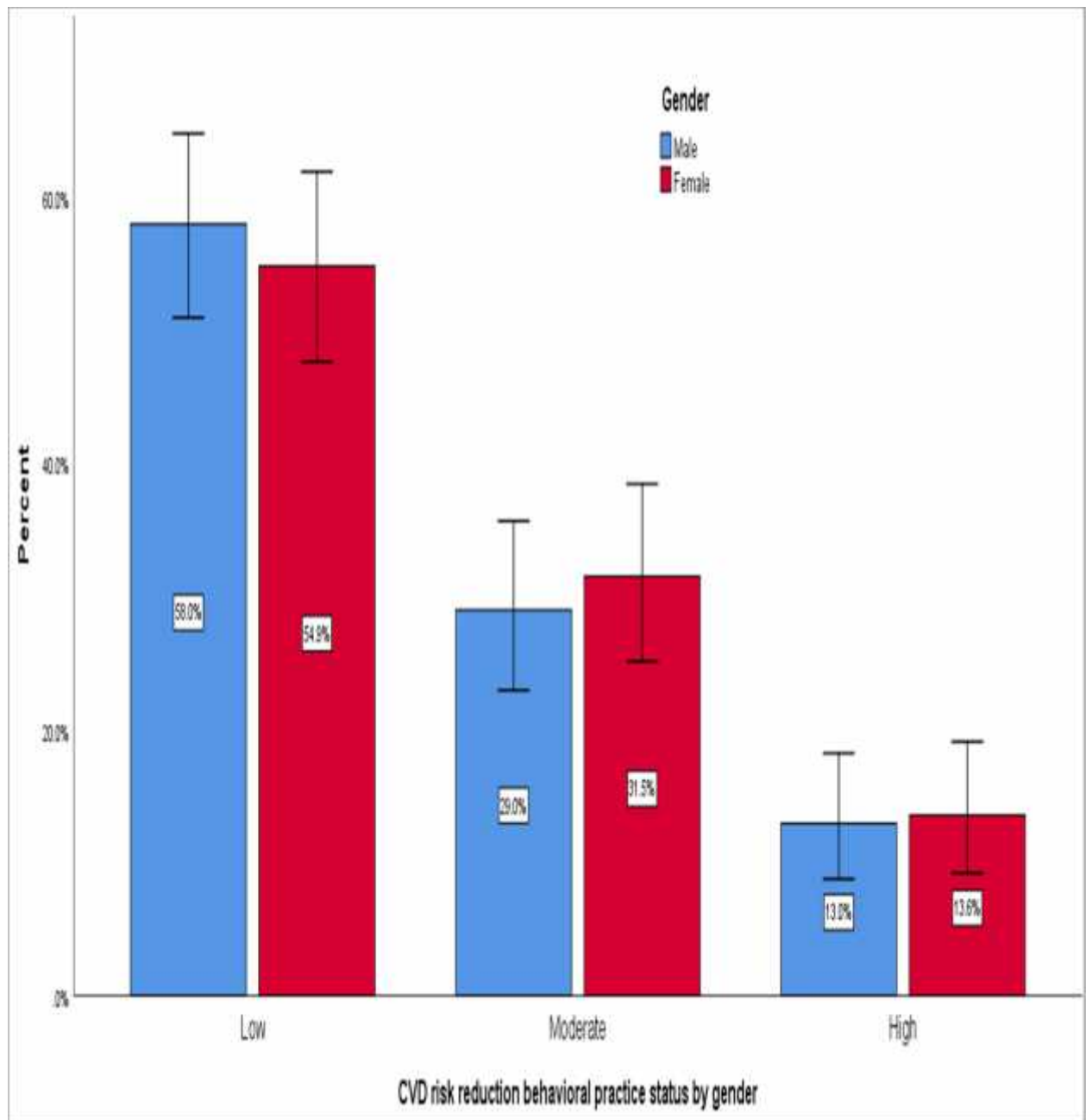


Figure 8. Bar graph showing CVD risk reduction behavioral practice status of adult hypertensives attending follow-up at TASH CV clinic in Addis Ababa, Ethiopia, 2020, n = 377

More than half (58%, males; and 54.9%, females) participants were low behavioral CVD risk reduction adopters.

Objective 5: Determine the associations among CVD outcome risk reduction behaviors status, and demographic and clinical profiles, knowledge, and risk perception scores of adult hypertensives attending CV follow ups at in tertiary hospital Addis Ababa

To achieve this objective, chi-square test and ordinal logistic regression analyses were performed to investigate the association between participants' ranked CVD risk reduction behavioral status (low, moderate, and high) and their predictors including, selected demographic and clinical variables, knowledge, and risk-perception scores. The demographic and clinical variables (gender, age, educational status, income, comorbidity, duration of HTN, clinic visits for HTN, history of hospitalization related to HTN, current number of medications, history of traditional medicine use, risk-perception status, BMI, PHQ-9 score, and CVD knowledge score) were analyzed using chi-square tests for significant associations with CVD risk reduction behaviors.

On bivariate chi-square test analysis (Table 11) of independent variables: age, monthly income, HTN duration, comorbidity, and BMI were significantly associated with CVD-risk reduction behaviors. However, all independent variables with p-values less than 0.25 were moved to the final ordinal logistic regression analysis model (Table 13) to test their strength of association with the CVD-risk reduction behavior.

Table 11. Bivariate chi-square test showing the association between CVD risk reduction behavior (high, moderate, and low) and independent variables of adult hypertensives attending follow-up at TASH CV clinic in Addis Ababa, Ethiopia, 2020, n = 377

Variable	CVD risk reduction behavior practice				χ^2	df	p - value
	Low n(%)	Moderate n(%)	High n(%)	Total n(%)			
Age category					12.137	4	.016*
Young adults	24(42.9)	18(32.1)	14(25)	56(100)			
Middle-age adults	110(58.5)	53(28.2)	25(13.3)	188(100)			
Elders	79(59.4)	44(33.1)	10(7.5)	133(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
Gender					.452	2	.798
Male	112(58)	56(29)	25(13)	193(100)			
Female	101(54.9)	59(32.1)	24(13)	184(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
Education level					5.320	6	.504
Cannot read and write	14(53.8)	4(42.3)	1(3.8)	26(100)			
Elementary	78(57.8)	41(30.4)	16(11.9)	135(100)			
High school	78(58.6)	38(28.6)	17(12.8)	133(100)			
College diploma & above	43(51.8)	25(30.1)	15(18.1)	83(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
Marital status					2.831	4	.586
Single	25(48.1)	21(40.4)	6(12.2)	52(100)			
Married	164(57.7)	82(28.9)	38(13.4)	284(100)			
Others	24(28.5)	12(29.3)	5(12.2)	41(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
Monthly income in ETB					14.002	6	.030*
<1000	70(59.3)	40(39.9)	8(6.8)	118(100)			
1001-3000	104(58.1)	52(29.2)	23(12.8)	179(100)			
3001-6000	28(45.9)	17 (27.9)	16(26.2)	61(100)			
>6000	11(57.9)	6(31.6)	2(10.5)	19(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
Family Hx of HTN					.623	2	.732
No	128(54.9)	74(31.8)	31(13.3)	233(100)			
Yes	85(59)	41(28.5)	18(12.5)	144(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
HTN duration (in years)					12.769	6	.047*
1-4	79(59.8)	33(25)	20(15.2)	132(100)			
5-9	54(49.5)	39(35.8)	16(14.7)	109(100)			
10-14	35(49.3)	24(33.8)	12(16.9)	71(100)			
15+ years	45(69.2)	18(27.7)	1(3.1)	65(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
Comorbidity					26.364	2	<.001*
NO	69(41.8)	65(39.4)	31(18.8)	165(100)			
Yes	144(67.9)	50(23.6)	18(8.5)	212(100)			
Total	213(56.5)	49(30.5)	49(13)	377(100)			
Traditional medicine uses for HTN					.583	2	.747
No	186(57.2)	98(30.2)	41(12.6)	325(100)			
Yes	27(51.9)	17(32.7)	8(15.4)	52(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			

Table 11 continued

CVD risk reduction behavior practice							
Variable	Low	Moderate	High	Total	χ^2	Df	p-value
Hx of hospitalization related to HTN					5.889	2	.053
No	150(53)	92(32.5)	41(14.5)	283(100)			
Yes	63(67)	23(24.5)	8(21)	94(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
Frequency of Clinic visits for HTN					12.588	6	.050
Monthly	11(50)	7(35)	2(10)	20(100)			
Bimonthly	154(56.6)	86(31.6)	32(11.8)	272(100)			
Every 3 months	28(52.8)	11(20.8)	14(26.4)	53(100)			
Every 4 months or longer	20(62.5)	11(34.4)	1(3.1)	32(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
Depressive symptom					3.498	2	.174
Absent	50(49)	35(34.3)	17(16.7)	102(100)			
Present	163(59.3)	80(29.1)	32(11.6)	275(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
CVD risk-perception					.539	4	.970
Low	124(56.1)	68(30.8)	29(13.1)	211(100)			
Moderate	21(55.3)	13(11.6)	4(10.5)	38(100)			
High	68(57.6)	34(28.8)	16(13.6)	118(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
BMI					15.501	6	.017*
Underweight	5(50)	4(40)	1(10)	10(100)			
Normal	65(46.1)	54(38.3))	22(15.6)	141(100)			
Overweight	104(60.8)	44(25.7)	23(13.5)	171(100)			
Obese	39(70.9)	512(21.8)	4(7.3)	55(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			

Note: ETB (Ethiopian Birr), Hx (history), HTN (hypertension), BMI (body mass index), CVD (cardiovascular disease), χ^2 (chi-square), df (degree of freedom), *(Bold figures indicate significant findings).

Before proceeding with the ordinal logistic model, assumptions of ordinal logistic regression were ascertained that there was no violation of: 1) the dependent variable is measured at ordinal levels; 2) one or more independent variables are categorical (including dichotomous variables), ordinal or continuous variables; 3) there is no multicollinearity; and 4) the proportional odds assumption was met.

The assumption of no multicollinearity was tested by running Spearman's correlation after transferring the categorical variables (gender, educational status, income status, HTN clinic visit frequency, traditional medicine uses to control HTN, hospitalization due to HTN and/or related complications) to a numeric dummy variable. The proportional odds assumption was assured with the test of parallel line, as ordinal logistic regression assumes that the relationship between the independent variables is the same across all possible comparisons (260) involving the dependent

variables are presented separately below. This assumption from the test of parallel line indicated non-significance $\chi^2 (38) = 24.795$, $p = .951$, which means that the assumption of proportional odds was satisfied. The results of the parameter estimate are presented in Table 12 below.

The case processing summary Table (not shown here) indicated none of the cells were too small or empty, with a total of 377 observations. The model fitting information Table (not shown here) showed the -2log likelihood for the intercept only and final model and a chi-square test with statistically significant values $\chi^2 (38) = 203.064$, $p = .000$, indicating that the model fits the data well. The model's goodness-of-fit was determined through the use of the Pearson and Deviance chi square tests to check whether the model exhibits good fit to the data yielded non-significant outputs indicating that the null hypothesis that the model fits the data well could not be rejected (261). The tests non-significant results indicated the assumption that the model fitted the data well could not be rejected with both the Pearson and Deviance's chi square values: $\chi^2 (714) = 718.005$, $p = .451$, and $\chi^2 (714) = 562.038$, $p = 1.000$, respectively. The pseudo- R-square values that accounted as rough equivalence with R-square value in ordinary least square (OLS) in linear regression and though it shall be interpreted with caution as there is no clear guideline (260). With this test, the model (Nagelkerke) estimated that 47.9% of the variance among participants' CVD risk reduction behavioral practice are explained by the independent variables fitted in the model.

Table12. Spearman correlation for testing the assumption of no multicollinearity of adult hypertensives attending follow-up at TASH CV clinic in Addis Ababa, Ethiopia, 2020, n = 377

IV		Age	Edu status	Comorbidity	Source of information	HTN DUR	Traditional medicine use	Hospitalization related to HTN	Depressive Sx	Current NO medication use	BMI	Risk perception status
Age	rs											
	p											
Edu status	rs	-.184**										
	p	.000										
Comorbidity	rs	.092	.054									
	p	.074	.295									
Source of information	rs	-.079	.030	.071								
	p	.127	.561	.169								
HTN dur.	rs	.198**	-.054	.095	-.003							
	p	.000	.292	.065	.947							
Traditional medicine use	rs	.030	.014	-.004	-.088	.021						
	p	.555	.786	.942	.088	.679						
Hospitalization related to HTN	rs	-.022	.014	.199**	-.052	.082	.072					
	p	.674	.793	.000	.310	.112	.165					
Depressive Sx	rs	.003	-.019	.101	.001	.003	.001	.075				
	p	.948	.716	.051	.977	.952	.982	.146				
Current NO medication use	rs	.068	-.033	.086	-.011	.195**	.060	.095	.082			
	p	.187	.521	.096	.836	.000	.243	.065	.114			
BMI	rs	.137**	-.010	.045	.085	.029	-.042	.022	.016	.069		
	p	.008	.840	.388	.101	.573	.416	.671	.753	.180		
Risk perception status	rs	-.048	.024	.069	-.034	.130*	-.034	-.005	.139**	.081	.038	
	p	.356	.645	.182	.508	.012	.506	.930	.007	.115	.468	

** . Correlation is significant at the 0.01 level (2-tailed). * . Correlation is significant at the 0.05 level (2-tailed). rs = spearman rho; p= p-value.

Note: edu (education), HTN (hypertension)

From the correlation matrix above (Table 12) there is no high correlation coefficient ($\geq .80$) that indicated strong linear relationships between the independent variables. Since there is no evidence of multicollinearity, there is no indication to run the variance inflation factor (VIF) test, which confirmed that the ordinal logistic regression assumption of no multicollinearity was fulfilled. This suggests that the results obtained by running ordinal logistic regression with these data will yield meaningful outputs.

The other main assumption of the ordinal logistic regression is the proportional odds assumption that states the relationship between each pair of outcome groups is the same. This means that the coefficients that describe the association or relationship between the categories of the independent variables are the same. Since it assumes that the relationship between all pairs of the group is the same thus, only one set of coefficients is produced. To assure this assumption, the test of parallel lines was carried out (Table not shown). From the test, we concluded that there was no violation of the proportional odds assumption [chi square test, $\chi^2(21) = 18.09$, $p = .64$] and the model is valid with the dataset. Had this assumption violated ($p < .05$) we would have used instead the multinomial logistic regression. The next table, the parameter estimate (Table 13) presents the result of the ordinal logistic regression analysis of predictors of the high CVD risk reduction behavior practice of study participants with the adjusted odds ratio/ $\text{Exp}(B)$ with the 95% CI and significance (p-values).

Table 13. Ordinal logistic regression analysis of predictors of the high CVD risk reduction behavior practice of adult hypertensives in AA, 2020, n=377

Predictors		B	Std. Error	95% CI		Wald X ²	Df	AOR	95%CI		p-value
				Lower	Upper				Lower	Upper	
Age category	Young adult	.706	.3449	.030	1.382	4.188	1	2.025	1.030	3.982	.041
	Middle age adult	.060	.2461	-.423	.542	.059	1	1.062	.655	1.720	.808
	Old age	Ref	.	.	.	.	.	1	.	.	.
Monthly income in ETB	<1000	.045	.5454	-1.024	1.114	.007	1	1.046	.359	3.046	.934
	1001-3000	.142	.5339	-.905	1.188	.070	1	1.152	.405	3.281	.791
	3001-6000	.980	.5683	-.134	2.094	2.971	1	2.664	.874	8.114	.085
	>6000	Ref	.	.	.	.	.	1	.	.	.
Comorbidity	No	1.104	.2273	.658	1.549	23.581	1	3.015	1.931	4.707	.000
	Yes	Ref	.	.	.	.	.	1	.	.	.
HTN duration (years)	1-4	.233	.3439	-.441	.907	.459	1	1.263	.643	2.477	.498
	5-9	.738	.3471	.057	1.418	4.518	1	2.091	1.059	4.130	.034
	10-14	.710	.3713	-.018	1.438	3.658	1	2.034	.983	4.211	.056
	15+	Ref	.	.	.	.	.	1	.	.	.
Clinic visits for HTN	Monthly	.205	.5992	-.970	1.379	.117	1	1.227	.379	3.971	.733
	2 months	.108	.4045	-.685	.901	.071	1	1.114	.504	2.462	.789
	3 months	.986	.4834	.039	1.934	4.165	1	2.682	1.040	6.916	.041
	4 months or longer	Ref	.	.	.	.	.	1	.	.	.
Hospitalization r/t to HTN	No	.407	.2699	-.122	.936	2.279	1	1.503	.886	2.551	.131
	Yes	Ref	.	.	.	.	.	1	.	.	.
BMI (Kg/M ²)	Underweight	.722	.6850	-.621	2.065	1.111	1	2.058	.538	7.882	.292
	Normal	.953	.3594	.249	1.657	7.030	1	2.593	1.282	5.245	.008
	Overweight	.577	.3532	-.115	1.269	2.668	1	1.781	.891	3.558	.102
	Obese	Ref	.	.	.	.	.	1	.	.	.
PHQ-9) score (Scale)		-.076 1 ^b	.0394	-.153	.001	3.731	1	.927	.858	1.001	.053

*AOR (adjusted odds ratio), CI (confidence interval) CVD (cardiovascular disease), ETB (Ethiopian Birr), HTN (hypertension), BMI (body mass index), Kg (kilo gram), M² (meter squared, PHQ (patient health questionnaire/depressive symptoms) *(Bold figures indicate significant findings), Ref (Reference group).*

In ordinal logistic regression analysis (Table 13 above), the absence of comorbidity, clinic visits of every three months, normal BMI, HTN duration of 5-9 years, and being young age adults were the statistically significant positive predictors of participants' high CVD risk reduction behavioral practice. The presence of depressive symptoms though did not reach the statistically significant level ($p = .053$) was a negative predictor of the high CVD risk reduction behavioral practice.

The predictor variable the absence of comorbidity in ordinal logistic regression analysis contributed the most to the model. The ordered log odds estimate ($B = 1.10$), $SE (.23)$, $Wald X^2(1) = 38.20$, $p < .001$ Accordingly, the odds of practicing high CVD risk reduction behaviors were three times higher on average for patients with no comorbidity as compared to the combined low and moderate category CVD risk reduction behavioral practice adaptors of patients with comorbidities.

The predictor variable HTN clinic every three months visit in ordinal logistic regression analysis contributed the second most to the model. The ordered log odds estimate ($B = .99$), $SE (.48)$, $Wald (1) = 4.16$, $p = .041$. The estimated AOR favored a positive relationship of nearly three times higher CVD risk reduction behavior adoption on average for patients who visit the HTN clinic every three months as compared to the combined low and moderate category CVD risk reduction behavioral practice adaptors of patients who visits the clinic every four months or longer. The odds of practicing high CVD risk reduction behaviors were almost three times higher on average for patients who maintained normal body weight as compared to the combined low and moderate category CVD risk reduction behavioral practice adaptors of obese patients. The odds of practicing high CVD risk reduction behaviors were two times higher on average for patients with the HTN duration of 5-9 years as compared to the combined low and moderate category CVD risk reduction behavioral practice adaptors of patients with the HTN duration of 15 years or longer. The odds of practicing high CVD risk reduction behaviors were two times higher on average for young adult patients as compared to the combined low and moderate category CVD risk reduction behavioral practice adaptors of old age adult patients.

Summary

This chapter presented the analyses and main findings of the study. Data were analyzed using SPSS 25.0. Both descriptive and inferential statistics were used for the analyses. The results of the data analyses are presented in this section using tables, figures and texts as appropriate. Main demographic and clinical characteristics, CVD knowledge, CVD risk-perception, and CVD risk reduction behavioral practice and its predictors among the hypertensive study participants are presented. The next chapter will present discussions on the significant and clinically important findings of this chapter.

CHAPTER V: DISCUSSION

The purpose of this study was to examine CVD risk reduction behaviors and their determinants among adult hypertensives in Addis Ababa, Ethiopia. The study utilized a cross-sectional design to examine CVD risk reduction behavioral practices, knowledge and risk perception of adult hypertensives attending CV follow-up at a tertiary care outpatient clinic. This chapter presents the discussion on the results of the data analysis within the framework of HBM (Figure1, Chapter I). In addition, it presents the implication of the findings for policy considerations, practice, teaching and further research direction as well as the strengths and limitations of the study. The discussion of the main and important findings (both statistical and clinical) is sequentially presented by objectives.

Objective 1: Describe the demographic and clinical characteristics of adult hypertensives attending CV follow-ups at a tertiary outpatient clinic in Addis Ababa, Ethiopia.

Key sociodemographic and clinical characteristics findings

In the present study, the mean age of adult hypertensive participants attending the CV follow-ups at a tertiary outpatient clinic in Addis Ababa, Ethiopia was 53.61 ± 12.80 years and was higher among males. The present finding was comparable with previous studies in Addis Ababa and across regions in Ethiopia that reported similar mean age of hypertensives on follow-ups (61,195,262,263). However, reports from other studies showed variations in the mean age both higher and lower (264–267), which might be explained from the possible difference in individual risk factors for the onset of HTN. In the present study, the mean age at the diagnosis of being hypertensive was 45.60 ± 12.56 years, which also significantly differed by gender. The observed mean difference in the present finding is congruent with Olatunbosun, and colleagues (2000) who also reported a higher mean age for HTN in males than females. But previous studies in Addis Ababa also reported higher rates of HTN among males than females (28,61,268). In the present study, even though the mean age of the male hypertensive participants was higher than that of their female counterparts there was slight sample disproportion for gender (males = 51.2% vs female = 48.8%). These findings may suggest that the higher prevalence of behavioral risks among females than males.

In the present study, in terms of adult developmental stage, half (49.87%) of participants were middle aged adults which was consistent with previous study findings in Ethiopia (36,269). It is well documented that HTN is increasingly prevalent among older adults. As observed in the Framingham Heart Study and other research, greater than 90% of individuals with normal BP at the age of 55 years will develop HTN at later age in life (270–273). By the age of 60 years, 60% of the population will exhibit HTN and for ages advancing beyond this year, the prevalence increases further and females exceed males (75% vs 65%) by the age 70 years (271). However, the result of the present study was somewhat different as most of the participants (about 65%) were in middle and young age adult categories, which suggests that these individuals were more likely to have young age HTN onset. The determination of HTN age onset requires validated methods (such as serial BP measurements, medical records or self-reports) from epidemiological and clinical studies that provide accurate information on individuals' BP satisfying the criteria for defining young age HTN onset (274). However, the present finding may reflect the age at which the participants were diagnosed of HTN for the first time, rather than, in fact, the age at which they developed HTN owing to the asymptomatic course of the disease and variations in patients' health and sickness behaviors, which were not accounted in the present study. However, in the present study, greater than three-fourths (78.78%) of the participants were diagnosed of HTN at ≤ 55 years of age with a mean ($\pm$ SD) age of 45.6 ± 12.56 years when first diagnosed. In addition, 52.78% of the present study participants were in the age ≤ 55 years and this was particularly remarkable for the female gender (63.59%). In fact, some recent studies in southern Ethiopia have also reported higher proportions (85% - 92%) of hypertensives in the age ≤ 55 years (275,276).

The present finding was also consistent with a study carried out in Taiwan on hypertensives that reported an early onset of HTN before the age of 40 years (277). The study reported that male with the clinical characteristics of persistently high triglycerides (TG) and higher BMI had much more tendency to have an early onset of HTN as compared to their female counterparts (277). In fact, early life events were suggested to influence BP elevation in young adults with unclear underlying mechanisms. However, early onset HTN is a rare phenomenon particularly among females. For instance, the study by Hinton and colleagues (2020) documented young age HTN only one in eight individuals (278). Other studies reported 7% early HTN onset among young adults (279,280). However, in certain populations such as black race, early age HTN onset may be even higher by as much as two-folds when compared to whites (280). Similarly, a large sample (N

= 33 469) study of HTN screening among Japanese university students found only nine students with an early HTN age onset before the age of 25 years (early young adults) among male students with eight of them having a family history of HTN (281), which suggests that early HTN age onset among young adults is relatively rare. However, many studies have found a strong relationship between higher BMI, and increased BP among individuals with young age onset of HTN in the absence of further identifiable risk factors (278,279,282), which was also evident in the present study as 60% of the participants were overweight or obese by their BMI though it was difficult to ascertain whether this risk factor was present at the time of diagnosis. In the present study, specifically, 22.28% and 7.25% of female and male hypertensive participants were obese, respectively. In the present study, the proportion of obese females in comparison with their male counterpart was about three folds, which might explain why this unusual finding of females exceeding males for the early age HTN onset in contrary to studies that have documented early HTN age to be common occurrence in males than females (277,281). Furthermore, prior studies showed that being male sex, high BMI, high TG and genetic background were associated with early HTN age onset even though the possibility for secondary causes of HTN must have been precluded (277,281).

The possible finding of early HTN age onset in the present study should be an alarming concern as documented evidence showed that increased CVD risk in middle life is associated with early age onset of HTN (278). Studies have emphasized that the harmful health effects of young age HTN onset such as LVH leading to hypertensive heart disease (HHD) and alterations in brain vasculature (283,284) and increased CVD mortality rates (284–286). These risks may be pronounced in young adults as they have lower awareness, slow at seeking the diagnosis, poorer BP control compared to older adults (280,287,288). Furthermore, young adults were reported to exhibit less BP control compared to middle and old age hypertensive patients (34% vs 58% and 50%, respectively) (280) though there was no significant differences ($p=.245$) in the present study. The less BP control achieved among young adults could be partly related to psychological reasons by not wanted to be perceived as having a chronic condition or on antihypertensive medications that influence sexual function(278). Patients with early HTN age onset were much prone to adverse CVD outcomes in the current study. This finding should be considered a research priority and warrants that young adult be screened for HTN earlier when treatment may be more amenable for

preventing complications. The finding that early onset HTN may be prevalent in Ethiopia, future research is needed to identify time of HTN onset gender specific behavioral risk factors.

In the present study three-fourths of the hypertensive participants were married. This finding was consistent with study in Nigeria that reported a higher prevalence of HTN among married (289). This may reflect the social clock for marriage in adult age that coincides with early HTN age onset. However, the possibility of additional role burden stress during young and middle age among married adults cannot be totally neglected. According to Holmes and Rahe's (1967) Social Readjustment Rating Scale (SRRS), marriage was being the 7th top in the list of 43 event or life change unit's indicator of the stress load one bears (290). Furthermore, several studies have attested the relationship between chronic stress and higher CVD risk mainly HTN (291,292). In contrary to the divorce, Aynabolu and colleagues (2017) suggested marriage to act as a comfort zone and to have a cushion effect on rising BP (289), which, in fact, needs further study support. The proportion of divorced participants in the present study was about 6%. However, the divorce rate in Ethiopia is increasing with 25% of married women divorced (293).

The relationship between SES and CVD/HTN has long been recognized. In general, an individual SES is directly or indirectly reflected by educational status, occupation and/or income level. To date, the relationship of CVD and SES in Ethiopia has not been examined. In the present study, the proportion of participants with an average daily income of < 1 USD was about a third, and those with the average daily income of $\leq$ 4 USD was about half (47.5%). The income of the participants indicated that poverty was present among the majority of study population. Similarly, regarding education level, greater than a third of the participants had completed elementary and high school, while others had no formal education. Thus, our finding clearly demonstrates that most of the hypertensives attending a tertiary outpatient clinic in Addis Ababa had low SES. This finding is consistent with the study in Nigeria that reported hypertensives generally had low education and poorer income (289).

In the present study, half of the participants were receiving government sponsored medical care. This is comparable to other LMICs such as Pakistan where over one-third of hypertensives receive government sponsored health care (294). Ethiopians are predominantly (85%) a rural and agrarian population (295). Thus, in Ethiopia, the rural population in comparison with urban has low access to health services, safe water, sanitation, housing with overall poor income. With the recent health policy of the country that opted two types of strategies to address health insurance

notably: the social health insurance (SHI), which is a formal sector affordable for only high income individuals people; and community-based health insurance (CBHI) that is deemed to address the majority of people (rural and urban poor informal sector) to relieve them from the burden of excessive out of pocket (OOP) payment required for health care utilization (296). Despite the overall low monthly income observed still closer to half of them self-paid for HTN follow-up and health care utilization. Although the present study did not examine the net cost incurred on participants for the HTN illness, a previous study (264) documented the median OOP cost of hypertensives attending the government's secondary level hospitals in Addis Ababa was ETB 5279.50 (~USD150.0) despite their low monthly income (with the median of 2125.0 (~ \$61.0). However, in another study of the cost of HTN illness among patients attending hospitals in Oromia Region, Ethiopia it was found that the mean monthly cost of HTN illness per patient was USD 22.3 (297), which was, in fact, much lower than the OOP payment in Addis Ababa. The cost variation between these studies could be due to differences in the direct and indirect cost related to HTN illness in metropolitan and small community locations. The finding of the present study highlighted more need for the government to improve and accelerate Ethiopian's move towards the goal of universal health coverage for individuals at high risk for adverse CV events.

In the present study, greater than three-quarters of the patients reported that physicians were the main source of information for the seriousness of HTN with nurses cited by less than a fifth. However, the source of information remained largely from the HCPs. The present finding is comparable with a recent study that reported that for the majority of patients the source of information was health education by HCPs. In another longitudinal study from Italy, sources of patient information for HTN included HCPs, relatives, television, magazine, internet, leaflets, friends, and association (298). This difference may be due to the study setting difference and SES background of the participants, and the countries and health care development status. In the present study, the higher proportion of patients utilizing physicians as the main source of information on HTN may be due to the tertiary location. In tertiary care settings, patients with complex health conditions are referred for specialist care by physicians with less opportunity to see other HCPs. Health literacy has a remarkable and a strong influence in patient-HCP communications, and patients' adherence with recommended therapeutic and preventive actions (299). Because the majority of our HTN study population were from low SES (education and income) suggests they may have lacked adequate knowledge or health literacy skills to be more active in their disease

management. This was further noted by the lack participants' citing printed material as a source of information. This is supported by argumentation in a study by Ademe and colleagues (2019), who reported less than a tenth of hypertensives citing printed materials as a source of information for seriousness HTN (300). The lack of patients' citation for other sources of information on seriousness of HTN may mean that either the patients did not have enough access to them or HTN was not recognized as a serious health concern in the general public to become a media issue.

Key clinical characteristics findings

In the present study, slightly more than a third (38.20%) of the patients had a family history of HTN. This finding is consistent with several community-based study of adult HTN prevalence in Ethiopia that reported a greater tendency of HTN among individuals with family history (301–303). Several genetic studies have suggested that genetic factors contribute to approximately 30–60% BP variations in human with polygenic susceptibility to environmental insults leading to essential HTN (304,305) that accounts for 90–95% of clinical HTN. This finding was based on patients' self-report. Given the potential for undiagnosed HTN in patients' family members, it might be underestimated. The present finding may suggest that family history of HTN is an important risk factor in the target population. Much of the risk factors of essential HTN are attributed to the environmental insults such as unhealthy diet and obesity, sedentary life, tobacco use, and excess alcohol consumption that are augmented by a family history of HTN placing the individuals at higher risk.

In the present study, nearly three-quarters (72.10%) of the participants had been visiting the HTN clinic bimonthly. In a case-control study that examined factors associated with stroke among adult hypertensives on follow-up appointments at Hyder Hospital Tigray (Ethiopia) greater than half (58%) of the patients visited their physician every 2 months (306). Studies conducted at different levels of care settings in Ethiopia to assess the status of BP control among hypertensives on follow-ups have found > 90% and around 3% of patients were on a monthly and bimonthly return visit interval (RVI), respectively (265,266). These variations in RVI follow-up may be due to the case load reception of the institutions for their populations. It is also possible that the observed differences (high percentage of a monthly RVI) may mean that patients were being monitored more closely to achieve BP control that required medication adjustment (based on patients' adherence and possible drug side effects) and evaluation of target organ disease.

Available indexed guidelines (249,307) recommend that hypertensive patients should have frequent clinic RVI with the HCPs during the initial drug therapy approximately every 2-4 weeks and extending the interval to 4-6 weeks for patients who make progress to target BP control. Eventually, it is recommended that RVIs every 2-4 months be conducted once the patient has achieved the target BP control extending to 3-6 months once BP has stabilized. More frequent visits for patients with comorbidities are recommended. Among hypertensives with low SES observed in the present study there may be an economic and literacy barrier for BP equipment at home and ineffective self-management skills for accurate and reliable BP monitoring. Based on these factors, considerations of shorter intervals for RVIs merit further investigation to determine which visit frequency is optimal for HTN management.

Although the total number of visits made by the patients was not determined in present study, the determination of sustained controlled or uncontrolled BP requires at least three consecutive follow up BP measurements (195). In the present study, the minimum duration on follow-up was one year and 90% of them had a RVI of 2-4 months. These findings suggest a range of visits from 3 times -12 times in a year. Despite the frequency of follow-up clinic visits the target BP control rate was low (45.1%), although limited by cross-sectional data. The percentage of target BP control for the number of visits is worth considering as a possible way to determine a sustained BP control rate among hypertensives than snapshot. A study of visit frequency and HTN has documented that visits of patients with uncontrolled BP has resulted in statistically significant reduction in SBP for short RVI up to 90 days though a reduction in SBP for RVI of 90-180 days was observed with no statistically significant difference from patients of RVI long RVI >180 days (308). Similarly, the study documented that a short RVI up to 60 days of patients with controlled SBP showed statistically significant and lesser increase in SBP. However, there was no statistically significant difference for patients on RVI of 60-180 days compared to long RVI beyond 180 days, though there was notable lesser percent increase in SBP (308). Even though one can inherently suppose that the more frequent the visit the greater chance of achieving the target BP control, the key issue is what occurs during the patient-HCP visit. Thus, hypertensives-HCP visit should go beyond BP monitoring and medication refills. Rather, the visit should provide the opportunity to lower CVD risk and should be a key patient education goal during the clinic follow-up visits and is an area of future research.

In the present study, a quarter of participants had a history of hospitalization related to HTN. Documented studies show variations in the proportion of hypertensives with history of hospitalizations in Ethiopia. For example, over three-fourths of hypertensives in southwest Ethiopian had at least one history of hospitalization (309). In another study, closer to half (48%) of hypertensives in Northern Ethiopia had at least one HTN related hospitalization (310). These variations might be due to the inconsistencies in CVD risk reduction behaviors of patients or BP self-management skills. Across these studies finding, however, regardless of the variations, the findings reflected higher risk of CVD among hypertensives that required hospital admissions. To support this argument, a recently conducted retrospective analysis of records on the pattern of complications of HTN among 106 hypertensives admitted to a tertiary hospital in Addis Ababa has documented that two-thirds of the patients were admitted with the HTN complications of CVD and hemorrhagic stroke (311). According to the study findings from Northern Ethiopia, about a fifth of the patients had repeated hospital admissions of two and more times prior to these adverse CVD events (310). Hospitalizations have significant economic and psychological burdens on patients and their families. These findings suggest a pressing need for CVD risk assessments and provision of appropriate health literacy at each follow-up visit on the potential life-threatening risks posed by HTN and the importance of government sponsored public campaigns to increase awareness of HTN and CVD risks.

In the present study, closer to two-thirds of the participants on follow-up were overweight and obese according to BMI measures. This finding was relatively comparable to another study in Ethiopia (263). Previous epidemiological studies in Ethiopia documented a higher (30%) prevalence of overweight and obesity among the urban population of Addis Ababa (28), which may also account for the high proportion of overweight and obesity in the present study. Other researches have shown that hypertensives also have high rates (38%-48%) of overweight and obesity in Ethiopia (265,312), though lower compared to the present finding. Similarly, South African and other large samples (n=30044) multi-sites African studies that examined the relationship of obesity and HTN in 13 African countries have found higher (70%) rate of obesity among hypertensives, which was statistically significant with a three-fold risk of uncontrolled BP, and a two-fold increase of HTN across the countries (313,314), respectively. However, the finding of higher proportion of overweight and obesity in the present study in contrast to the former studies in urban Ethiopian settings may be due to the fact that the present study was conducted at a tertiary

level clinic where patients are basically referred for better evaluation and likely have more risk factors than those monitored at the primary and secondary care levels (where the former studies were conducted). However, studies conducted in other parts of Ethiopia have reported considerable rates of overweight and obesity among hypertensives on follow-up (61,266,306,315). These variations could be due to multifactorial risk for HTN, apart from the overweight and obesity, and partly might be due to the semiurban nature of the study settings where lower rates of overweight and obesity were reported compared to Addis Ababa where the current study was conducted. Given the higher prevalence of overweight and obesity in the study area and the present finding's corroboration with the existing facts in literature that attested the relation of obesity with HTN and CVD, it is no more a coincidence to observe high rates of hypertensives with overweight and obesity. Rather, it is the reflection of the magnitude and importance of obesity as a risk factor for HTN in Ethiopia.

In the present study, the great majority (93.4%) of participants thought that their high BP was controlled, despite greater than half (54.9 %) of them having uncontrolled BP as observed by clinic measurement. Although there was a paucity of literature for comparison in Ethiopia, Banegas et al (2007) reported a lower rate (18.2%) of concordance of BP control between office and ambulatory BP monitoring (316). The patients' over-estimation of their BP control in the present study might be due to alleviating symptoms with modest reduction in BP following strict adherence to the drug treatment. It seemed however, that patients lacked recognition of several factors on which BP control depends. Considering the several factors that come into the interplay and affect BP level including the diurnal BP variation, antihypertensive plasma half-life, and patients' behaviors that may lead to the possibility of misclassifying the BP control status. Several studies that measured the magnitude of BP control among hypertensives such as studies from multi-center in Ghana (267) and Ethiopia have reported higher rates (48.6 % - 88.6%) of uncontrolled BP among hypertensives with comorbidity (262,315). The present finding should be viewed in light of its advantages in addressing some patients who possibly had misconceptions that strict adherence to drug treatment alone and lack of symptom experience confirms high BP was controlled. It is essential to be aware of proactive behavioral measures to control BP and prevent potential adverse CVD events. Furthermore, it is worth considering the ambulatory blood pressure monitoring (ABPM) to have accurate concordance of BP control rate among hypertensives.

In the present study, a considerable proportion (14%) of the participants were using traditional medicine for the control of high BP. The overwhelming majority of those who have used the traditional medicine, used it used along with their physician's prescription as a combination treatment. The practice was much more prevalent in the current study than the finding of a recent PubMed review conducted by Azizah and colleagues (2021) worldwide which included 7302 hypertensives between 1960 and 2020 with concomitant use of herbal and antihypertensive drugs. They reported that 3.6% (n=262) of hypertensives used traditional medicine (317). The study also reported that the practice was much more prevalent among females than males. In the present study, Moringa and thyme were the main traditional medicine used by patients. Moringa olieferas (family of Moringaceae) apart from their high nutritive value have been documented to cause a brief reduction in BP in animal models (318). However, the evidence of any antihypertensive effects in humans is lacking, although there might be some antihypertensive benefit from their antioxidant and anti-inflammatory properties (319–321). In Azizah and colleagues' (2021) review garlic was the most commonly used herbs for HTN (317). Erku and Mekuria (2016) reported 37.6% of hypertensives on follow-up at Gondar Hospital (Ethiopia) used herbs (322). The traditional medicine used for HTN control seemed much more prevalent in rural African countries such as Nigeria and South Africa than in UK and India (323). The greater use of traditional medicine among the hypertensives was attributed to patients knowledge, local beliefs, and health care deficiencies (323) The difference observed in literature might be due to the sociocultural and education level of the participants, and the accessibility of health care.

In the present study, nearly three-quarters (72.9%) of the patients had depressive symptoms based on the PHQ-9. Although the PHQ-9 measures depressive symptoms, not clinical depression, this finding is much higher than the study finding that reported (24.7%) (324), and 40% (325) of hypertensives on follow-up at Hawassa (Ethiopia) and Karnataka (India) had depression comorbidity, respectively. The coexistence of depressive symptoms rates difference observed across studies might be related to the difference in the assessment rating scale and patient characteristics at study settings. The present finding highlights that further research is required. Similarly, in the present study, the proportions of patients who had diabetes comorbidities was 48.11%. This finding was consistent with several previous studies (61,262,266). The diabetes coexistence has been documented among patients with higher rates (50.9%) (262), 31.6% (315) of uncontrolled BP. Evidence shows that hypertensives with diabetes were also at increased risk for

microalbuminuria with progression to CKD, and microthrombi with potential of an increased risk of stroke, CAD, HF, PVD, and increased CV mortality at every BP level (326).

In the present study, with regards to the mean scores (Table 4) of participants body weight, height, and BMI profiles, there were observed statistically significant mean differences by gender. Male hypertensives were on average heavier and taller by (5.22 Kg and 9.17 cm, respectively) than their female counterparts. But on average they had lower (1.04 kg/M^2) BMI's than their female counterparts. Participants in the present study were overweight, which is an important risk factor for HTN and adverse CV outcomes. The present observation was consistent with findings of studies of high BP control among hypertensives on follow-up in Zimbabwe and Nigeria (327,328). Furthermore, the present hypertensive participants body weight and height was similar with the study in Nigeria that reported the mean body weight and height $66.9 \pm 12.7 \text{ kg}$, and $160 \pm 10 \text{ cm}$, respectively (328). However, compared to the recent Ethiopia steps survey report on risk factors for non-communicable diseases and prevalence of selected NCDs, on average, the present study participants were heavier and taller, and had a higher BMI (39). This difference is likely due to the difference in the study population (community-based). Furthermore, female hypertensive participants had BMI exceeding their male counterpart, which was consistent with the study in Zimbabwe that reported the mean BMI of female hypertensives on follow exceeding their male counterparts (327).

Regarding lipid profiles (Table 4), in the present study, only fewer than half of participants had their lipid profile checked. The proportions of patients who had lipid profile checks for both genders were very similar and was considerably low for hypertensives. There were statistically significant mean differences observed for the LDL-c, which showed on average the male hypertensives had (13.37 mg/dl) LDL-c less than their female counterparts. Measurements of hypertensives' clinical profiles such as lipid levels are required for calculating their risk for CVD events and also for guiding when to initiate therapies to reduce the CVD risk. It is generally recommended that lipid levels monitoring for individuals with an estimated Framingham 10-years CVD risk of $\geq 5\%$ and for those $<5\%$ should have an annual and every 3-5 years checks, respectively (329). The low proportion of the participants having lipid check in the present study might be due to the lack of knowledge related the risk and/or to a larger extent the financial cost related the test.

There were no statistically significant mean differences observed for clinical profiles: SBP, TC, TG, HDL-c, and FBG. There was no observed statistically significant mean difference by gender, though it was a cross sectional measure. However, the overall mean score (irrespective of the diabetes and CKD comorbidities) in present finding was within the expected target SBP control for hypertensives and was consistent with previous studies findings in Ethiopia (262). However, the BP control rate in the present study was low (45.1%). Plenty of studies have documented that mean SBP was beyond the expected target BP control level indicating lower rates of BP control among hypertensives on follow-ups (310,327,330,331). This discrepancy may be due to the cross-sectional BP measure in the present study. However, owing to the lower rate of BP control in the present study and previous studies finding of higher mean SBP and lower BP control BP rate among the hypertensives suggested that the problem was perennial and unwelcome needing a due consideration for the abatement of the harmful end of CVD events due to uncontrolled SBP.

The present study showed lower mean and median duration of HTN, which is comparable with several studies of the hypertensives participants in Ethiopian (195,265,310,332). In the present study, slightly over a third of the participants were among patients diagnosed in the last 4 years. Greater than a quarter (28%), and about one-fifth (18.83%) of them were among those who had HTN duration of 5-9 years and 10-14 years, respectively. Overall, there was a progressive staged pattern decline observed in number of the hypertensives on follow-up. Particularly, the proportions of patients on follow-up with HTN duration of 14 and beyond years were remarkably low. Studies that have examined HTN duration and duration of treatments found a declining pattern in the proportions of patients over time that were much similar with the present observation (265,266,333). In fact, in other Ethiopian studies a rapid marked decline in the proportion of patients on follow-up within the first decade of diagnosis has been noted (306,309,334,335). However, the present finding is inconsistent with a study report in Iran that utilized similar inclusion criteria with the present study and found about two-thirds and over a third of patients with the HTN duration of <10 years and ≥ 20 year, respectively (105). This difference might be due the study population demographic variability (such as age at the diagnosis) and patients' behavioral practice of HTN control and its adverse CVD outcomes. For example, in the Iran study about 85% the patients reported the importance of controlling SBP, greater than half monitored their own BP at home and over two-thirds of them had clinic return follow-up visits on monthly basis (105).

Little evidence from a large sample that participated the original and Framingham Heart Offsprings Study of participants aged 40-89 years has documented that the progression from HTN to CVD complications (such as HF) occurred on average at 14.1 years with a peak 5 years survival of only 24% of males and 31% of females (336). The remarkably low proportion of participants on follow-up in present study may suggest the possibilities of patients developing HTN related CV complications with increased risk of mortality. Uncontrolled sustained high BP leads to myocardial remodeling with resultant left ventricular structural and functional dysfunctions (249,309,310) and increased risk of fatal CV outcomes. Emphasizing on an individualized approach to achieve target BP control is a key to avert or deter the pathophysiological changes leading or enhancing left ventricular remodeling and potentially reduce the adverse CV clinical events such as MI, stroke, and CV deaths (337).

Objective 2: Determine the knowledge of CVD risk of adult hypertensives attending CV follow-up care at a tertiary outpatient clinic in Addis Ababa, Ethiopia.

Key knowledge findings

To achieve this objective, the study has assessed and determined knowledge level of CVD risk factors of adult hypertensives. Fewer than half of the patients surveyed had adequate knowledge of CVD risk factors (Table 6). There were no significant gender differences in knowledge level. This finding is consistent with a previous study that evaluated hypertensives' knowledge of CVD risk factors in eastern Ethiopia (338). The present study found that the majority (58.62%) of patients queried were knowledgeable about CVD risk factors compared to a one-third finding in a similar sample from Nigeria (339). Considering the potentially fatal CVD outcome of HTN however, the proportion of current study participants with adequate knowledge was considerably low.

In the present study, with respect to three specific subscales or content areas (Table 6-7) of knowledge, participants with higher levels of knowledge had increased scores on behavior change, and risk factors for CVD compared to the characteristics of CVD and their avoidance and age. Approximately half of the participants were aware that a person does not always realize if he/she has a heart disease. This finding was comparable to previous studies (338,339). This present finding is concerning since it could potentially inhibit health seeking behaviors particularly among older patients and those with comorbid illnesses such as diabetes, which could mask symptoms. Longstanding HTN leads to left ventricular hypertrophy, which is an independent risk factor for CAD and SCD (340). During the follow-up visits performing individual tailored CVD risk assessment is essential to identify patients with low knowledge to potentially lower adverse CVD outcomes.

Over two-thirds of participants knew that a family history of CVD increases risk of CVD. In contrast, previous findings in Ethiopia reported only a tenth of patients were aware that family history was a risk factor for developing heart disease (338). This discrepancy may be attributed to the tertiary setting of the present study where participants likely received education on CVD risk factors. In hypertensives, positive family history of CVD was suggested to increase the risk of CVD events (341). On top of the familial genetic risk of HTN, patients with HTN, may have shared similar physical environment and lifestyles, which may give cues to the presence of other potential

risks in families. Therefore, it is important for the HCP to elicit family history of CVD from all hypertensives to avoid overlooking its importance on patients' clinical outcomes.

In the present study, over four-fifths of participants were aware that advancing age was a risk factor for heart disease and was consistent with a previous study conducted in Ethiopia (338). The fact behind advancing age as risk factor for CVD is that the normal process of ageing brings progressive structural and functional vascular changes that increase arterial stiffness and loss of elasticity, which may be modifiable with risk factors prevention behaviors (342). In the present study, similar proportions of patients, as with the knowledge finding of advancing age as a risk factor for CVD, knew that CHD can be prevented. Such finding could be an opportunity to prompt patients for behavioral actions to reduce the adverse CVD outcome.

In the present study, 90% of patients knew that smoking is a risk factor for heart disease and a preventable cause of death and was consistent with previous findings in Ethiopia (338). Evidence strongly supports the association between smoking and increased incidence of fatal CVD outcomes and is a leading cause of preventable death worldwide (207,209,210).

Relatively a lower proportion (Table 6) of the patients had the knowledge of CVD harmful effect of eating red meat more often (> 3 times) in a week, which was far less than the study finding in Nigeria (339). This difference might be due to the study population health literacy and information accessibility.

Most participants were aware (Table 6) that dietary salt intake increases BP. The finding was comparable with the study's finding in China (343). Evidence shows that a high salt intake (> 6 gm/day) is associated with an increased risk of CVD (130,133,134), primarily via increasing the BP (130). Future studies should explore dietary sources of hypertensives in Ethiopia as most processed foods use large amount of salt, which can provide over 75% of the daily salt need for individuals with no dietary salt restriction (130). Continuous individual patient dietary salt intake assessment during the follow-up care visits with a reinforcement of teaching on low salt diets may remedy such a knowledge gap.

Participants knowledge regarding lipids, and diabetes as risk factors for CVD (Table 6) was high as evidenced by over 75% of participants knowing that high cholesterol blood level and diabetes are risk factors for heart disease. However, fewer were aware of benefits of glycemic control, as well as the link between dyslipidemia and heart disease. In a previous study in Ethiopia, greater than four-fifths of hypertensives were reported to be knowledgeable about fatty diet effect

on blood cholesterol levels and that a high blood cholesterol is a risk factor for developing heart disease, which is comparable with the present finding. However, in the present study the proportion of patients that had knowledge of high LDL-cholesterol's effect on heart was much lower than what was reported by this previous study (338), but interestingly, the reverse was true regarding patients' knowledge of the protective effect of high HDL-cholesterol level. The present study's finding regarding the good and bad cholesterol was also inconsistent with a study finding in Nigeria that reported only half of hypertensives had knowledge of the protective and harmful effect of HDL and LDL cholesterol (339), respectively. In fact, a study in Egypt reported almost all (99%) of hypertensives were unaware that high cholesterol level increases the risk of CVD (100). These inconsistencies across studies are likely due to lower educational status and low health literacy among the participants (339).

Most participants (Table 6) knew that overweight and obese individuals have a higher risk of heart disease. This finding is consistent with the previous study finding (338). However, a study's finding from Egypt (100) reported that less than half of the patients knew the link between obesity and CVD. This variation might be due to the differences in the population, culture and educational status. Obesity is rapidly becoming the most preventable and yet prevalent risk factor for CVD. Evidence supports that at least one in three individuals worldwide are overweight or obese (344). Overweight and obesity pose individuals to multiple and serious health conditions including dyslipidemia, HTN, diabetes, CAD, stroke, sleep apnea, and musculoskeletal conditions (118,164). As a CVD risk factor, an increase in bodyweight was primarily associated with an elevated BP and conversely, in fact, studies observed that behavioral measures that led to bodyweight reduction in hypertensives was accompanied by BP reduction (148,161), which suggested it is preventable in nature. In the present study, despite the encouraging patients' knowledge of excess bodyweight's adverse CVD effects, about two-thirds of them were overweight or obese by BMI, which suggests that there is a crucial need for behavioral actions.

Approximately 90% (Table 6) of participants were aware of the deleterious effect of psychological stress on BP, which raises risk for CVD. Although this finding was comparable with a previous study's report of hypertensives in Ethiopia (338), it was much higher than studies finding in Zimbabwe and Nigeria (339,345). These variations may be due to the study setting and participants sociodemographic background differences. Several studies showed that chronic stress was linked with an increased risk of adverse CVD outcomes (240,241).

The overwhelming majority (Table 6) of the patients knew that high BP is a risk factor for heart disease. This finding was fairly comparable with prior studies in Ethiopia, Zimbabwe, Poland, Baltimore (USA) and Brazil that reported over four-fifths of patients with CVD knew that high BP is a risk factor for CVD (338,345,346). Similar previous studies have also reported relatively good proportions (61% - 69%) of hypertensives had the knowledge of seriousness of HTN (347,348). Although poor knowledge of CVD was identified as one of the main barriers to the achievement of target BP control (67,89), knowledge alone may not indicate that HTN is controlled. This is supported by previous research of unsatisfactory BP control rates (33% vs 38%) (89) in both developed and developing countries, respectively, with a significantly lower BP control rate in Africa (21% - 25%) (192).

It was encouraging that most patients (Table 6) knew that the risk of developing heart disease is reduced when a person stops smoking. This finding was comparable with previous studies reported of about 85% - 96% of patients with CVD had the knowledge of pros and cons of smoking and its cessation on heart disease (66,79,338). Ethiopia has relatively low rates (8.3%) of the population who smoke (204). Maintaining this culture and tradition of smoke free healthy population behavior should be welcome and encouraged by HCPs as part of the primary and secondary CVD risk prevention/reduction strategies. However, taking an account of this prevailing population behavior, it is likely to overlook smoking as risk factor for CVD among the few smokers (5.8%) observed in the present study. Hence, the HCPs should take the patient-clinic encounter as an opportunity to combine this culture advantage and reinforce patients' behavior of smoking abstinence and cessation of smoking even among the just a few smokers as part of strategies CVD risk reductions.

Over four-fifths (Table 6) of the patients had knowledge of the health benefits of eating 2-3 portions of fruit and 2 portions of vegetables in a daily food, which was comparable with the study in Zimbabwe that reported a similar proportion of hypertensives had knowledge of the dietary risk factors for CVD (345). However, the present finding was much higher than other studies that reported as low as a tenth to two- third of hypertensives had knowledge of healthy diet (66,105,339). These differences may be due to the present study patients' long exposure to different HCPs at different levels of care. The CVD benefit of high fruits and vegetables consumptions have long been recognized. Documented evidence showed that there was a significant inverse relationship between fruits and vegetables intake and CVD (349). Accordingly,

fruits and vegetables consumptions have been instituted as one of the elements of the non-drug intervention strategies to reduce or prevent adverse CVD outcome among hypertensives. With consumptions of Mediterranean diet (fruits, vegetables, whole grain and other plant origin oils and beverages) and DASH dietary plan, combined with other healthy lifestyle practices would account for profound reduction in the CVD risks (127,129). Fewer than half (Table 8) of patients knew the health benefit of having diet low in carbohydrate and fat. The possible reason for low knowledge regarding carbohydrate in comparison with fruits and vegetables in the present study needs further research. Such inconsistent patients' knowledge suggests patients' nutritional teaching/advice is essential for HTN self-management and lower CVD risk.

Most participants (Table 6) were knowledgeable regarding the health benefits of regular PA in reducing the risk of heart disease. The cardio-pulmonary and peripheral health benefits of regular PA is well-established (179,186,190). The present finding was consistent with previous studies finding in Ethiopia and Nigeria (338,339). In the present study, though the patients had an encouraging knowledge of PA, a considerable proportion of them seemed to lack the broader concept of PA, as reflected by the misconception they held, i.e., PA within confine of exercise done in the gym only although this misconception was much higher in a previous study in Ethiopia (338). These inconsistent findings within local settings may indicate a lack of standard health information provided by HCPs. Patient education based on standardized health education materials may clear patients' misconception and motivate patients for behavioral actions.

The majority (Table 6) of the patients knew that controlling the high BP reduces the risk of heart disease. This finding was consistent with previous local studies in Ethiopia (338,350). In other study the lack of this knowledge was reported to account for the adverse CVD outcome (67). Furthermore, hypertensives' awareness and control of high BP for the reduction of CVD mortality is generally low for LMICs (351). The relatively encouraging finding of this specific knowledge in the present study might be due to the follow-up care at tertiary level.

Being on follow-up care, only two-thirds (Table 6) of the patients knew that the medications should be taken for the rest of their life. However, this finding was comparatively higher than previous studies that reported only a third to half of patients had this knowledge (79,347) but lower than one recent study that reported about three-quarters of hypertensives knew that antihypertensive medications should be taken for life to control the high BP (352). This

knowledge inconsistency may suggest the lack of standard patient health information and teaching within and across countries.

Less than half (Table 6) patients knew that every person with high cholesterol did not require medication for controlling it. It is well known that high cholesterol level raises the risk of CVD. Combinations of lifestyle modifications (such as diet, exercise with weight reduction) and lipid lowering medication are effective measures to reduce the blood cholesterol level thereby reducing CVD risks such as heart attack and stroke. There was little research for comparison and discussion of this finding in Ethiopia. However, the finding may indicate that hypertensives had low knowledge of the harmful effect of high cholesterol level and the initial behavioral management options. Health education that addresses the initial behavioral actions to reduce the blood cholesterol level should be given due attention by the HCPs during outpatient clinic visits.

In summary, most participants had higher knowledge of behavioral change than risk factors for CVD, and characteristics of CVD. Considering their long years HTN duration and follow-up care at a tertiary setting, which we believe these patients have reached this point of care level after going through lower care levels, their knowledge was inadequate and contradictory specifically regarding CVD risk factors. Furthermore, the specific knowledge assessment areas showed that patients had poor knowledge of heart disease, cholesterol and non-drug measures to lower a high blood cholesterol level, healthy diet, the importance of life-long antihypertensive medications, and the general concept of PA. These findings clearly indicate the need for planning proper health education for hypertensive patient population to address their knowledge gap for effective reduction of adverse CVD outcomes. Health care provider-patient co-designing of CVD preventive measures should largely depend on patients' knowledge and behavioral change levels.

Objective 3: Compare the perceived and the 10-year nl-Framingham risk score for CVD among adult hypertensives attending follow-up care at a tertiary outpatient clinic in Addis Ababa, Ethiopia.

Proportions of Self-Perceived CVD Risk

In the present study, CVD risk-perceptions were low. Even though studies that measured risk-perceptions in solely hypertensives were scarce, several studies that have examined hypertensives reported consistent findings. Barnhart et al (2009) (353) and Lafler et al's (2009) (354) studies reported 46% and 41% of participants, respectively had low CVD risk-perceptions, and several other HTN studies also reported comparable findings (64%-65%) of low CVD risk-perceptions (355,356). The present findings clearly indicated participants' CVD risk underestimation. This finding is very concerning because it is from hypertensive patients receiving follow-up at a tertiary care level. Several studies since Weinstein 1980 (357) refer to this situation as 'optimistic bias' (354,358-360), which is an error in an individual's judgment tending to rate oneself above average for positive events and below average for the negatives (358). Risk-perceptions are threat specific, rather than reflecting a general sense of optimism or pessimism (255). Although studies' used a variety of risk-perception assessments, lower risk-perception scores were reported in several studies (354,361), which are consistent with the present findings. Risk-perceptions among participants did not significantly differ by gender although females attained a higher risk-perception mean score than their male counterparts, which is consistent with previous studies (361,362). Other previous studies also reported that female patients were more likely to overestimate their CVD risk than males (363,364).

In the present study, despite the substantial finding of low rate (45.1%) of BP control, and low rate (56.5%) of CVD reduction behavior observed, the CVD risk underestimation may be attributed to a lack of specific knowledge and/or a complacency among participants. This suggests that this population is at high-risk for adverse CVD outcomes. Only a small proportion, and less than one-third of participants, perceived their CVD risk at moderate to high-levels respectively, which differed from the Lafler and colleagues (2009) finding (354). Participant sociodemographic, risk profile and sample size may explain in part these differences in the study findings.

Proportions of nl-Framingham 10-year CVD risk calculated

The nl-Framingham 10-year CVD risk was calculated with a mean score of 13.84 ± 4.82 , which showed that nearly three-quarters (72.4%) of participants were at moderate CVD risk over the next 10 years. Although the discussion of these findings was restricted by the lack of studies in Ethiopia for comparison, the finding was inconsistent with studies in Brazil and South Korea that found the majority of participants to be at low (77.9% and 54.2%, respectively) CVD risk (356,365). However, interestingly, the proportions of participants at high CVD risk in the present study was comparable with these study findings (10.6% vs 7.7%, and 12.6%, respectively). The observed variations in CVD risks may be due to differences in risk factors, demographics, behavioral and clinical risk profiles across countries. For example, the mean age in the present study was higher than in the Brazil and South Korean studies. Similarly, there were differences with other risk factors such as current smoking (5.8% vs 8%, and 27.7% in the present vs Brazil, and South Korean studies, respectively), diabetes (28.12% vs 4%, and 8.8% in the present vs Brazil, and South Korean studies, respectively), and the clinical risk factors differences (356,365). These variations likely reflect participants' risk factors by utilizing the same well-validated and reliable (FRS) CVD risk prediction. Even though the proportion of participants with the high CVD risk in the present study was low compared to moderate and low CVD risks FRS calculated, studies reported that the FRS overestimates the 10-year CVD risk, which led to question the FRS external validity that may in part be due to the inherent tool overestimation when used with population other than where it was originally validated (USA) (366). Furthermore, a study indicated the BMI FRS overestimated 10-years CVD compared to the lipid profile-based (367). Our findings were limited by the lack of lipid profile test from many of our participants, which could lower CVD risk estimates. Therefore, the possibility of obtaining accurate risk estimation may have been reduced which contributed to high rates of disagreement between self-perceived CVD risk and the nl-Framingham 10- years.

Comparison of proportions of self-perceived CVD risk against concordance-discordance with the Framingham 10-year CVD Risk Estimated

Less than a quarter (23.34%) (Table 13) of patients had accurate (concordance of self-risk-perception with that of the nl-Framingham 10-year predicted) risk perception of CVD risk. However, being on long-term follow-up care at a tertiary clinic, disappointingly, the majority

(76.66%) of them had inaccurate risk perception of CVD risk. This risk-perception inaccuracy included both the underestimated (UE) and overestimated (OE) CVD risks i.e., just half (50.13%) and fewer than a quarter (26.53%) of them UE and OE their CVD risk, respectively. The present finding was consistent with several studies that reported poor risk-perception agreement between patients' perceived and their Framingham 10-year CVD risk calculated (363,368–371). However, the proportion of risk accuracy did not differ by gender, which confirmed to previous studies (371,372).

Inaccurate risk-perception is prevalent with tendencies for optimism (risk underestimation) (5,369,373,374). Lowering CVD risk through lifestyle changes and the avoidance of adverse events requires an accurate estimation of CVD risks. In several previous studies, rates of patients who had accurate risk-perceptions were consistently low and comparable with the present finding (363,369,370,374). However, some previous studies have documented higher rates of significant associations between patients' risk-perceptions and their Framingham 10-year predicted (353,356) when compared to the current study findings. Such differences may be attributed to participants' sociodemographic background. For instance, compared to the present study, most participants in the Katz et al. 2015 (356) study had a higher educational levels. In other prior studies, higher educational level was associated with better risk-perceptions (375) and by the same token patients with low education level were found not to perceive their CVD risk accurately (372).

Our findings were supported by several previous studies which reported perceptions of CVD risk did not necessarily agree with their predicted CVD risk (366,376–378). It is important therefore to appraise individual factors when CVD perception is not congruent with objective predictors of risk. According to the HBM (228,234), knowledge, and perceptions of risk were conditional factors for behavioral change to occur, but alone were not adequate for individuals to engage in the recommended actions (228,234).

It is apparent in the model, which has been widely used in health and behavioral research, that the concept of individual perception of susceptibility and seriousness of the a disease threat is recognized as the key components for optimal behavior changes (379). In HBM, it is generally believed that an individual seeks preventive care including health screening if he/she has sufficient motivation for the health issue of concern. On the other hand, this motivation is enhanced if he/she believes that he/she is susceptible (perceived susceptibility) to a serious health condition or its aftermaths (perceived severity) and that undertaking the recommended preventive behavioral

action will avert or mitigate the known risk, taking into account the relative advantages of the actions to be taken over barriers to actions (362,379).

The paramount importance of studies of risk-perceptions is their ability to uncover an individuals' risk appraisal of a disease threat or a health condition and ability to self-evaluate and construe (accurate vs mis-perceived) its potential health consequences (255,380).

In the present study, in bivariate chi square test-analysis, the independent variables: frequency of clinic visits for HTN, and duration of HTN were variables that had significant relationships with patients' risk-perception categories (i.e., accurate, underestimated, or overestimated) at the 0.05 level of significance. However, there were no observed statistically significant associations between the independent variables: sociodemographic (marital status, educational status, monthly income, and age); clinical variables (family history of HTN, previous history of hospitalization, history of comorbidity, SBP control, BMI status, and diabetes control); behavioral variable (engagement in PA); and knowledge of CVD.

In MNLR analysis, CVD risk-perception was significantly associated with frequency of clinic visits, diabetes control, HTN duration, and engagement in PA status but its association with the sociodemographic variables (marital status, history of comorbidity, and age) did not reach a significance level. Further examination of the risk-perception indicated that participants' CVD risk OE was significantly associated with clinical variables: frequency of clinic visits every 2 months, frequency of clinic visits every 3 months, controlled diabetes, HTN duration of 10-14 years.

Participants who had visited the HTN clinic every two and every three months tended to OE their CVD risk four and six times (OR = 4.338, and OR = 6.331), respectively compared to those who had visited the clinic every four months or longer. Although there was a paucity of literature regarding the clinic visits frequency, CVD patients' visit frequencies are basically the other dimensions of studies such as appointment attendance and health seeking behaviors of patients with CVD. The current finding of patients' CVD risk OE could be related to lack of BP control, unalleviated symptoms, and/or the indefinite follow-up schedule required. Furthermore, it is possible that patients may perceive and consider that their health conditions needed more attention when they were put on such a schedule in comparison with, other patients they may know, who were put on long appointment schedules (≥ 4 months). This is supported by a cross-sectional study of patients with severe and poorly controlled HTN that found a significant association between a clinic follow-up appointment attendance and poor HTN knowledge (381). In another

similar study, CVD risk OE tended to be high among hypertensives, and was associated with old age, family history of CVD, and smoking status (72). However, the former two variables did not reach the level significance in the present study while the latter variable was very less prevalent behavior noted among participants. In the present study, the proportion of risk accuracy did not differ by gender, which was consistent with previous studies report (371,372). However, Frijiling et al's 2004 study reported that male participants had a higher risk-perception accuracy than their female counterparts (72).

Some scholars suggested that CVD risk overestimation is preferred to underestimation (382), as CVD overestimation may trigger patients for possible positive actions to reduce the likelihood of adverse CVD outcomes. However, this may incur unnecessary costs on patients and their families, and the health care services in individuals with over-motivated health seeking behavior (383). Hence, the significant associations between patients CVD overestimated and their every-two and every-three months clinic visits observed in the present study may suggest that patients had much concern for the reduction of adverse CVD outcome as opposed to those who had much extended return visit to HTN clinic. In fact, hypertensives who follow may benefit from regular interval assessments (including analysis and interpretation of their current symptom experiences, physical examination, and laboratory work-up). Furthermore, obtaining advice and reinforcements on behavioral risk reduction (diet, PA, body weight, medication adherence including monitoring of side effects and dose adjustments), as part of the routine health communication with their HCPs should be encouraged.

In a previous study, of patients at low or moderate predicted CVD risk by FRS, over half (56%) of them OE their CVD risk (363) however, this rate was much higher than the present finding (26.53%). This difference may be explained by participants socioeconomic background for example, the majority of the participants in the present study had low education level while in Brawarsky et al (363) the overwhelming majority (92%) were high school graduates and above. When examining patients specific risk factors, the study noted that compared to patients with normal bodyweight by BMI, overweight and obese patients were more likely OE their CVD risk, which was in contrast to our findings. This may suggest that patients may have some grounds for their CVD risk estimation (over/underestimated) beyond what was observed in the present and previous studies, which highlights the need for further research with different methodologic approaches.

Hypertensives with controlled diabetes were 90% less likely to OE their CVD risk compared to those patients with no history of diabetes, which may suggest that patients with controlled diabetes were more likely to perceive their CVD risk accurately than those patients with uncontrolled diabetes. It is possible that this risk-perception may have initiated them to take tight control on their diabetes. This may also signal that patients were quite aware of the CVD risk due to diabetes and that that they controlled it well accounted for the subdued OE CVD risk. However, compared to patients with no history of diabetes, those patients who had uncontrolled diabetes were 14.1% less likely to OE their CVD risk but this was not statistically significant. Such a finding may suggest patients lack of knowledge of uncontrolled diabetes link with HTN and its CVD outcomes. Previous studies showed that patients with history of diabetes had higher CVD risk-perception but was not significant (371,372). However, in another previous study, it was reported that hypertensive and diabetic patients OE their CVD risk (72), which may be due to the fact that chronic health conditions do impact emotional stress and the chronic emotional stress, in turn, could lead to risk overestimation (356).

In the present study, hypertensives with HTN duration of 10-14 years OE their CVD risk nearly 2 times ($OR = 1.463$) compared to those of patients with HTN duration of 20+ years, which was consistent with a study in Nepal that reported significant association between HTN duration of 10-15 years and CVD risk OE (384). Furthermore, in the present study, HTN durations exhibited a U-shaped feature with the HTN duration of 10-14 years as peak suggestive of the extremum of the effect of HTN duration on risk perception. In observations that contain limited data ranges such finding may mislead the interpretation (385), which was however, less likely with the present study as the observation contained more data ranges (HTN duration categories). The increasing trend observed up to the vertex (HTN duration 10-14 years) followed by declines thereafter coincided with most notable time to expect HTN complication appearance in a previous study (336).

Framingham Heart Study which included the original and offsprings who ranged in age from 40-89 years, the progression of HTN to target organ disease such as CHF and other CVD complications occurred on average at 14.1 years (336). However, in a 78 months retrospective follow-up study of hypertensive patients in Gondar (Ethiopia) that examined the progression of HTN, complications were present at the time of diagnosis (386). This is likely due to late health seeking behavior and reinforces why HTN is called “the silent killer.” This study observed lower rates of complications of HTN in the first three years with treatment but after five years, the risk

of developing complications increased three fold at seven years (386). The discrepancy observed between these two previous studies may be explained by the fact that low HTN control and treatment adherence rates in addition to late HTN diagnosis in Ethiopia suggests early onset of complications among hypertensives. In fact, the timing of TOD appearance was suggested to depend on several coexisting triggering factors in hypertensives (386). The observation of the U-shape feature with CVD risk OE in the present sample evoked a sense of debate was limited by lack of previous studies, which suggests the need for further researches.

Cardiovascular risk underestimation (Table 9) was significantly associated with participants' frequency of HTN clinic visits every 3 months; not engaged in PA; HTN duration of 5-9 years; and HTN duration of 10-14 years. Patients who had visited the HTN clinic every three months UE their CVD risk three times ($OR = 3.211$) compared to those who visited at four months or longer intervals. As the frequency of visit intervals extended (moving from every month onward to every three months), the OR showed an increasing pattern but was not significant.

Hypertensives who did not engage in regular PA UE their CVD risk nearly three times ($OR = 2.585$) than those regularly engaged in regular PA. This risk underestimation clearly explains the sine qua non of accurate risk-perceptions in guiding individuals' behavior to avert the potential CVD outcomes, though the reverse is not always necessarily true. Patients' risk UE may be due to the fact that they did not perceive the seriousness of the CVD event likely due to their CVD event free years of life with HTN, which might have suppressed their initiative of engagement in PA. The present finding is consistent with a recent study in Indonesia that reported over half of hypertensives had less engagement in PA from lack understanding of the link of HTN with CVD outcome (387).

In the present study, participants with HTN duration of 5-9 years and 10-14 years tended to UE their CVD risk 3 and 6 times ($OR = 3.166$, and $OR = 6.354$), respectively compared to those with HTN duration of 20+ years. Therefore, participants' underestimated CVD risk may have potential adverse CVD consequences due to the uncontrolled HTN alone. Although several studies indicated that FRS likely UE CVD risk in some populations (369,382) and in patients: age ≥ 70 years, with diabetes, CKD, LVH, and vascular diseases, evidence is lacking in Ethiopia. However, regardless of the population variance and their characteristics, one study suggested that in patients on treatment, use of risk factors for CVD risk estimation may underestimate the actual CVD risk (370).

In the present study, there were no statistically significant associations (Table 9) between CVD risk-perceptions and sociodemographic (marital status, educational status, income, and age); clinical variables (family history of HTN, previous history of hospitalization, history of comorbidly, SBP control, BMI status); and the knowledge of CVD. These findings are consistent with a previous study. However, in other previous studies family history of CVD was significantly associated with CVD risk perception (375,378,388). In the present study, there were no CVD risk-perceptions status differences across participants age range. However, several studies found significant associations between adult development stage and CVD risk underestimation (355,369,377,388–390). The observed lack of associations between non-modifiable risk factors such as family history and age in the present study might be related to lack of knowledge that age is independent risk factor by itself for CVD and the fact that these variables are basically out of the participants' locus of control. Furthermore, evidence shows that there were significant interactions between age and other CVD risk factors (375). Furthermore, the lack of association between participants' risk-perceptions and age in the present study may also suggest that patients after certain years of CVD free experience period might hold the misconception that the effect of the disease to cause adverse CVD event is worn off and consider themselves no more at risk than people of their age. However, the absolute CVD risk increases with advancing age, hence periodic patients risk assessment with status re-stratification should be integral part of the hypertensive patients' routine clinical care.

In the present study, the lack of associations between patients' risk-perceptions and clinical variables and knowledge of CVD might be related to patients' socioeconomic variables such as educational level and health literacy skills, which were generally low in this sampled population, and it was supported by plenty of previous studies (372,391–393).

The finding of prevalent CVD risk underestimation may be related to the less common occurrence of CVD risk in the general population as CVD is in the emergent phase in Ethiopia with less coverage by media in creating public awareness on the seriousness and escalating nature of CVD, which was evidenced by participants source of information, and lack of a single lipid test for most of participants. In this case, participants unrealistic CVD risk underestimation may be due to general lack of information and awareness, which is also supported by literature that low education and literacy skills were associated with unrealistic risk-perceptions (394).

Though the proportion of CVD overestimation was low in the present study, risk overestimation did not necessarily lead to behavior modifications (356). This was further attested by the HBM as the likelihood of executing recommended actions depended on weighing relative benefits of actions over barriers to actions (379).

In the present study, the finding of significant relationships between underestimated and overestimated risk-perceptions with HTN duration and frequency of physician visits was a counterintuitive finding however, this may be due to the prevalent poor CVD risk-perceptions (395). Patients with HTN, a chronic health condition, exhibited mal-adaptive coping behaviors (denial/avoidance) when they perceived it uncontrollable illness (395). In the present study, the significant risk-perceptions findings were more of the non-traditional risk factors ((such as physician visits frequency, duration of HTN, engagement to PA) with further complicated overlaps of underestimated and overestimated for some of factors that have obscured our full insight to the direction of unrealistic CVD risk-perception. A study by Waters et al (2011) also found such a commonsense expectation mismatch of risk-perception among patients with breast cancer (373). Thus, the present finding might highlight a possibility of divergence of HCPs and patients' perspective CVD risk considerations with possible mismatches of care provided to patients.

In the present study, the finding of high discordance between patients perceived and their Framingham calculated can also be seen as patients might be more accurate about their predicted risk-perceptions since the FRS overestimated CVD risk (367). However, to ascertain whether such a finding is due to the risk score tool overestimation, or patients' lack of risk recognition may need prospective studies combined with regular patients' clinical assessments than relying on cross-sectional studies.

In summary, participants' CVD risk-perception status should be understood as only time specific findings, and it is worth remembering that this risk status is mutable over time either progressively or regressively depending on the absence or presence of patients' behavioral and therapeutic measures. In a study of large samples ($n = 3150$) of adult patients in Brazil that evaluated the progression of CVD risk profile based on extensive clinical and laboratory testing approximately two years apart and that determined the CVD risk by the FRS, patients classified at moderate and high 10-years risk at the first follow-up check showed a significant increase (31%) ($p < .001$) on the second check-up despite the medical interventions continued during the interval period. This suggests the progression of CVD risk status even with medications. Alarming, the

study uncovered that two-thirds of those who were classified at high CVD risk at the earlier check-up did not exhibit improved risk status after two years. Yet again, the study documented further deteriorations of risk profile levels in TC and LDL-c, and HDL-c, and no significant mean BP changes on top of the advancing age risk factor (396). Thus, regular patients' risk assessments and re-stratifications with practical preventive and therapeutic measures are critical to reduce the potential adverse CVD outcomes among hypertensive patients.

In the present study, the fact that the higher proportions of patients had low CVD risk-perception suggests the need for planned CVD risk factors awareness and knowledge patients teaching, and on the other hand the finding of large proportions of patients with moderate CVD risk by the nl-FRS suggests the critical need to capitalize on designing lifestyles risk reduction strategies for hypertensives.

Objective 4: Determine the CVD risk reduction behavioral status among adult hypertensives attending follow-up care at a tertiary outpatient clinic in Addis Ababa, Ethiopia.

The present study examined the status of CVD risk reduction behavioral practice among adult hypertensives attending follow-up care at a tertiary outpatient clinic in Addis Ababa, Ethiopia. The majority of participants (56.5%) had low CVD risk reduction practices with a lower mean score (mean 3.48; 95% CI: 3.37, 3.60), which indicates higher rates of unmanaged risk factors that may result in future adverse CVD events. This finding is comparable with findings of 44%-59% hypertensives' in previous self-care behavioral practice studies report in Ethiopia (397–400) and other African countries such as Tanzania (401). Furthermore, it is also comparable with recent hypertensive patients studies finding in Nepal (402) and Indonesia (403) that documented 57% and 55%, respectively had adopted self-care behavior for CVD risk reduction. However, compared to previous studies and meta-analyses documenting 16%-44% (44,404–407) of participants practiced CVD risk reduction behaviors in Ethiopia, the present finding showed higher proportions of hypertensive patients had adopted the recommended lifestyle CVD risk reduction practices. These findings collectively show that in Ethiopia CVD risk reduction practices are low in a population at high risk for adverse events. Low CVD risk reduction behavior adoption also has been documented in other LMICs such as Pakistan (408), and in West Bengal (409). Healthy lifestyle is considered first-line management for hypertensives with further benefits that reduce CVD risk (410). Although CVD risk stratification guidelines are being initiated at primary healthcare facilities in Ethiopia (411), its availability is low and remains uninsured making access more difficult in many Eastern SSA countries including Ethiopia (412).

Physical activity

Further examination of participants' specific CVD risk reduction behavioral practices (Table 10) revealed mixed findings that were both positive and negative regarding CVD risk reduction behavioral practices. The highest CVD risk reduction practice was the engagement in PA. Greater than three-quarters (83.6%) of participants were engaged in weekly regular to moderate PA. This is consistent with previous studies in Ethiopia that found 77% (413) and 83% (397) of hypertensives met the recommended guidelines for PA, 150 minutes weekly at moderate intensity level. This is consistent with a study in Tanzania which showed 93% of hypertensive population surveyed, met PA guidelines (146). According to the recent Ethiopian STEPS Survey (2016) report, over three-quarters (86.4%) of the population fell to the moderate-to-high level PA activity

category (31) that suggests PA was generally high in the population, primarily due to the fact that over 80% of the population were rural dwellers. We did not investigate participants activity levels who resided outside Addis Ababa and may be due to HCP's encouragement since engagement in PA was not consistently reflected across studies of hypertensives in Ethiopia and surrounding countries. The stronger engagement in PA may provide an opportunity for designing intervention to lower other CVD risk factors. Our findings of higher engagement in PA guidelines are in disagreement with a number of individual and meta-analyses studies, which showed low adherence to the recommended PA guidelines in Ethiopia and in other LMICs (398,405,407,409,414). A previous study that used objective fitness measures (accelerometer, maximum oxygen uptake) versus self-report showed greater PA risk reduction behavior (57% vs 30%, respectively) (415). Physical activity level was based on self-report in the current study, which limits interpretation due to overestimation or underestimation of activity level. Use of objective measures such as accelerometers are needed to more accurately depict PA levels to better ensure CVD risk reduction strategies. Additionally, it is necessary to assess the physiological results of PA (such as aerobic capacity, blood biomarkers, and clinical characteristics) that may demonstrate its more direct positive impacts on CVD endpoints.

The strong link between PA and health benefits and CVD risk reduction are well established (416,417). Individuals engaged in regular moderate PA had 20%-25% reduced risk of CVD while this cardioprotective effect was heightened to 30%-35% for those with a high PA engagement (417,418) and this cardioprotective gain was further backed by findings from meta-analyses of large samples that found a huge reduction in CVD mortality by as high as 50% for all-cause mortality (113,415). However, to gain this health beneficial effect of PA, adults should perform at least 150 minutes a week of moderate intensity or 75 minutes a week of vigorous intensity aerobic PA or an equivalent combinations (410). Some individuals such as those who are older, sedentary and planning to engage in higher levels of PA or those with a family history of CVD should undergo exercise testing to avoid potential adverse events (410). Hypertensives should be encouraged to engage in PA at each clinic visit. Patient education on multiple bouts of PA also could be considered, instead of the 30 minutes PA at time each lasting at least 10 minutes, and evenly spread throughout most of the days (4–5 days), and preferably every day of the week.

Smoking

In the present study, the overwhelming majority of the participants were nonsmokers, which indicates a positive CVD reduction behavior among the participants. This finding is consistent with previous studies of hypertensives in Ethiopia (398,405,419). The smoking trend has continued to decline in Ethiopia 16% in 1995 (420), 12% in 2008 (28), and more recently 4.6% in 2016 (30). This decline in smoking may be in part due to a national campaign of tobacco use regulation by the government of Ethiopia in March 2015 (421). In addition, the lower rate (5.8%) of participants who smoked in the present study may be due high knowledge (Table7, Objective 2) of smoking as a risk factor for CVD and preventable cause of death. However, the present finding is much different from what was observed from studies in other African countries such as Tanzania and Kenya that reported about 20% and 14% of patients with CVD, respectively were smokers (401,422). In fact, according to the STEPS Survey of those countries, the smokers rates in the general population were higher, 14% in Tanzania (423) and 13% in Kenya (424), compared to the 4.6% of the Ethiopian recent finding (30). These differences may reflect the recent national campaigns on the health benefits of no smoking in Ethiopia. Smoking, being one of the modifiable CVD risk factors, has long been recognized to increase the incidence of fatal CVD outcomes mainly CHD (203,205,206). Smoking results in the development of CV events through its several roles on the development of atherosclerotic changes in vascular beds with acute thrombosis of the narrowed vascular bed that, in turn, precipitates an acute CV event of clinical atherosclerotic syndromes such as stable angina, acute coronary syndromes, stroke, and sudden death (203,207–209). Smoking has both immediate and sustained impacts on the atherosclerotic process ranging from endothelial dysfunction to organ damage and acute clinical events (205,207). Furthermore, a significant relationship between smoking and early onset CAD was discovered in recent research (425). Similarly, many of the CVDs such as CHD, stroke and PAD by large are attributed to smoking, though others such as HTN, diabetes, hyperlipidemia and advanced age are equally important (426).

Since 2004 countries that have followed Ireland, who initiated, in posing a strict smoking ban at work and public venues appear to have reduced number of active smokers (426,427). Since this action would seriously jeopardize the tobacco industries' benefits, they may switch their markets from the developed to the developing nations where the ban is not enacted and the vast majority of cigarette smokers live or where the ban lacks law enforcement (427). Thus, improving

public awareness of tobacco's health damage, law enforcement of the smoking ban legislation, and posing a higher taxation on tobacco trading may largely have a positive impact on the primordial and primary prevention of CVD, and general health and economic effects from cigarette smoking. Even though the proportion of smokers in the present study was considerable low, HCPs should use the at interval visits as an opportunity to assess and identify smoker patients and delivery effective counseling and set the motivation to quit smoking. Case study reports from even among the resistant and unwilling patients to quit smoking showed that HCPs initiated interviews to quit smoking has been seen to increase patients' motivation for successful results (428).

Dietary sodium intake

In the present study, less than half (42%) of participants used < 5 - 6 gm of salt per day indicating a lack of dietary salt restriction among participants. This finding is consistent with previous individual and meta-analyses studies finding of sub-optimal (26%-57%) adoption of low dietary salt among hypertensives in Ethiopia (399,405,406,419,429–431). However, a few studies have reported higher rates (69%-81%) of adherence to low dietary salt intake behavior among hypertensives in Ethiopia (397,400), which contradicts our findings. These differences might be due to the heterogeneity between data collection questionnaires used, where the comparison authors used the blanket approach to elicit dietary salt intake response from participants than asking a more measurable and definite amount of salt used in food, which was prone to a recall bias.

The adoption of a strict dietary salt restriction is one of the important dietary behaviors required of hypertensives to achieve a target BP control with the ultimate goal of preventing target organ diseases and CV events. In humans, excess salt intake primarily causes an elevated BP due to excess water gain (130,136,432). In addition, for each gram increase/day in salt intake a 26% increase in obesity risk is reported (433). A higher salt (> 5g/d) intake than the current recommended guidelines (432) has dual roles in HTN. First, it directly causes plasma volume expansion leading to high BP, and secondly through contributing to overweight and obesity, which is an important risk factor for HTN that, in turn, is a major risk factor for adverse CVD outcome (434,435). In the present study, despite the lower proportion (42%) of participants' adoption of low salt intake, the majority (60%) of them were either overweight or obese by BMI that suggests the existence of compounding problems and multiple risk factors for CV events among this population. Findings of meta-analyses and prospective cohort studies showed that the increased

risk of CV events associated with a higher salt intake is most prominent in those with HTN (130,132–135,436). On the other hand, in patients with HTN, strict adherence to a low dietary salt intake was associated with reduction in SBP and lower rates of CVD events (436). According to the WHO (2012) guideline on sodium intake recommendation, adults need less than 5 g (a teaspoon) of salt per day, which is equivalent to 3 g of sodium (432). A rise in SBP, due to excess sodium, was linked with CVD events for example, salt intake was observed to cause an increase in aortic SBP, which is more predictive of CV events than it would on brachial SBP (437).

While there are limited data on population salt intake in Ethiopia and African countries in general and hypertensives in particular, it is generally believed that a higher daily use of salt than what is recommended by WHO 2012 (432) is likely occurring due to the local tradition of home food preparations in Africa. For example, in South Africa up to 46% of salt consumed is added during preparation of food or at the table and still the larger proportion of the remaining salt consumption comes from processed food (437), which are suggestive of the higher use of salt-rich foods. In SSA countries, the effect of salt intake on BP was underemphasized compared to its effect on BP although the WHO supported STEPS Survey (31).

In Ethiopia, the consumption of processed food is slowly growing as a consequence of the rapid urbanization that brought an increased access to unhealthy ultra-processed food (438) containing excess salt. Even though the present study was conducted in the metropolis Addis Ababa where consumption of process foods is relatively high, at this point in time, the consumption of processed food might not be a crucial concern for the present participants considering their low purchasing power of these foods based on their income observed. The culture and tradition of liberal salt adding to raw food items in preparation for stew and cooking (28), should be a pressing concern. Such practices were documented in previous epidemiological study in Ethiopia (28,432). Patients' knowledge of dietary sources of salt, food preparation practice at home and consumption of processed foods should be assessed to encourage them adopt the salt reduction behavior at all clinic return visits; with special emphasis during holidays when dietary restrictions are more relaxed and sodium intake increased. Improving patients' acceptance and disclosure of his/her health condition may relieve the social pressure and enhance the BP control, which is the prime factor for CVD event risk reduction. Furthermore, improving patients' knowledge of variants of natural food contents of sodium such as meat, milk, and shellfish (though not commonly consumed in Ethiopia) should be HCP's concern during the follow-up visit encounters. However, it must be

noted that the present study's finding is based on patients' self-report and did not take into account the dietary sources of participants' salt intake either. Thus, research studies that utilize more valid and robust check of patients' dietary sodium consumption using food items inventory and urinary sodium excretion test can be seen as an alternative technique in future.

Vegetable and fruit intake

In the present study, less than one-third (30%) of participants ate the recommended (≥ 5) servings of fruits and vegetable/day. Previous research in Ethiopia has attempted to examine fruit and vegetable consumption, but has not been a target or emphasized as a CVD risk factor which limits our interpretation. One study conducted in southwest Ethiopia by Angelo and colleagues (2020), where fruits and vegetables production are relatively abundant, only 39% of hypertensive patients followed the DASH diet (406), consistent with our finding. Similarly, in one systematic review of stroke prevention practice among hypertensive patients, there was greater heterogeneity (37% - 87%) regarding the vegetable consumption (407). Although Ethiopian are predominantly (80%) rural and agriculturally dependent a significant number (41% - 75%) of households did not grow fruits and/or vegetables in Addis Ababa which was suboptimal (439). Fresh fruit consumption was often thought the intake of processed fruit juice in urban areas (440,441). A recent survey reported the average fruit and vegetable consumption was very poor (0.9 days and 1.5 days/week) (31). Similarly, the Ethiopian's per capital consumption of fruits and vegetables was the lowest (7 Kg/person/year) compared to East African countries (such as Sudan and Kenya) primarily due to low income and poor dietary habits (440) and is far less than what is recommended by WHO and Food and Agricultural Organization (FAO) (146 kg/person/year or 400gm/day) (440). In addition, there is a lack of awareness of the health benefits of fruit and vegetable intake on CVD risk reduction (440). According to meta-analysis of prospective study findings, consumption of more fruits and vegetables were inversely associated with CVD events such as CHD and stroke with the dose-response relationship of greater protection effects with five or more servings/day (441,442). Adequate consumption of fruits and vegetables exerts its CV health benefits through several avenues: 1) of primarily their abundant dietary fiber contents (441); 2) their low glycemic loads and low energy density that play an important positive impact on weight control and obesity reduction (441); and 3) their micro-nutrients richness as precursors of antioxidants required for the elimination of free-radicals and the protections offered against lipid oxidation damage on vascular endothelium (441). Besides, fruits and vegetables are also rich in

minerals such as potassium, magnesium and calcium that are vasoactive mainly in inducing endothelium-dependent vasodilation for BP reduction (443). Although the consumption of fruits and vegetables is generally very low among the population of Ethiopia, such a low finding is unexpected among this CVD risk population that have tertiary care HCPs. In the general population, increased fruit and vegetable intake can be expected to improve with increased education on the CVD benefits by HCPs. Evidence from clinical research shows that early awareness following the detection and diagnosis of HTN and adoption of heart health diets including fruits and vegetables has a favorable effect on reducing CVD events (such as stroke by 40%) among high-risk patients (407). It is imperative that clinicians inform patients during routine clinic visits of the importance of dietary intake of fruits and vegetables as a strategy to reduce CVD morbidity and mortality.

Alcohol intake

In the present study, the adoption of low-to-moderate alcohol intake in the last 12 months was remarkably low (7.7%). Similarly, the rate of excessive alcohol use beyond moderation recommended was also negligible (3.18%). However, it was interesting to note that the overwhelming majority (89.12%) of them were abstainers. The present finding contradicts with findings from systematic review and meta-analyses studies in Ethiopia that documented two-thirds to three-fourths of hypertensive patients on follow-up had moderate alcohol intake (404,405). The difference may be due to the lack of differentiating abstainers from those who drink alcohol in moderation in prior studies. However, individual studies that separately analyzed the abstainers', reported higher rates (67% - 88%) of this subgroup among hypertensives (399,400,429,431,444), which is comparable with the present study finding. Based on the present and previous studies findings, better definitions of alcohol intake may be needed in order to accurately capture actual alcohol intake in future studies. In the present study, hypertensive patients tended to abstain from alcohol use rather than drink in moderation.

Both the beneficial and potential adverse health effects of alcohol intake depend on the average volume and patterns of consumption (114). Although a small-to-moderate amount of alcohol intake (1-2 drinks/day for men and one drink/day for women) was suggested to have a cardio-protective effect. Based on strong evidence, greater than this amount of alcohol is associated with potentially harmful cardiovascular effects (115–117). Although a postprandial alcohol intake in the recommended amount was suggested to suppress the potentially toxic non-

esterified fatty acids (NEFA) and its cardio-protective effects; it cannot diminish the transient postprandial decline in HDL- cholesterol (115). Previous studies suggest alcohol in moderation improves endothelial function through the activation of the endogenous nitric oxide synthase expression (eNOS). High alcohol daily intake and binge drinking may impair this mechanism (445) by decreasing in eNOS and impaired vascular function (445). There is also evidence that those who abstain from alcohol may also have an impaired endothelial function (446).

In an experimental study that investigated the acute effect of binge drinking on the vascular endothelium, a single episode of binge drinking was found to impair arterial endothelium-dependent and independent vasodilation leading to an elevated BP (447). Hypertensive individuals who likely already have endothelium dysfunction, may be at even greater risk for adverse events from the occasional binge drinking (445,446,448). Based on the evidence alcohol in moderation as recommended for cardioprotective benefits should be advised by HCPs during clinic follow-up visits for hypertensive patients who drink. It is important that hypertensive individuals also understand the heightened risk they are in for adverse CV events when they drink excessively.

Diabetes control

In the present study, a remarkable proportion (28%) of participants had diabetes comorbidity, and their diabetes control was very poor which suggests patients were at increased risk for adverse CVD outcomes. This finding is supported by a number of previous studies (449–452). In a prospective cohort study, the coexistence of HTN-diabetes clinical conditions was suggested to have synergized damaging effect on vascular endothelium with a heightened risk of macrovascular disease leading to CV events (such as MI, stroke, and mortality) and microvascular diseases (nephropathy and retinopathy) (453) that largely accounted for poor BP and glycemic control, which demands tight glycemic control. On the contrary, patients with diabetes and HTN with tight control of these disease conditions were observed to have a lower risk of CVD events such as strokes, compared to those patients with less intensive control (454). Despite our participant having a lower rate of target SBP control, which was much lower among patients with comorbid diabetes than those with HTN alone, our finding is indicative of the potential risk of CV events among the study population requiring further investigations of the underlying factors contributing to poor BP and diabetes control and urgent management approach for achieving optimal BP and glycemic control. Despite the better knowledge about the CV risk due to

suboptimal BP and glycemic control, our data suggest that there is a clear gap that requires critical appraisals of patients' management and further research to delve into the root problems.

Medication adherence

The rate of adherence to taking antihypertensive medication in the present study was high and is consistent with previous research that reported higher adherence among hypertensive patients in turkey (455–457) but higher than the finding of several research report (187–189,198). This difference might be due to the present participants were followed at the highest referral clinic with the majority of them having a relatively monthly-bimonthly regular clinic visit, which may also suggest that patients attending to the highest level of care may follow strict instructions given from their HCPs. It is also possible that the adherence variation may be due to tools used to measure medication adherence rate. Medication adherence measured with self-report questionnaires tends to produce an exaggerated adherence rate compared to validated tools (198) though studies of systematic review and meta-analysis findings indicated that the pooled percentage of adherence rate ranging from 65%-69%) that indicate a moderate adherence (199,458). Poor medication adherence was one of the main reasons for suboptimal high BP control and may lead to adverse CV outcomes by accelerating the progression of atherosclerosis and destabilizing the vascular lesion resulting in the precipitation of acute coronary events (190). The goal of HTN management is to reduce adverse CVD outcomes through the reduction of high BP, which requires strict adherence to antihypertensive medications. However several previous studies of antihypertensive medication adherence in Ethiopia reported prevalent low adherence rates (89,187–189). However, findings from a recent systematic review in Ethiopia showed a pooled prevalence of medication adherence rate of 65.4% among hypertensive which suggests a moderate rate showing some improvement in recent year (44,199) that indicate gradual improvement in hypertension medication adherence over time.

Psychological stress

Findings from our current study indicated that only a tenth (10%) (Figure 8) of participants managed their stress effectively. This suggests that the overwhelming majority (90%) were subject to the sustained effects of chronic stress which has been shown to negatively impact cardiovascular health outcomes. This is similar to a study in India that reported (84%) of hypertensive patients had unmanaged stress (459). Stress management as a determinant of CVD risk reduction has

received little research attention in Ethiopia. Even fewer studies that have examined stress levels among hypertensive patients have documented much lower rates (55% - 59%) of stress (398,413) than our findings of 90%. Similarly, findings from a tertiary level care in Nepal found more than half (55%) of hypertensive patients managed stress (402). Differences in findings may be related to sociodemographic, stress awareness levels, and strategies used to manage stress by individual patients and advice received from HCPs. In Ethiopia, hypertensive patients' understanding of stress is not addressed by the HCP or included in health histories which provides an opportunity to determine issues related to psychological health and what coping mechanisms are utilized. In a study conducted in India with similar findings of stress (96), the proportion of patients that sought stress related consultation from HCPs was very low (2.4%) (459). In both studies (India and Ethiopia), financial limitations were key components driving the levels of stress observed. (459). In the Indian study, the effect of stress on HTN management showed that nine-tenths (89%) of patients with unmanaged stress were not adhering to the treatment of HTN while 95% of those with no or managed stress had greater adherence with the recommended pharmacological treatment (459). Furthermore, a statistically significant ($p < .001$) difference in BP control rate was observed among patients with no or managed stress (76%) compared to those with unmanaged stress (20%) (459). Further study is needed in Ethiopia to determine the extent to which stress influences on adherence in HTN management. Given that Ethiopia has elevated levels of stress as the current study showed, it may be important to develop stress management programs or address stress levels to improve BP management.

A considerable number of epidemiological and pathophysiological studies including the international INTERHEART study indicated that chronic psychosocial stress was linked to etiology and progression of CVD (218,222,223). Furthermore, a study by Rosengren et al (2004) has observed that individuals with chronic stress had 2-fold or greater risk for CVD events such as MI (224). It was also suggested that stress induces a vascular inflammatory response in CV system which may accentuate the atherosclerotic disease process in up to 40% of cases leading to the increased risk of heart disease (460). The mechanism by which chronic psychological stress leads to the development of CVD is linked to the activation of the hypothalamic-pituitary-adrenal (HPA) axis resulting in excess release of the corticotrophin releasing hormone (CRH) and the dysregulation of the sympathetic nervous system (218,222,223). Chronic activation of CRH leads to negative psychosomatic effects with pathologic consequences, such as autonomic dysfunction,

inflammatory reactivity, oxidative stress, insulin resistance and diabetes, endothelial dysfunction, low heart rate variability and elevated BP, platelet abnormalities, with an increase in CVD risks (218,222,223). Among individuals with chronic psychological stress maladaptive unhealthy behavioral coping practices such as poor diet, high BMI (which are observed in this study), inactivity, and smoking (though not common in this study) were also more likely to lead to the development of more risk factors for CVD (218).

Regardless of its substantiated destructive effects, chronic psychological stress is potentially a modifiable CVD risk factor. Substantial evidence in literature highlights individualized behavioral activities and stress management skills that target at psychosocial stress were found to reduce stress level and were cost efficient that, in turn, reduced the elevated BP and lowered the strain on the CV system (461,462). Furthermore, implementing stress management intervention can have clinically useful effects in the secondary prevention of CVD outcomes (MI and stroke) and mortality in hypertensive population (227). Stress assessment and their potential sources should be part of the routine care of hypertensive patients to design individual tailored interventions to help reduce the negative physiological pathways that result in adverse CVD events. The encouragement of healthy behaviors such as maintaining PA (as observed in this study) and educating patients on additional stress management skills were suggested to have greater protection against the adverse effects of stress (463). Emphasis should be given to the more at-risk patients such as older adults where their capacity to adapt to stress declines (460). Interventions aimed at stress management techniques with the involvement of clinical psychologists may be worthwhile effort to employ to address psychosocial needs. Importantly, patient education on the recognition of stressor, and skills in managing them are of paramount importance since stress levels may not be situation dependent but rather on how the individual perceives their self-control of stressors (464).

Objective 5: Determine the associations among CVD outcome risk reduction behaviors status, and demographic and clinical profiles, knowledge, and risk perception scores of adult hypertensives attending CV follow-up at in tertiary hospital Addis Ababa

Factors associated with CVD risk reduction behaviors

Further examination of participants' specific CVD risk reduction behavior practices (Table 10) revealed some encouraging but also poor practices. Higher CVD reduction behaviors were

observed regarding PA, no smoking, and medication adherence rates. However, for many CV protective behaviors: dietary salt restriction, servings of fruits and vegetables, stress management, and alcohol moderation, the rates of behavioral adoption were low.

In the ordinal logistic regression model (Table 13), several participants' sociodemographic and clinical factors were identified to significantly influence their high CVD reduction behaviors. However, there were no association observed between patients' CVD reduction behaviors and their knowledge of CVD risk factors and CVD risk perceptions.

Participants who have no comorbidities were three times more likely to have practiced the high CVD risk reduction behavior as compared to those with comorbidities. Although the impact of comorbidity on CVD risk reduction behavior has not been widely examined but may compete with other chronic conditions, it is more difficult to adhere to the recommended guidelines (269). Our finding is supported by previous studies findings that hypertensives with comorbidity were 72% less likely to have practiced CVD reduction (465,466). Furthermore, comorbidity such as depression was linked to poorer prognostic risk (466), which may be due to its deleterious effect and poor adherence to CVD risk reduction behaviors. Over two-thirds (70%) of our study participants had depressive symptoms indicating it should be routinely assessed in hypertensives. The high burden of comorbidities may reduce patients' motivation for risk reduction behavior due to its psychological and/or physical burdens. Contrary to our findings, however, earlier studies have shown that hypertensives with comorbidities had a considerably higher adherence rate to the necessary lifestyle adjustments than those with HTN alone (467). Comorbidities may incite patients to take their health seriously and engage in risk-reducing behavior, which may help to explain this discrepancy. Early comorbidity screening, HTN monitoring, risk factor evaluation, and intensive multifactorial lifestyle modification may help hypertensives experience less comorbidity development and its burden.

The observed statistically significant associations between patients' high CVD reduction and every three-month clinic follow-up visit in the present study may suggest that patients had a reasonable concern for the reduction of adverse CVD outcomes based on their previous assessments and knowledge gained regarding risk factors and the required behavioral adjustment from the HCPs during the follow-up. Hypertensives may benefit from regular interval assessments (including analysis and interpretation of their current symptom experiences, physical examination, and laboratory work-up). Furthermore, obtaining advice and reinforcements on behavioral risk

reduction (diet, PA, body weight control, medication adherence including monitoring of side effects and dose adjustments), as part of the routine health communication with their HCPs may have accounted for the high-risk reduction behavioral practice. Even though studies on this topic have yielded few results, the frequency of clinic visits may be a reflection of patients with CVD's health-seeking behaviors, related to patients' perceptions that their BP and symptoms are under control, that clinic visits have been scheduled at regular intervals by doctors, or related to the COVID-19 pandemic season. According to the current HTN management guidelines (468), clinic visits every 2-4 months should be conducted for patients who have achieved the target BP control. However, only 14.1% of our study participants had every three months follow-ups visits, while nearly three-quarters (72.1%) of them, and in other studies, the majority of hypertensives (265,266) had the visit follow-up clinic scheduled monthly and/or bimonthly for HTN that may suggest patients were being monitored more closely to achieve BP control that required medication adjustment (based on patients' adherence and possible drug side effects) and evaluation of target organ disease and the co-existence of comorbid conditions. Hypertensives-HCP visits should go beyond BP monitoring and medication refills. Rather, the visit should provide the opportunity to improve the CVD risk reduction behavioral adoption and should be a key patient education goal during the clinic follow-up visits and is an area of future research.

Participants with normal body weight were nearly three times more likely to have high CVD risk reduction behaviors compared to obese participants. The present finding is supported by previous research that a normal BMI is a predictor of adequate self-care management among hypertensives (431) and that hypertensives with a normal BMI were more likely to adhere to self-management behaviors (419). The development of obesity is multifactorial including being sedentary, genetic predisposition, and environmental contributors (such as socioeconomic, behavioral, and epigenetics) (469). The finding that the majority (60%) of our study participants were overweight or obese indicates the importance of weight control in this population. (399,408,410). According to data from the SSA (154) obesity is a health concern, and certain African nations, like Nigeria, have higher rates of obese hypertensives (470). It was well documented that weight reduction among hypertensive adults was accompanied by BP reduction (471). Interventions that target patients' behaviors favoring for weight management in overweight and obese such as heart healthy diet and a low-salt diet along with continued BMI assessments

during the clinic return visits are crucial to reduce the potential adverse CV risk, particularly for patients with additional signs of metabolic syndrome.

The significant association between the high CVD risk reduction behavior and the HTN length of 5-9 years as opposed to 15 years or longer seems appropriate. In the original and Framingham Heart Offsprings Study of a large sample of participants aged 40-89 years the progression from HTN to CHF and other CVD complications occurred on average at 14 years with a peak 5 years survival of only 24% of males and 31% of females (336). Due to the disease's asymptomatic progression and the potential late health and sickness behaviors of our study participants, complications could parallel the 5–9 years of HTN length in our participants with possible symptom experiences that could serve as a warning for patients to heavily engage in risk reduction behavior. We also noted a shorter mean and median HTN duration in the current study, which is consistent with several previous studies of hypertensives in Ethiopia (265,310). Furthermore, nearly two-thirds (63%) of our study participants had an HTN duration of < 10 years which conforms to previous research (265,266). All that is in support of the 5-9 years HTN length to match the likely time for appearances of HTN complications and may trigger patients for high CVD risk reduction behavior.

The odds of practicing high CVD risk reduction behaviors were two times higher on average for young adult patients as compared to the combined low and moderate category CVD risk reduction behavioral practice adaptors of old age adult patients. This finding is supported by a study finding from northern Ethiopia (429). The observed phenomenon may be due to likely multiple pathologies in old age, and HTN complications with more extended duration of HTN on top of the age-related overall physiological deterioration in old age that limits patients' ability to engage in risk reduction behavior such as PA. Furthermore, old age patients' economic factors may limit their fruits and vegetables consumptions at the recommended servings. In previous research economic status was an inverse explanatory for the adoption of CVD risk reduction (472).

When depressive symptoms were present, the high CVD risk reduction behavioral practice was 9% less likely to happen; nonetheless, this finding was statistically insignificant despite having clinically substantial implications. The combination of depressive symptoms with HTN may operate as a deterrent to patients engaging in CVD risk-reduction activity, which could have detrimental effects and impair the clinical outcome of CVD (432,473). This finding can act as an important reminder for HCPs who monitor hypertensives, to use a depression screening tool to

detect depressive symptoms as soon as possible and refer patients to get psychiatric guidance to improve CVD risk reduction behavior with the ultimate goal of preventing negative CV outcomes.

In summary, CVD risk reduction through lifestyle modifications continued to be at stake even in most affluent nations (474). Creating desirable and targeted health behaviors for better prevention and reduction of future CV events in hypertensives should be based on a wider scope and in-depth recognition of patients' risk factors appraisal at all times during the clinic follow-up visits. Early screening of comorbidities and appropriate treatment of the individual hypertensive patient may help to improve adhere adoption of healthy lifestyle behaviors to reduce adverse CV outcomes.

Strength of the study

The present study has a number of strengths. First, most importantly, there were no reported research that examined hypertensives risk perceptions in previous studies in Ethiopia that this study was able to reveal. Second, there was a major gap in knowledge concerning CVD risk reduction behaviors practiced among adult hypertensives in Ethiopia. The findings from this study helped fulfill that void which was novel and provides future directions for increasing awareness of risk reduction behaviors. Thirdly, the knowledge of CVD risk factors had not been studied in previous research among hypertensives that this study examined that may be used to develop a planned teaching program and implement at all levels of care with the aim of improving patients' knowledge and heighten their risk perceptions. The study's strengths also included its prospective data collection methodology, appropriate power, use of validated instruments, and first-time use of nl FRS in Ethiopia and its therapeutic value of determining that hypertensives had a moderate 10-year chance of developing CVD justifies taking behavioral precautions against the anticipated risk.

Limitations of the study

Results of the present study has to be cautiously interpreted in light of some of its limitations. The study was a cross-sectional by design and its findings are limited to associations vs causality. Though the study was conducted at tertiary hospital level of care with large sample, it was a single site study that limits its generalizability to patients attending other levels of hospital care. Participants education level was low, risk perception is based on patients' comprehension ability of CVD risks, and the risk perception was measured on scale validated in different population.

However, despite these aforementioned limitations of the study, the study yielded a number of novel findings that outweighs its limitation with significant implications. Self-reported data recall bias, lack of lipid measures documented.

Conclusions

Hypertensives' practice of CVD risk reduction behaviors was low, with a variety of unmanaged risk factors and few cardioprotective behaviors reported. The absence of comorbidities, maintaining a healthy weight, having HTN for 5–9 years, scheduled clinic visits every three months, and being a young adult were predictive of performing high-risk CVD reduction behaviors. Despite being on long-term follow-up at a tertiary-level clinic hypertensives, were at moderate risk for CVD events by an objective measure, nl-FRS. Target blood pressure control was low particularly among overweight and obese hypertensives with comorbid diabetes and CKD. Most participants lacked knowledge of risk factors for CVD, and characteristics of CVD.

Implications and recommendations

Since the study was carried out at a tertiary referral care setting the present study findings have several clinical practice, research and policy importance and implications. The findings suggest that HCPs should:

- Screen on a regular basis the patients' CV risk reduction lifestyle behavior during scheduled clinic visits.
- Appraise CVD, lifestyle risk factors and early comorbidity assessment among young to middle aged adults when treatment is most likely to have the greatest benefit for preventing complications and adverse events.
- Provide patient education of lifestyle behaviors known to prevent or delay adverse CVD events such as reduced salt intake, adequate fruit and vegetables servings, glycemic control, weight management during follow-up clinic visits.
- Address knowledge and literacy levels of the majority of patients seen in the outpatient clinic by providing materials and directions that are easy to understand and follow.
- The HTN clinic/the specialist team should focus on patients' self-sustained goal BP control for the optimum self-management of HTN.
- Screen for depressive symptoms and stress on a routine basis using simple tools such as the PHQ-2 or 9 and the PSS, respectively. If patients are experiencing depressive symptoms

indicative of major depression they should be further evaluated by a clinical psychologist or psychiatrist for potential treatment.

- There is also a need to advance the role of nurses and other HCPs in HTN care and management, through a collaborative/interdisciplinary practice team approach to be most successful in bringing BP under control thereby avert CV events.

Future research

- Research that takes into consideration gender-specific risk, and lifestyle factors that cause HTN to begin at a young age may be considered as priority research.
- Further large-scale research is crucial in the area of risk perception with a combined teaching intervention among hypertensive population.
- Besides large-scale research that delves into root causes of low target BP control using a better methodological approach including both the office and ambulatory BP measurements is a consideration.

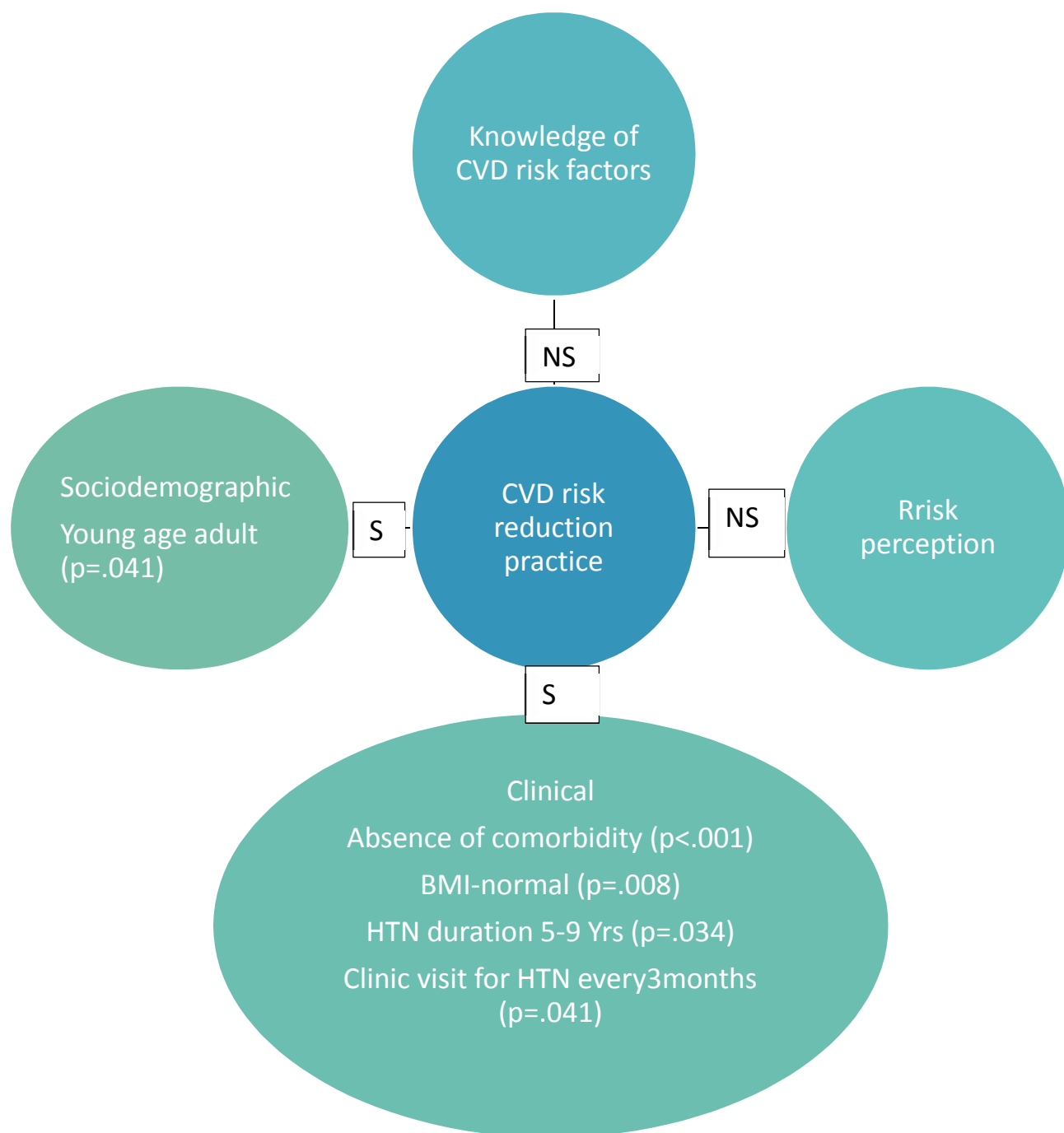
Policy/MOH

- Cardiovascular disease is on escalation and its risk reduction cannot be complete without effective national healthcare policy from the federal ministry of health (FMOH).
- The result of the current study suggests the critical need for CVD risk factor awareness through media campaign as a national priority for both the primary and secondary prevention of CVD.
- In addition, primary care and community clinics are important venues to educate the public on BP awareness since most of the population in Ethiopia uses these services.
- Incorporating risk reduction strategies and the importance of managing HTN to prevent CVD adverse outcomes should begin early with risk assessment beginning in adolescents and young adults should be part of the healthcare professional education and service policy.
- National policy that supports research with important public health problems like CVD at all levels of care and community setup, which targets CVD-risk factors would have a substantial impact on CVD related morbidity and mortality and also reduces the healthcare burden related to the disease.
- Furthermore, Since the results of the current study suggested that HTN may manifest itself early in adult life, that HTN onset at a young age is associated with an increased risk of CVD

morbidity and mortality by middle adulthood, and that these results can be viewed as the tip of the iceberg, it is imperative that young adults be screened for HTN.

Summary of the study

The present study utilized a cross-sectional design that examined the CVD risk reduction behavioral practices and its associations with the sociodemographic, clinical, knowledge of CVD risk factors and CVD outcome risk perception of 377 hypertensives attending to a tertiary level hospital follow up care in Addis Ababa, Ethiopia. Primary data collection from a self-report using standardized interview questionnaire, direct physiological variable measures by trained professional research assistants. A major finding was the low CVD risk reduction behavioral practices among hypertensives. Higher CVD risk reduction behavioral action was associated with the participants demographic variable young age adults, and clinical variables such as absence of comorbidity, HTN duration of 5-9 years, clinic visits for HTN every three months, and normal BMI. Hypertensives CVD risk reduction behavioral adoption was independent of their knowledge and risk perceptions. These associations are summarized by the diagram below.



S (significant), NS (non-significant)

Figure 9. Path diagram showing the association between CVD risk reduction practice and its independent variables

Acknowledgments

I would like to express my heartfelt and sincere gratitude to my Primary Advisor Dr. Rebecca Gary, RN, PhD, FAHA, FAAN, Professor of Nursing, at Nell Hodgson Woodruff School of Nursing Emory University (USA) for her invaluable and expertise guidance, constant support, and encouragement provided to me from the inception to the completion of this PhD dissertation project. Besides, I would like to thank her for willingness to serve as a coordinator of this program at Emory University.

I would like to thank my Co-Advisor Dr. Dejuma Yadeta, Associate Professor of Internal Medicine and Cardiology for provided to me unreserved guidance and constructive suggestion throughout the project period.

I would like to express my gratitude to my Co-Advisor Professor Alemayehu Worku for his passionate effort and provision of sound guidance throughout my research period.

I would like to express my gratitude to my Co-Advisor Professor Melinda Higgins, for her constructive guidance regarding statistical procedures used in my research.

I would like to express my special gratitude to my Mentor, Professor W. Kenneth Hepburn at Nell Hodgson Woodruff School of Nursing, Emory University (USA) for his full heart support, encouragements, invaluable critiques, and constructive suggestions on the draft proposal. More importantly, I owe a lot of gratitude to him for his outstanding effort, historical initiative, and dedication to making the PhD Nursing program at AAU a success.

I would like to extend my gratitude to Dr. Getnet Yimer who served as a coordinator of this program at AAU, CHS and contributed a lot to the smooth running of the program.

I am very much appreciative of Professor Sandra B. Dunbar, Dean, Nell Hodgson Woodruff School of Nursing, Emory University, Atlanta G, (USA), all faculty members who contributed to courses offered from Atlanta, and Mr. Steave Ellwood, Instructional Technologist, for his support and patience in organizing live Skype/Zoom classes and discussions.

Last but not least I would like to thank the study participants for their time.

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APPENDICES

APPENDIX –A: Letter requesting the IRB permission to conduct the main study

To: Institutional Review Board (IRB) College of Health Sciences, AAU

Subject: Request for Approval of PhD Dissertation Proposal to Conduct a Dissertation Project

I am a PhD Nursing student of this College. For the partial fulfillment of the requirements for Doctor of Philosophy degree, I will be undertaking dissertation project titled: Knowledge and self-risk perception of cardiovascular disease outcomes, and cardiovascular disease risk reduction behavior of adult hypertensive patients attending cardiovascular and renal follow up clinics at Tikur Ambessa Specialized Hospital, Addis Ababa. Hence, I would request the Office for kind approval of the project.

With regards,

Daniel Mengistu, RN, Bsc.N. MSc.N.

Department of Nursing

CHS, AAU

	Addis Ababa University College of Health Sciences Institutional Review Board Title: Knowledge and Risk Perception of Cardiovascular Disease, and Cardiovascular Disease Risk Reduction Behavior of Adult Hypertensive Patients in AA, Ethiopia 3.4. Initial Review of Application Protocol	SOP# AAUMF 010 Version 3.0 Effective date: 1 June 2015 Page 170 of 10
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APPLICATION FORM for INITIAL REVIEW

Protocol Title: Knowledge and Risk Perception of Cardiovascular Disease, and Cardiovascular Disease Risk Reduction Behavior of Adult Hypertensive Patients in AA, Ethiopia	
Protocol number:	Total Participants to be included: 384

STUDY TYPE: (Mark "✓" "whichever" apply to

- ☒ Survey
 ☐ Social
 ☐ Medical
 ☐ Community based
 ☐ Individual based
☐ Screening
☒ Observational
☐ Epidemiology
☐ Intervention study
☐ Clinical Trial:
☐ Phase I
☐ Phase II
☐ Phase III
☐ Phase IV
☐ Genetic Study
☐ Retrospective
☐ Prospective
☐ Others.....

STUDY POPULATION:: ☐ Healthy ☒ Patient ☐ Vulnerable groups ☐ Animals

CHARACTERISTICS of PARTICIPANTS PARTICIPATED:

- Age Range:
☐ 0 -17 yrs
☒ 18 - 44 yrs
☒ 45 - 65 yrs
☒ > 66 yrs
 Pediatric
☐ None
☐ < 1 yr
☐ 1-3 yrs
☐ 4 -14 yrs
 Impaired
☐ None
☐ Physically
☐ Cognitively
☐ Mentally

☒ Specify the age rang as: **18 and above years of age.**

REQUESTED EXCLUSION OF PARTICIPANTS:

- ☐ None
☐ Male
☐ Female
☐ Children
☐ Other (specify) **None**

SPECIAL RESOURCE REQUIREMENTS (check all that apply):

- ☐ Intensive Care
☐ Isolation unit
☐ Surgery
☐ Pediatric Intensive Care
☐ Transfusion
☐ CAT scan
☐ Gene therapy
☐ Controlled substances (Narcotics/Psychotropic)
☐ Prosthetics
☐ Gynecological services
☒ others, specify **BP, weight and height measuring devices**

IONIZING RADIATION USE (X-rays, radioisotopes, etc):

- ☒ None
☐ medically indicated only

INVESTIGATIONAL NEW DRUG (IND) / DEVICE (IDE):

- ☒ None
☐ IND
☐ IDE
 FDA No.:.....
 FDA No.:.....
 Name:.....
 Name:.....
 Sponsor:.....
 Sponsor:.....
 Holder:.....
 Holder:.....

PROCEDURE USE: ☐ Invasive ☒ Non-invasive ☐ Not applicable the study)

	Addis Ababa University College of Health Sciences Institutional Review Board Title: Knowledge and Risk Perception of Cardiovascular Disease, and Cardiovascular Disease Risk Reduction Behavior of Adult Hypertensive Patients in AA, Ethiopia 3.4. Initial Review of Application Protocol	SOP# AAUMF 010 Version 3.0 Effective date: 1 June 2015 Page 171 of 10
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MULTI-SITE COLLABORATION: ☐ YES ☒ NO

FINANCIAL DISCLOSURE: ☐ YES ☒ NO

Conflict of Interest ☒ None ☐ If yes, specify or declare it to the chairperson.

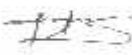
INSTITUTE RESEARCH CONTACT

Name: Daniel Mengistu Address: CHS/SoNM Fax
E-mail: Mengistudaniel@yahoo.com Telephone 251911119597.

	Addis Ababa University College of Health Sciences Institutional Review Board Title: Knowledge and Risk Perception of Cardiovascular Disease, and Cardiovascular Disease Risk Reduction Behavior of Adult Hypertensive Patients in AA, Ethiopia 3.4. Initial Review of Application Protocol	SOP# AAUMF 010 Version 3.0 Effective date: 1 June 2015 Page 172 of 10
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APPLICATION FORM for INITIAL REVIEW

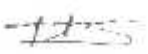
PARTICIPATING INVESTIGATORS:

First / Last Name	License No.	Institution	Telephone / Fax No.	Signature
Daniel Mengistu		Addis Ababa University	251 911119597	
Dr. Rebecca Gary		Emory University	4047278360	
Dr. Dejuma Yadeta		Addis Ababa University	251 911411081	
Prof. Alemayehu Worku		Addis Ababa University	251911495652	
Dr. Milinda Higgins		Emory University	404-434-1785	

TYPE OF REVIEW:

☐ Initial Review ☐ Resubmission Review Amendment Review Expedited Review	Emergency Review Continuing Review Report Review Protocol Termination
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SIGNATURES:


 _____ Date:
 Principal Investigators
 _____ Date:.....
 Protocol Chairperson (if applicable)

COMPLETION:

_____ Date:.....
 Secretary, IRB, ...AAUMF....

APPLICATION NUMBER : / -

APPENDIX-B: Certificate of IRB, CHS, AAU Approval of the Study

 **ADDIS ABABA UNIVERSITY, COLLEGE OF HEALTH SCIENCES (CHS)**
የአዲስ አበባ ዩኒቨርሲቲ ሳይንስና ቴክኖሎጂ ትምህርት ማኅተሚያ
Institutional Review Board

ANNEX 3
Form AAU/MP/03-008

IRB's Decision

Meeting No: 08/2018 Date: 12/12/2018
Protocol number: 091/18/Nursing

Protocol Title: Cardiovascular Disease Risk Reduction Behaviors, Knowledge And Risk Perception Of Adult Hypertensive Patients In Addis Ababa, Ethiopia

Principal Investigator:	DANIEL MENGISTU
Institute:	College of Health Sciences, AAU
Elements Reviewed (AAU/MP/03-008)	☒ Attached ☐ Not attached
Review of Revised Application ☐ Yes ☐ No	Date of Previous review:
Decision of the meeting:	☒ Approved ☐ Approved with Recommendation ☐ Resubmission ☐ Disapproved

I. Elements approved:

1. Protocol Version No: 2
2. Protocol Version Date:
3. Informed consent Version No: 2
4. Informed Consent Version Date:

II. Obligations of the PI:

1. Should comply with the standard international & national scientific and ethical guidelines
2. All amendments and changes made in protocol and consent form needs IRB approval
3. The PI should report SAE within 10 days of the event
4. End of the study, including manuscripts and thesis works should be reported to the IRB.

III. TO NERC ☐

Institution Review Board (IRB) Approval: Period from: March 04, 2019 to March 03, 2020

Follow up report expected in

3 Months _____ 6 months _____ 9 months ☒ one year _____

Chairperson, IRB
Dr. Adama Adhossie

Signature: _____
Date: 04/03/2019



APPENDIX –C: Letter Requesting Permission to Conduct the Pilot Study



APPENDIX-D: Certificate of IRB, SPHMMC Approval of the Study

Ref. No. SPH/25/2019
Date 14/12/2019

Institutional Review Board (IRB) of St. Paul's Hospital Millennium Medical College (SPHMMC)
Ethical Clearance

Research Title: - Cardiovascular disease risk reduction behaviors, knowledge and risk perception of adult hypertensive patients in Addis Ababa, Ethiopia

Principal Investigator:- Daniel Mengistu

The IRB of SPHMMC has reviewed the above mentioned research proposal and made the following decision:-

- Approved - ✓
- Approved with recommendation:- _____
- Approved on condition:- _____
- Disapproved:- _____

The decision is valid for 12 months and the research should be conducted in compliance with the protocol/proposal approved by the IRB of SPHMMC. Any subsequent revision/amendment of the protocol/proposal needs approval before conduct of the research. The researcher should also submit written summaries of the research status to the IRB every 03 months. Upon the conclusion of the study, manuscripts and thesis work to the final/completed research project needs to be submitted to the IRB.

IRB Chair: M. Bakela
Signature: _____
Date: December 12, 2019
Makeme Bakela (MD)
Associate Professor Research
Deputy Director

Cc:

- Vice Provost for Academic and Research
- IRB
- Daniel Mengistu
SPHMMC

APPENDIX-E: Letter Requesting Permission the Study Site Hospital to Recruit Participants

 **ፕቀር አንበሳ**
TIKUR ANBESSA

School of Nursing and Midwifery
የርሴ.ንግና ማረጋገጫ ትምህርት ቤት
Department of Nursing
የርሴ.ንግ ትምህርት ክፍል

Ref.no/ቁጥር: CHS/NSG/16/2012/19
Date/ቀን: Friday, February 07, 2020

To: Clinical Services Director
College of Health Sciences

From: Niguse Tadele
Chair, Department of Nursing

Subject: Request for permission



Mr. Daniel Mengistu, a PhD student at the Department of Nursing, School of Nursing and Midwifery, has planned to conduct a study at your hospital for his PhD research project entitled: *"Cardiovascular Disease Risk Reduction Behaviours, Knowledge and Risk Perception of Adult Hypertensive Patients in Addis Ababa, Ethiopia."* His study obtained ethical approval from Institutional Review Board of Addis Ababa University, College of Health Sciences.

Hence, we would like to request your kind support and cooperation to enable him to conduct his study at your hospital.

Please find the IRB approval attached with this letter.

With Regards,

Email: chs.nursing@aau.edu.et
ጽሑፍ ሲጽፉልን እባክዎ ይህን ቁጥር ይጥቁሱ።

APPENDIX-F: Certificates of Permission by the Study Site Hospital to Conduct the Study

የብዕር ደረጃ ምርመራ ቅጽ
የምርመራ ምርመራ ቅጽ
የምርመራ ምርመራ ቅጽ

 Department of Internal Medicine
School of Medicine
Addis Ababa University

Department Research Ethics Review Form
Adapted from the National Research Ethics Review Guideline

Date: 12/02/2020
Ref.No. IMED/345/12

To: Cardiac Unit

The study entitled "Cardiovascular Disease Risk Reduction Behaviors, Knowledge and Risk Perception of Adult Hypertensive Patients in Tikur Anbessa Specialized Hospital Addis Ababa Ethiopia" to be done by Mr.Daniel Mengistu, is approved by the department. We request your unit to cooperate with the investigator in data collection.

With regards

Tesfayoh Haile, MD
Head, Department of Internal Medicine



Tel: 251 11 551 06 53 P.O. Box 2380
Fax: 251 11 551 30 99 E-mail: imed.som@aaau.edu.et

የወጪ ሰነድ ቁጥር
ሰነድ ቁጥር 127
በሰነድ ቁጥር 127



Department of Internal Medicine

School of Medicine
Addis Ababa University

Department Research Ethics Review Form

Adapted from the National Research Ethics Review Guideline

Date: 12/02/2020
Ref No: IMIS/43/13

To: Renal Unit

The study entitled "Cardiovascular Disease Risk Reduction Behaviors, Knowledge and Risk Perception of Adult Hypertensive Patients in Tikur Anbessa Specialized Hospital Addis Ababa Ethiopia" to be done by Mr. Daniel Mengistu, is approved by the department. We request your unit to cooperate with the investigator in data collection.

With regards

Tewodros Haile, MD

Head, Department of Internal Medicine

Tel: 251 11 551 06 53
Fax: 251 11 551 30 99

P.O. Box 2380
E-mail: imed.som@aaau.edu.et

APPENDIX-G: *Letter Requesting Participation of the Study Participants*

From: Daniel Mengistu, PhD student, CHS, AAU

Dear Participant,

I am a PhD Nursing student of the College of Health Sciences, AAU. I am intended to conduct research on a topic Knowledge and self-risk perception of CVD and its outcomes, and CVD outcome risk reduction behavior of adult hypertensive patients attending cardiovascular and renal follow up clinics at Black Lion Hospital. The purpose of this study is to assess CVD outcome risk reduction behavior and their correlates among adult hypertensive patients attending cardiovascular follow up clinic in Addis Ababa, Ethiopia.

Therefore, I would request you kindly respond to each of the question asked without any hesitation. I assure you that the information you provide will be kept utmost confidential and used only for the purpose of the study. This study is anonymous with no any name or identity. The information you provide will be highly valuable to develop an educational program and also to improve the services rendered to hypertensive patients in Ethiopia and it is highly appreciated. Please feel free and frank in answering all the questions. You do not have to answer if you are not interested in it and you are free to withdraw at any time.

Thank you

Sincerely,

(Daniel M.)

Signature of the participant

APPENDIX-H: *Participant Information Sheet.*

Date: _____

Dear Study Participants,

You are invited to take part in this main study that aimed to examine: Your knowledge of CVD, risk perception of CVD outcomes and CVD risk reduction behavior. This study is required for my PhD as part of the partial fulfillment of the requirement for the Doctor of Philosophy degree in nursing at Addis Ababa University.

Before you decide whether to take part in the study, I would like you understand what the study is for and what you will be asked to do. Please take time to read/listen to me, to the following information and discuss it with me. You are free to decide whether or not to take part. If you decide to take part, you will also be asked to sign a consent form. You can change your mind at any time and withdraw from the study without giving a reason. Participating or not Participating in this study will not have anything on your standard of care.

The purpose of the research study is to examine the knowledge of CVD, risk perception of CVD outcomes and CVD risk reduction behavior of hypertensive patients on a follow up at tertiary hospitals. I would like to ask questions related to these areas.

You have been chosen because you have been of follow up for hypertension treatment for more than 3 months at TASH. The study will involve up to 384 participants, whom we will interview individually. The interview will take approximately one and a half hour. If you choose to take part I will proceed to interview you. The information gained from this study will be used to make recommendations for further research and improvement care and treatment for hypertensive patients.

The data obtained through this interview will be stored in a secured place and will not be shared with other people. The data then will be entered into a computer for analysis of the mentioned purpose. After the analysis I will write a report and the results may be published in journals and conference presentations. No participant will be identifiable. This study has been approved by the IRB of College of Health Sciences, AAU and Office of Director of Clinical Service of TASH. Please do not hesitate to contact me if you need further information.

Thanking you in anticipation,
Daniel Megistu, Assistant Professor
Dept of Nursing and Midwifery, CHS, AAU. Tele: +251 911119597. Email: mengistudaniel@yahoo.com

APPENDIX-I: Study Participants Consent Form for Interview

Date: _____

Thank you for reading/listening to the information sheet I read to you to participate in the interview for the study. If you like to participate, please sign on the form below. Please indicate your agreement for the interview by making you initial on each space to confirm that you agree with each statement:

I confirm that I have understood the information sheet and have had the opportunity to ask questions and I voluntarily agree to participate in this research study dated on __/__/2011EC ☐

I understand that my participation is voluntary and that I am free to withdraw at any time without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question or questions, I am free to decline. ☐

I understand that my responses will be kept strictly confidential. I understand that my identity will not be linked to the research. ☐

I understand that the data obtained through this interview will be used only for analysis of the research purposes and I would not be personally identified, and may be used in any conference presentation, report or journal article developed as a result of the research with being anonymised and no one outside the research team will be allowed access to the data. ☐

I agree to take part in this interview.

_____	_____	_____
Participant	Date	Signature

_____	_____	_____
Principal Investigator	Date	Signature

APPENDIX-J: Data Collection Tool – English Version.

Tool for data collection for dissertation titled: Knowledge of CVD, self-risk perception, and risk reduction behavior of adult hypertensive patients attending cardiovascular and renal follow up clinics at TASH, Addis Ababa, Ethiopia

Purpose: to discover the CVD risk reduction behaviors and their associations with knowledge and risk perception of CVD among adult hypertensive patients attending follow ups at tertiary hospital in Addis Ababa, Ethiopia.

Demographic questionnaire

Instruction I: For each of the following 26 demographic and health status profile question, please writing as appropriate or put an “X” mark on the blank space provided in front of each question for the elicited response from the patient

1. What is your age in years? _____
2. What is your gender? Male _____ Female _____
3. What is your religion?
Orthodox _____
Protestant _____
Islam _____
Others; please specify _____
4. What is your marital status?
Single _____
Married _____
Divorced _____
Widow _____
Separated _____
5. What is your family situation?
Live alone _____
With spouse _____
With parents _____
Others/specify _____
6. What is your educational status?
Can't read and write _____

Elementary _____
High school _____
College diploma and above _____

7. How much is your monthly income in ETB? _____

Less than 1000 _____
1000-3000 _____
3001-6000 _____
6000-10,000 _____
Greater than 10,000 _____

8. When were you diagnosed with high blood pressure (duration in years) _____

9. Is there history of hypertension in your parents? Yes_____,No_____

Current health status (to be checked on spot)

10. Current Body Wt in KG _____
11. Height in M² _____
12. BP in mmHg _____

Current health status (Q15-17, to be counterchecked from the patients' file)

13. How is your Medicare covered?

Self/family _____
Free/government _____
Third party _____

14. Was your blood cholesterol level checked in the last six months? Yes_____,No_____, if yes what was the value level?_____

15. Was your high-density lipid cholesterol (HDL-C) level checked in the last six months? Yes_____, No_____, if yes, what was the value level_____

16. Was your creatinine level checked in the last six months? Yes_____, No_____, if yes, what was the value level? _____

17. How often do you see your doctor for your blood pressure? _____

Every month_____, every two months_____, only whenever I feel sick_____

18. Have you ever hospitalized for your blood pressure or related complications? Yes_____, No___

a. If yes, what was the diagnosis?

CHD _____
Stroke/TIA _____

Diabetes _____

CKD _____

PVD _____

Other, specify _____

19. Do you think your blood pressure is well controlled? Yes____, No____.

a. If yes, what did you do to keep your blood pressure under control?

i. I strictly adhere to my doctor's advice and prescription_____

ii. I use self-treatment_____

iii. I use traditional medicine_____

iv. Any other, please specify_____

b. If no, what do you think that your blood pressure is not under control? Please specify reasons_____

20. If you did use any traditional medicine measures to keep your blood pressure under control, how did you use it?

a. I use as an additive to my doctor's prescription_____

b. I switch from the prescribed medicine to the traditional medicine_____

c. Any other, please specify_____

d. Please list the traditional medicines you have ever used to control your high blood pressure

21. List current blood pressure medications you are taking (to be collected from patient's medical record

a. _____

b. _____

c. _____

d. _____

e. _____

22. List other current medications you are taking.

a. _____

b. _____

c. _____

d. _____

e. _____

23. Do you have other medical conditions, please list

24. From where did you get information about seriousness of CVD (HTN) outcomes?

Instructions II: For each item listed in the below table, indicate the patient's response by placing an "X" mark in the cell/box in the column in front of each question.

Cardiovascular Disease Risk Factors Knowledge Level (CARRF-KL) Scale.

Purpose: To assess knowledge of CVD risk of hypertensive patients.				
		True	False	DK
1.	A person always realizes if he/she has a heart disease			
2.	A family history of CVD increases your risk of having heart disease			
3.	Elderly people are at a higher risk for heart diseases			
4.	Coronary heart diseases can be prevented			
5.	Smoking is a preventable cause of death and diseases in our country			
6.	Smoking is a risk factor for heart disease			
7.	The risk of developing heart disease is reduced when smoking is stopped			
8.	It is beneficial to eat 2-3 portions of fruit and 2 portions of vegetable daily.			
9.	It is harmful to eat red meat more than 3 times a week.			
10.	Eating salty lead to increases in blood pressure.			
11.	Fatty meals do not increase the cholesterol level in blood.			
12.	Fats that are solid at room temperature are beneficial for heart health.			
13.	A low carbohydrate and low fat diet is beneficial for heart health.			
14.	Overweight individuals have higher risk of heart disease.			
15.	Regular exercise reduces the risk of heart disease.			
16.	Risk can be reduced by exercising only in a gym.			
17.	Slow walking and wandering are also considered as exercise.			
18.	Stress, sorrow, and burden increase the risk of heart disease.			
19.	Blood pressure increases under stressful conditions.			
20.	High blood pressure is a risk factor for heart disease.			
21.	Blood pressure control reduces the risk of heart disease.			
22.	Hypertension medications should be used for a lifetime.			
23.	High cholesterol is a risk factor for heart disease.			
24.	There is a risk of heart disease if good (HDL) cholesterol is high.			
25.	There is a risk of heart disease risk if bad (LDL) cholesterol is high.			
26.	Every person with high cholesterol level is given medicine.			
27.	Diabetes is a risk factor for heart disease.			
28.	The risk can be reduced in diabetic patients with glucose control.			

Instruction III. For each of the following 8 questions, please rate the patients your own risk of heart attack and stroke responses by encircling the number that best corresponds to the patient's views.

Self- risk perception of CVD outcomes of hypertensive patients (ABCD Questionnaire)

1 = strongly disagree, 2 = disagree, 3 = agree or, 4 = strongly agree

1	It is likely that I will suffer from a heart attack or stroke in the future.	1	2	3	4
2	It is likely that I will have a heart attack or stroke some time during my life.	1	2	3	4
3	I feel I will suffer from a heart attack or stroke sometime during my life.	1	2	3	4
4	There is a good chance I will experience a heart attack or stroke in the next 10 years.	1	2	3	4
5	I am not worried that I might have a heart attack or stroke.	1	2	3	4
6	My chances of suffering from a heart attack or stroke in the next 10 years are great.	1	2	3	4
7	It is likely I will have a heart attack or stroke because of my past and/or present behaviors.	1	2	3	4
8	I am concerned about the likelihood of having a heart attack or stroke in the near future.	1	2	3	4

Instruction IV. For each behavior listed below, indicate the patient's adopted CVE risk reduction practice/behavior by encircling the yes or no response provided by the patient to represent the patient's reported behavior and put 'X' mark as appropriate for questions that have follow up questions. For question N0 9; rate the patient's current stress level on a five-point scale by encircling the number that indicates the patient's stress level.

Adopted CVD risk reduction behavior of Hypertension patients

	Behaviors	Yes	No
1.	Are you regularly engaged to moderate physical exercise: walking for ≥ 30 minutes per day (cycling, gardening ≥ 5 times/week)? Or strenuous exercise (jogging, swimming, playing football) for ≥ 4 hours/week?	Yes	No
2.	Do you currently smoke any form of tobacco? (Current means smoking at least one cigarette during the previous 12 months including those who had quit smoking within the past year.	Yes	No
3.	Is your diabetes controlled? (current glycemic control: FBG < 100 mg/dl or Hgb A1c $< 7\%$) if diabetes	Yes	No
4.	How much salt per day do you add to your diet? (< 5 to 6 gm). If no check one. > 6 gm _____ Unknown amount _____	Yes	No
5.	I strictly adhere to my doctor's advice on my antihypertensive prescription	Yes	No
6.	How many servings of fruits and vegetable do you have per day? > 5 servings (400-500gm). One serving is equivalent to: one orange or one apple or one banana and three tablespoons of cooked vegetables). If no check one 1-3 servings _____ 4-5 servings _____ Specify _____	Yes	No
7.	How many alcohol drink(s) do you have per day or per week? (Low to moderate alcohol intake within the past 12 months):		
	1 drinks/day or < 4 drinks/week (Female)	Yes	No
	1-2 drinks/day or < 4 drinks /week (Male)	Yes	No
	No drink al all	Yes	No

8. **Perceived Stress Scale (PSS):** The questions in this scale ask you about your feelings and thoughts during the last month. In each case, please indicate with a check how often you felt or thought a certain way.

Question	Never	Almost never	Some- times	Fairly often	Very often
1. In the last month, how often have you been upset because of something that happened unexpectedly?	☐	☐	☐	☐	☐
2. In the last month, how often have you felt that you were unable to control the important things in your life?	☐	☐	☐	☐	☐
3. In the last month, how often have you felt nervous and “stressed”?	☐	☐	☐	☐	☐
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	☐	☐	☐	☐	☐
5. In the last month, how often have you felt that things were going your way?	☐	☐	☐	☐	☐
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	☐	☐	☐	☐	☐
7. In the last month, how often have you been able to control irritations in your life?	☐	☐	☐	☐	☐
8. In the last month, how often have you felt that you were on top of things?	☐	☐	☐	☐	☐
9. In the last month how often have you been angered because of things that were outside of your control?	☐	☐	☐	☐	☐
10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?	☐	☐	☐	☐	☐

The PSS is a self-reported measure of stress with ten items. The PSS was originally developed by Cohen, Kamach, and Mermelstein in 1993 and remained widely in use to assess how different

situations affect our feelings and our perceived stress. the questions in the scale ask about one's feelings and thought during the elapsed month. The scale had a reported reliability of Cronbach's α between 0.84 - 0.86 test-retest reliability of 0 .85. Each question is provided with five alternative responses (0 – never, 1 - almost never, 2 – sometimes, 3 - fairly often, and 4 - very often). For scoring first item number 4, 5, 7, and 8 should be reversed as 0 = 4, 1 = 3, 2 = 2, 3 = 1, 4 = 0, and then adding up the total score. Individual scores on the PSS can range from 0 to 40 with higher scores indicating higher perceived stress. The scores are interpreted as:

0-13 considered low stress.

14-26 considered moderate stress.

27-40 considered high perceived stress.

PATIENT HEALTH QUESTIONNAIRE (PHQ-9)

	Over the last 2 weeks, how often have you been bothered by any of the following problems?	Not at all (0)	Several days (1)	More than half of the days (2)	Nearly every day (3)
1	Little interest or pleasure in doing things.	0	1	2	3
2	Feeling down, depressed, or hopeless.	0	1	2	3
3	Trouble falling or staying asleep, or sleeping too much.	0	1	2	3
4	Feeling tired or having little energy	0	1	2	3
5	Poor appetite or overeating.	0	1	2	3
6	Feeling bad about yourself or that you are a failure or have let yourself or your family down.	0	1	2	3
7	Trouble concentrating on things, such as reading the newspaper or watching television.	0	1	2	3
8	Moving or speaking so slowly that other people could have noticed. Or the opposite being so fidgety or restless that you have been moving around a lot more than usual.	0	1	2	3
9	Thoughts that you would be better off dead, or of hurting yourself	0	1	2	3

Appendix-K: Sample Evidence of the Study Instruments Professional Translation

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የመረጃ አስገኝቶ መሳሪያ - የአገልግሎት ትርጉም

በልብና የጽሑፍ ስራ ዘዴዎች ላይ ያለ ልውውጥ የራስ ስጋት ምልክት እና የአደጋ ቅንብር ምልክት ከፍተኛ የጽሑፍ ግልጽ ላለባቸው አጭር ቃላቶችን ይጠቅሙ፡፡

መሳሪያው የሚለካው የልብ ስራ እና የጽሑፍ ስራ ከትኩረት በኋላ ከሌላው አካል አጠቃላይ እንዲቀረጽ ላይ የሚደረግ የመረጃ መሳሪያ ነው፡፡

የስነ ህዝብ ጥያቄዎች

መመሪያ አገልግሎት ለሚሰጡት 25 የስነ ህዝብ እና የሰነድ ሁኔታ መግለጫ ጥያቄዎችን በተመለከተ እንዲያስቡ እንደተገባቸው ይጻፉ፡፡ ወይም የአካል ምልክት (X) በተቀመጠበት ክፍት ቦታ ላይ በጥንቃቄ ፊት ለፊት በተቀመጠው ምላሽ ከሚሰጥበት ቦታ ላይ ያስተምሩ፡፡

1. እድሜዎት ስንት ነው? _____
2. ጾታዎት ምንድነው? ወንድ _____ ሴት _____
3. ሃይማኖትዎ ምንድነው?
 ኦርቶዶክስ _____
 ፕሮቴስታንት _____
 መስሊም _____
 ሌሎች ካሉ ይጠቀሱ _____
4. የጋብቻዎት ሁኔታ ምን ይመስላል?
 ያላገባች _____
 ያገባች _____
 የተፋታች _____
 የሞተበት/ባት _____
 የተለየች _____
5. የቤተሰብዎ ሁኔታ ምን ይመስላል?
 ብቻዬን ነው የምኖረው _____
 ከባለቤቱ ጋር ነው የምኖረው _____
 ከቤተሰቦቼ ጋር ነው የምኖረው _____
 ሌላ ካለ ይጠቀሱ _____
6. የትምህርት ደረጃዎት ምንድነው?



1

Appendix-L: Data collection Tool Amharic Version

አባሪ

የመረጃ አሰባሰብ መሳሪያ - የእንግሊዘኛ ትርጉም

በልብና የደም ስር በሽታዎች ላይ ያለ ዕውቀት፣ የራስ ስጋት ምልክታ እና የአደጋ ቅነሳ ባህሪያት ከፍተኛ የደም ግፊት ላለባቸው አዋቂ ታካሚዎች በሚል ርእስ ለሚወሰን የመረጃ መሰብሰቢያ መሳሪያዎች የልብ በሽታ እና የደም ስር ክትትል በሽታ ክሊኒክ አዲስ አበባ ኢትዮጵያ ላይ የሚደረግ የመረጃ መሰብሰብ፡፡

የስነ ህዝብ ጥያቄዎች

መመሪያ አንድ፡- ለሚከተሉት 26 የስነ ህዝብ እና የጤና ሁኔታ መግለጫ ጥያቄዎችን በተመለከተ እባክዎት እንደተገቢነቱ ይጻፉ ወይም የኤክስ ምልክት (X) በተቀመጠው ክፍት ቦታ ላይ በጥያቄዎቹ ፊት ለፊት በተቀመጠው ምላሽ ከሚሰጥበት ቦታ ላይ ያስቀምጡ.

1. እድሜዎት ስንት ነው? _____
2. ጾታዎት ምንድነው? ወንድ _____ ሴት _____
3. ሃይማኖቶት ምንድነው?
ኦርቶዶክስ _____
ፕሮቴስታንት _____
ሙስሊም _____
ሌሎች ካሉ ይጠቀሱ _____
4. የጋብቻዎት ሁኔታ ምን ይመስላል?
ያላገባ/ች _____
ያገባ/ች _____
የተፋታ/ች _____
የሞተበት/ባት _____
የተለያየ/ች _____
5. የቤተሰቦት ሁኔታ ምን ይመስላል?
ብቻዬን ነው የምኖረው _____
ከባለቤቴ ጋር ነው የምኖረው _____
ከቤተሰቦቼ ጋር ነው የምኖረው _____
ሌላ ካለ ይጠቀስ _____
6. የትምህርት ደረጃዎት ምንድነው?
ማንበብ እና መጻፍ አልችልም _____
የመጀመሪያ ደረጃ _____
ሁለተኛ ደረጃ _____
የኮሎጅ ዲፕሎማ እና ከዚያ በላይ _____
7. ወርሃዊ ገቢዎት በኢትዮጵያ ብር ምን ያህል ነው?

ከ1000 ያነሰ _____

ከ1000-3000 _____

ከ3001-6000 _____

ከ6000-10000 _____

ከ10,000 ብር ይበልጣል _____

8. ከፍተኛ የደም ግፊት እንዳለቦት በህኪምና የታወቀው መቼ ነው? (ጊዜውን በአመት ይገነጥ) _____

9. በቤተሰብዎ (በዘሮ) ውስጥ የደም ግፊት ታሪክ አለ ወይ? አዎ _____ የለም _____

የአሁን የጤናዎት ሁኔታ (ወዲያውኑ የሚረጋገጥ)

10. በአሁኑ ወቅት የሰውነቶች ክብደትዎ በኪ.ግም _____

11. ቁመት በሜትር _____

12. የደም ግፊት በሚ.ሜ ሜርኩሪ _____

የአሁን የጤና ሁኔታ (ጥያቄ 13 እስከ 16 ከታካሚው የሕክምና መረጃ ላይ የሚረጋገጥ ይሆናል)

13. የሕክሚያዎት ወጪ እንዴት ነው የሚሸፈነው?

በግሌ/ቤተሰብ _____

በነጻ/ በመንግስት _____

በ3ኛ ወገን _____

14. ባለፉት 6 ወራት ውስጥ የደምዎት ኮሎስትሮል መጠን ታይቷል ወይ? አዎ _____ አልታየም _____
:: መልስዎ አዎ ከሆነ መጠኑ ምን ያህል ነበረ? _____

15. ባለፉት 6 ወራት ውስጥ የከፍተኛ የኮሎስትሮል አፍጋት (HDL-*c*/ኤችዲኤል-ሲ) መጠን ተመርምሯል ወይ? አዎ _____
_____ አልተመረምረም :: አዎ ከሆነ መጠኑ ምን ያህል ነበር?

16. ባለፉት 6 ወራት ውስጥ የክላሊት ምርመራ (Creatinin/ክራቲኒን) ተደርጓል ወይ? አዎ _____
_____ አልተደረገም :: መልስዎት አዎ ከሆነ መጠኑ ምን ያህል ነበር? _____

17. ለደም ግፊቶች ክትትል ከህኪሞች ጋር በምን ያህል ጊዜ ይገናኛሉ?

በየወሩ _____ በሁለት ወሩ _____ የህመም ስሜት ሲሰማች ብቻ _____

18. ከደም ግፊቶች በተነሳ ወይም በተያያዥ ችግሮች ምክኒያት ሆስፒታል ተጎዥተዋል ያውቃሉ ወይ? አዎ _____ አላውቅም _____

ሀ) መልስዎ አዎ ከሆነ ህመሙ ምን ነበር? _____

የልብ የደም ዝውውር በሽታ

እስትሮክ/ለአጭር ጊዜ የቆየ የሰውነት መዛል -----

ስኳር _____

ስር የሰደደ የክላሊት በሽታ _____

ከልብ በርቀት ላይ የሚገኙ የደም ስሮች በሽታ _____

ሌላ ካለ ይጥቀሱ _____

19. የደም ግፊቶችን በአግባቡ የተቆጣጠሩት ይመስሉታል? አዎ _____ አይደለም _____

ሀ) መልስዎ አዎ ከሆነ የደም ግፊቶችን ለመቆጣጠር ምን አድርገዋል?

- I. ሐኪሜ የሚሰጠኝን ምክር እና ትዕዛዝ በጥብቅ አከብራለሁ _____
- II. በራሴ ህኪምና በማድለግ _____
- III. ባህላዊ መድሐኒት በመጠቀም _____
- IV. ሌላ ካለ እባክዎት ይጥቀሱ _____

ለ) መልሶ አልተቆጣጠርኩም ከሆነ የደም ግፊቶችን ሊቆጣጠሩት ያልቻሉት በምን ምክንያት ይመስላሉታል ፤ ምክንያቱን ይጥቀሱ _____

20. የደም ግፊቶችን ለመቆጣጠር ባህላዊ መድሐኒት ተጠቅመዉ ከሆነ እንዴት ተጠቀሙበት?

ሀ) ከሐኪሜ ትእዛዝ በተጨማሪነት _____

ለ) የታዘዘልኝ መድሐኒት ትቼ _____

ሐ) ሌላ ካለ ይጥቀሱ _____

መ) የደም ግፊቶችን ለመቆጣጠር የተጠቀሙትን ባህላዊ መድሐኒቶች ዝርዝር እባክዎት ይጥቀሱ _____

21. በአሁኑ ወቅት የሚወስዱትን የደም ግፊት መድሐኒት ይዘርዝሩ (ከታካሚው የህክምና መዝገብ ውስጥ የሚሰበሰብ)

22. ሌላ በአሁኑ ሰዓት የሚወስዱት መድሐኒት ካለ ይጥቀሱ _____

23. ሌላ ተጨማሪ በሽታ ካለዎት እባክዎት ይጥቀሱ _____

24. ስለ ልብና የደም ዝውውር በሽታ አደገኛነት መረጃ ከየት ያገኛሉ?

መመሪያ ሁለት፡- ከዚህ በታች በሰንጠረዥ ለተዘረዘሩት የታካሚዎች ምላሽ በሰንጠረዥ ውስጥ ካለው ጥያቄ ትይዩ የኤክስ ምልክት በማስቀመጥ ይመልሱ

የልብና የደም ስር በሽታ የአደጋ መንስኤዎች እውቀት ደረጃ

ዓላማ የልብና የደም ስር በሽታ ስጋት ያለባቸው የደም ግፊት ታካሚዎች ዕውቀታቸውን ለመገመት የተደረገ ነው				
1	ማንኛውም ሰው ሁል ጊዜ የልብ በሽታ እንዳለበት /ባት/ ይገነዘባል፡፡	አውነት	ውሸት	አላወቅም
2	የልብና የደም ስር በሽታ ታሪክ ያለበት ቤተሰብ (ዘር) በልብ በሽታ የመያዝ አደጋ ይጨምራል፡፡			
3	በአድሜ የገፉ አዋቂ ሰዎች በልብ በሽታ የመያዝ ደረጃቸው ከፍተኛ ነው፡፡			
4	የልብና የደም ስር በሽታን መከላከል ይቻላል			
5	በእኛ ሃገር ማጨስን መከላከል የሚቻል ቢሆንም ማጨስ ለሞት እና ለበሽታ ምክንያት ነው፡፡			
6	ማጨስ በልብ በሽታ ለመያዝ ምክንያት ይሆናል፡፡			
7	በልብ በሽታ የመጠቃት እድል ሲጋራ ማጨስ በሚቆምበት ጊዜ ይቀንሳል፡፡			
8	በየቀኑ በምንመገበው ምግብ ከ2-3 ፍራፍሬ እና ሁለት አትክልት ከፍልፋይ መመገብ ጠቃሚ ነው፡፡			
9	ቀይ ስጋ በሳምንት 3 ጊዜ በላይ መመገብ ጎጂ ነው፡፡			
10	ጨውማ ምግብ መመገብ የደም ግፊትን ይጨምራል፡፡			
11	ስብ ምግቦችን መመገብ በደም ውስጥ የኮሎስትሮል መጠንን አይጨምርም፡፡			
12	የሚረጋ የምግብ ዘይት ለልብ ጤንነት ጠቃሚ ነው፡፡			
13	አነስተኛ ሙቀት ሰጪ (የካርቦሃይሬት) እና አነስተኛ የስብ ምግብ ለልብ ጤንነት ጠቃሚ ነው፡፡			
14	ከመጠን ያለፈ ውፍረት ያለባቸው ሰዎች በልብ በሽታ ለመያዝ እድላቸው ከፍተኛ ነው፡፡			
15	መደበኛ የሆነ የሰውነት እንቅስቃሴ በልብ በሽታ የመያዝን አደጋ ይቀንሳል፡፡			
16	በልብ በሽታ የመያዝ አደጋ ሊቀንስ የሚችለው የሰውነት እንቅስቃሴን በጅምናዚየም ውስጥ ብቻ በማድረግ ነው፡፡			
17	በቀስታ መራመድ እና ዱብዱብ ማለት እንደ እንቅስቃሴ ይቆጠራል፡፡			
18	ጭንቀት ሃዘን እና ጫና በልብ በሽታ የመያዝን አደጋ ይጨምራል፡፡			
19	የደም ግፊት ውጥረት በሚበዛበት ሁኔታ ውስጥ ይጨምራል፡፡			
20	ከፍተኛ የደም ግፊት ለልብ በሽታ አጋላጭ ነው፡፡			
21	የደም ግፊትን መቆጣጠር በልብ በሽታ የመያዝ አደጋን ይቀንሳል፡፡			
22	ለከፍተኛ የደም ግፊት መድሀኒት ለሙሉ ህይወት ጊዜ መወሰድ አለበት፡፡			
23	ከፍተኛ የኮሎስትሮል መጠን በልብ በሽታ ለመያዝ አደጋ ነው፡፡			
24	የጥሩ ኮሎስትሮል (ከፍተኛ አፍጋት ኮሎስትሮል) መጠን ከፍተኛ መሆን ለልብ በሽታ አደጋ ነው፡፡			
25	የመጥፎ ኮሎስትሮል (ዝቅተኛ አፍጋት ኮሎስትሮል) መጠን ከፍተኛ መሆን ለልብ በሽታ አደጋ ነው፡፡			
26	ማንኛውም ከፍተኛ የኮሎስትሮል መጠን ያለው ሰው መድሀኒት ይሰጠዋል፡፡			
27	የስኳር በሽታ ለልብ በሽታ ለመያዝ አደጋ ነው፡፡			
28	በልብ በሽታ የመያዝ አደጋ በስኳር ታማሚዎች የግሉኮስ መጠንን በመቆጣጠር መቀነስ ይቻላል፡፡			

መመሪያ ሶስት ፡- ለሚከተሉት 8 ጥያቄዎች የታካሚዎችን በድንገተኛ የልብ እና እስትሮክ አደጋ የመጠቃት በመገመት በጥያቄዎቹ ትይዩ የተቀመጡ ቁጥሮችን በማክበብ ይመልሱ፡፡

የልብና የደም ስር በሽታ በራስ ስጋት ምልክታ ላይ የደም ግፊት ታካሚዎች ውጤት (ሀ፤ለ፤ሐ፤መ ጥያቄዎች/ABCD Questionnaire)

1. = አጥብቄ አልሰማማም 2. = አልሰማማም 3. = እስማማለሁ 4. = አጥብቄ እስማማለሁ

1	ወደፊት በልብ ወይም በስትሮክ አደጋ የመጠቃት እድሌ አይቀርም፡፡	1	2	3	4
2	በህይወት ዘመኔ የልብ ወይም እስትሮክ አደጋ አይቀርልኝም፡፡	1	2	3	4
3	በህይወት ዘመኔ የልብ ወይም እስትሮክ አደጋ ጥቃት ሊያጠቃኝ እንደሚችል ይሰማኛል፡፡	1	2	3	4
4	በሚቀጥሉት 10 ዓመታት ውስጥ የልብ ወይም የእስትሮክ አደጋ ጥቃት ሊያጋጥመኝ በቂ አጋጣሚዎች አሉ፡፡	1	2	3	4
5	የልብ አደጋ ወይም እስትሮክ ይይዘኛል ብዬ እምብዛም አልጨነቅም፡፡	1	2	3	4
6	በሚቀጥሉት 10 ዓመታት ውስጥ በልብ ወይም እስትሮክ አደጋ ጥቃት የመስቃየት እድሌ ከፍተኛ ነው፡፡	1	2	3	4
7	አሁን ባለኝ ወይም ከዚህ በፊት በነበረ ልማዴ ምክንያት በልብ ወይም እስትሮክ አደጋ መጠቃቴ አይቀርም፡፡	1	2	3	4
8	በቅርብ ጊዜ በልብ ወይም በእስትሮክ አደጋ የመጠቃት እድሌ ያሳስበኛል፡፡	1	2	3	4

PHQ -9 Amharic –version

ተ.ቁ	ላለፉት ሁለት ሳምንታት እርስዎ ከዘህ በታች በተጠቀሱት ችግሮች ምን ያህል እስቸጋሪ ሁኔታዎች ተፈጥሮበዎታል? (መልስዎን በማሳየት "✓") ይጠቀሙ	በፍፁም	ብዙ ቀን	ከግማሽ ቀን በላይ በየቀኑ	በየቀኑ
1	ነገሮችን ለማከናወን የፍላጎት ማነስ ችግር አለበዎት?				
2	ተስፋ የመቁረጥ፣የሀዘን ወይም ተስፋቢነት ስሜት አለበዎት?				
3	የመውደቅ ወይም ተኝቶ የመቆየት ወይም ከመጠን በላይ የመተኛት ችግር አለበዎት?				
4	የመድከም ስሜት ወይም የሀይል ማነስ ስሜት አለበዎት?				
5	የምግብ ፍላጎት ማነስ ወይም ከመጠን በላይ የመብላት ችግር አለበዎት?				
6	ስለራስዎ መጥፎ ስሜት መሰማት ወይም እራስዎን እንዳልተሳካለት ወይም እራስዎን ወይም ቤተሰብዎን እንዳሳዘኑ አድርጎ የመቁጠር ስሜት ይሰማዎታል?				
7	በነገሮች ላይ ሀሳብዎችን የመሰብሰብ ወይም ትኩረት የመስጠት ለምሳሌ ጋዜጣ ማንበብ፣ቴሌቪዥን መመልከት ችግር አለብዎት?				
8	ሌሎች ሰዎች ሊታዘቡት በሚችል መልኩ በዝግታ መንቀሳቀስ ወይም መናገር ወይም በተቃራኒው ከመጠን በላይ እረፍት የለሽ በመሆን ያልተለመደ እንቅስቃሴን አሳይተው ያውቃሉ?				
9	ብሞት ወይም እራሴ ላይ ጉዳት ባስከትል ይሻለኛል ብለው ያውቃሉ?				
	ድምር				

እጅግ በጣም አመሰግናለሁ!

መመሪያ አራት፡- ከዚህ በታች የተጠቀሱት ባህሪዎች ታካሚው በጋራ ለበሽታ ተጋላጭ የሆነባቸው አደጋዎችን ለመቀነስ ልምዱን/ባህርይን በታካሚው የቀረበው ምላሽ የአዎ ወይም አይደለም የሚለው ላይ በማክበብ የታካሚውን ሪፖርት ባህሪ በማመልከት በቀጣይ ጥያቄዎች ላይ ተገቢ በሆነ ቦታ ላይ የኤክስ (X) ምልክት አስቀምጥ/ጭ። ለጥያቄ ቁጥር 9 የታካሚውን አሁኑን የውጥረት ደረጃ በአምስት ነጥብ መለኪያ የታካሚውን የውጥረት ደረጃ የሚያመለክተው ቁጥር ላይ አክብብ፡-

	ባህሪዎቹ	አዎ	አይደለም
1	መካከለኛ ወይም ከፍተኛ የሆነ የአካል እንቅስቃሴ በመደበኛነት ታደርጋለህ/ሽ ወይ? መካከለኛ ማለት በቀን ለ30 ደቂቃና ከዚያ በላይ በእግር መራመድ፣ወይም በሳምንት 5 ጊዜና ከዚያ በላይ ብስክሌት መጋለብ፣አታክልት መኮትኮት) ሲሆን ከባድ እንቅስቃሴ ማለት ሶምሶማ፣ ዋና፣ ኳስ መጫወት፣ በሳምንት ለ4 ሰዓትና ከዚያ በላይ፡፡	አዎ	አይደለም
2	በአሁኑ ወቅት ማንኛውም አይነት ሲጋራ ታጨሳለህ/ሽ ወይ? (በአሁኑ ወቅት ማለት በትንሹ ባለፉት 12 ወራት ማለት ሲሆን በዚህ ጊዜ ውስጥ ማጨስ ያቆሙትን ይጨምራል) እና በትንሹ በቀን 1 ጊዜ ማጨስ ማለት ነው)፡፡	አዎ	አይደለም
3	የስኳር ታማሚ ከሆኑ ብቻ የሚጠየቅ የስኳር በሽታዎች በቁጥጥሮች ስር ነው ወይ? በአሁኑ ጊዜ የግሉኮስ መጠን ከ100 ሚ.ግ/ ዲሲ ሊትር በታች ወይም (Hgb A1c ከ7% በታች)	አዎ	አይደለም
4	በቀን ውስጥ በምግቦች ላይ ምን ያህል ጨው ይጨምራሉ? (< ከ5-6 ግራም)፤ መልሶ አይደለም ከሆነ-ከ6 ግራም በላይ _____ መጠኑ የማይታወቅ -----	አዎ	አይደለም
5	ሐኪሜ ያዘዘልኝን መድሀኒት መጠኑንና ሰአቱ ሁልጊዜ በጥብቅ አከብራለሁ	አዎ	አይደለም
6	በቀን ውስጥ ምን ያህል ጊዜ ፍራፍሬ እና አትክልት ይመገባሉ? (አንድ አቅራቢት ወይም አንድ ጊዜ መመገብ ማለት አንድ ብርቱካን ወይም አንድ ፖም ወይም አንድ ሙዝ እና ሶስት የሾርባ ማንኪያ የበሰለ አተክልት ማለት ነው)፡፡ ከ5 ጊዜ በላይ (400-500gm)፡፡ መልሶ አይደለም ከሆነ፤ ከ1-3 ጊዜ _____ ከ4-5 እመገባለሁ _____ ከዚህ ሌላ-----	አዎ	አይደለም
7	በሳምንት ወይም በቀን በድግግሞሽ ለምን ያህል ጊዜ አልኮን ይጠቀማሉ? (ባለፉት 12 ወራት ውስጥ ዝቅተኛ ወይም መጠነኛ የአልኮን መጠጥ መጠቀም)፤		
	1 መጠጥ በቀን ወይም ከ4 መጠጥ በታች በሳምንት (ለሴት)	አዎ	አይደለም
	1-2 መጠጥ በቀን ወይም ከ4 መጠጥ በታች በሳምንት (ለወንድ)	አዎ	አይደለም
	ፈጽሞ አልጠጣም	አዎ	አይደለም

9. የታየ ውጥረት/ጫና መለኪያ (ፒ ኤስ ኤስ መለኪያ)፡ በዚህ ደረጃ የቀረቡ ጥያቄ የምጠየቅዎት የእርሶን ስሜት እና ባለፉት ወር ውስጥ ያለዎትን አስተሳሰብ ነው፡፡ በዚህ ጊዜ ምን ያህል ጊዜ ይህ ስሜት እንደሚሰማዎት እና እንደሚያስቡ ያመልክቱ ፡፡

ጥያቄ	በፍጽም	እምብዛም	አንዳንዴ	አልፎ አልፎ	አብዛኛውን ጊዜ
1. ባለፈው ወር ሳይጠብቁ ለጋጠሞት ክስተቶች በተደጋጋሚ ንዴቶት ተሰምቶታልን?	☐	☐	☐	☐	☐
2. ባለፈው ወር በህይወቶች ጠቃሚ በሆኑ ነገሮችን ላይ መቆጣጠር አለመቻል ተሰምቶታልን?	☐	☐	☐	☐	☐
3. ባለፈው ወር ምን ያህል ጊዜ የመደናገጥ እና የጭንቀት ስሜት ተሰምትዎታል?	☐	☐	☐	☐	☐
4. ባለፈው ወር የግል ችግሮችን ለመፍታት ምን ያህል በራስ የመተማመን ችሎታ ተሰምትዎታል?	☐	☐	☐	☐	☐

5. ባለፈው ወር ነገሮች ከእርሶ ቁጥጥር ውጪ ሆነዋል ብለው ምን ያህል ጊዜ ተስምቶታል?	☐	☐	☐	☐	☐
6. ባለፈው ወር ባደረጉት ነገር ሁሉ ላይ ምን ያህል ጊዜ የመቋቋም አለመቻል ሁኔታ ነጥመዋታል?	☐	☐	☐	☐	☐
7. ባለፈው ወር በህይወት ውስጥ የመቆጣት ስሜቶችን ምን ያህል ጊዜ ለመቆጣጠር ችለዋል?	☐	☐	☐	☐	☐
8. ባለፈው ወር ነገሮችን በበላይነት የመቆጣጠር ስሜት ምን ያህል ተስምተዎታል?	☐	☐	☐	☐	☐
9. ባለፈው ወር ውስጥ ነገሮች ከእስዎ ቁጥጥር ውጭ በመሆናቸው የተነሳ ምን ያህል ጊዜ ተናድደዋል?	☐	☐	☐	☐	☐
10. ባለፈው ወር ውስጥ ምን ያህል ጊዜ አስቸጋሪ ነገሮች ተቆልሎብኛል ብለው ልቋቋሙት/ ማሸነፍ እንደማይችሉ ተስምቶታል?	☐	☐	☐	☐	☐

APPENDIX-M: *Office BP Measurement Protocol.*

Instruction to follow:

1. Allow patients to sit for 5 minutes.
2. Take two BP measurements, in the sitting position, spaced 1–2 minutes apart, and an additional measurement if these reading are quite different ($>5\text{mmHg}$). Consider the average BP for recordings or the average of the last two if a third reading.
3. In patients with arrhythmias, such as atrial fibrillation takes repeated measurements of BP to improve accuracy.
4. Use a standard bladder (12–13 cm wide and 35 cm long), but have a larger and a smaller bladder for large (arm circumference >32 cm) and thin arms, respectively.
5. Record phase I and V (disappearance) Korotkoff sounds to identify SBP and DBP, respectively (with auscultatory method). Place the cuff at the heart level (whatever the position of the patient).

APPENDIX-N: Letter of Permission Obtained to use CARRF-KL Scale

Permission obtained to use the **Cardiovascular Disease Risk Factors Knowledge Level (CARRF-KL) Scale** for data collection on knowledge of CVD risk

Hello Daniel,
I give permission to use the scale.

I'd love to see how that turns out. I have attached the scale.

Thanks for your interest,

Associate Professor, M.D.

I.Arıkan

APPENDIX-O: Letter of Permission Obtained to use ABCD Questionnaire

Permission obtained to use the ABCD Questionnaire

Correspondence to
Dr Maria Woringer;
m. woringer@imperial.ac.uk



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Title: Development of a questionnaire to evaluate patients' awareness of cardiovascular disease risk in England's National Health Service Health Check preventive cardiovascular programme

Author: Maria Woringer, Jessica Jones Nielsen, Lara Zibarras, Julie Evans, Angelos P Kassianos, Matthew Harris, Azeem Majeed, Michael Soljak

Publication: BMJ Open

Publisher: BMJ Publishing Group Ltd

Date: Sep 1, 2017

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Languages	English
Circulation/distribution	1
Title of your thesis / dissertation	knowledge of CVD risk, risk perception of CV events and risk behavior of hypertensive patients
Expected completion date	Jun 2019
Estimated size(pages)	160
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APPENDIX-P: Curriculum Vitae of PI

Date: 4/12/2022

Curriculum Vitae

Personal Details:

Name: Daniel Mengistu Bekele, Associate Professor (MSc.N., BSc.N, RN), Chief Expert Nurse
Professional (MSc in Medical Surgical Nursing, (CENP: 14/2014)
Tele: 00251(0)911119597, E-mail mengistudaniel@yahoo.com

Education and Qualifications:

Tertiary:

Current- PhD Student at Addis Ababa University, Ethiopia in collaboration with Emory University, Atlanta Georgia, USA.
July 2020- Certificate of Competency for Teaching in Higher Education Institution; Addis Ababa University, Ethiopia.
Sept. 2003-Sept. 2005 - MSc. Nursing, Mahe University (Deemed University), MCON, Manipal, India.
Nov. 1996 - March 1998 - Baccalaureate Nursing, Jimma University, Jimma, Ethiopia.
Sept, 1987 - March 1990 - Diploma in Comprehensive Nursing (Addis Ababa University (Gondar College of Medical Sciences [GCMS])), Ethiopia.

Work Experiences:

Current - Associate Professor, School of Nursing and Midwifery, CHS, AAU, PhD Student, CHS, AAU.
March 2014-June 2016 - Assistant Professor, **Head**, Department of Nursing and Midwifery, CHS, AAU.
February 2009-February 2014 - Lecturer, **Unit Head** for the Undergraduate Nursing, Department of Nursing and Midwifery, CHS, AAU.
September 2008-March 2014 -Secretary/Minute Keeper for the Dept, Nursing and Midwifery, CHS, AAU.
April 8, 2008- Feb 2009 Lecturer, School of Nursing, Addis Ababa University.
March 2006- August 2007 Lecturer, **Head**, Department of Nursing, University of Gondar (UoG)
March 2006- November 2007 Nursing Link Coordinator with University Hospital of Leicester, England.

October 2001 – June 2003	Assistant Lecture, Head, School of Nursing, UoG, Gondar, Ethiopia.
March 1999 – Oct.2001	Assistant Lecture in School of Nursing, UoG, Gondar, Ethiopia.
March 1998 – March 1999	Graduate Assistant II in the School of Nursing, GCMS, Gondar, Ethiopia.

Courses Thought to Date:

GAHNS 522 Adult Health Nursing Theory I
GAHNS 524 Adult Health Nursing Theory II
GAHNS 517 Advanced Adult Health Assessment
GAHNS 523 Adult Health Nursing Practice I
GAHNS 532 Adult Health Nursing Practice II
GNURS 631 &621 Research Thesis Advisement
All Undergraduate Nursing Courses

College Community and Committee Work

October 2015-present- Member of the Educational Development Center, College of Health Sciences, AAU.
March 2014-June 2016- Member of the Academic Commission, College of Health Sciences, AAU.
March 2014-June 2016- Chairperson for Postgraduate Nursing Curriculum School of Nursing and Midwifery, AAU.
June 2014-June 2016- Chairperson for Comprehensive Exam Committee, School of Nursing and Midwifery, AAU.
July 2011-June 2016-Chair Person for the Modular Curriculum Committee, Department of Nursing and Midwifery, CHS, AAU.
January2012- Present -Member of the Academic Commission, School of Nursing and Midwifery, AAU.
March 2009- June 2016 -Chairperson of the Staff Appointment and Promotion, Committee- Department of Nursing and Midwifery, AAU.
November 2008-March 2016 -SBMR Team Member, Department of Nursing and Midwifery, AAU.
March 2009-June 2016 -Member of Research Committee, Department of Nursing and Midwifery
March 1, 2006- August 30. 2007 -Head Department of Nursing, UoG, Gondar, Ethiopia.
January 10/2007-March 30/2008 -Member of the Curriculum Committee, UoG, Gondar, Ethiopia.
October2007-April 2008 - Chairperson of Standard Based Educational Management and Recognitions SBEM-R Committee UoG, Gondar, Ethiopia.

January 2007-April 2008 - Member of Curriculum Committee, UoG, Gondar, Ethiopia.

August 2006-2008 - Member of the National Working Group on HIV/AIDS Pre-service Education for JHPIEGO, Ethiopia.

April 2006- April 2008 - Focal Person for JHPIEGO to UGR on HIV/AIDS Pre-service Education

June 1999- Sept. 2003 - Member of the Graduation Committee, UoG. Gondar, Ethiopia.

September 1999 – Oct. 2001- Member of the Scholarship Committee, UoG, Gondar, Ethiopia.

March 2001 – Sept. 2003 - Member of the Anti HIV/AIDS Committee, UoG, Gondar, Ethiopia.

November 2001 – Sept. 2003 - Member of the Promotion and Recruitment Committee, UoG. Ethiopia.

November 2001 – Sept. 2003 - Member of the Committee of College of - Medical Sciences Expansion, UoG, Gondar, Ethiopia.

October 2001 – Sept.2003 - Member of the Reproductive Health Technical Standing Committee of the Ethiopian Public Health Training Initiative in collaboration with TCC, Addis Ababa, Ethiopia.

Participation in Community Services/Professional Activities

- Moderates Nursing Research Presentation at the 2014 Annual General Nursing Assembly.
- Rural nursing community practices with graduating nursing students each year for a period of two months.
- Notional Technical Working Group on Pre-service Education of HIV/AIDS August 2006-March 2009.
- Executive Member of the Ethiopian Nurses Association, University of Gondar Hospital Branch; October 2006-March 2008.
- Member of the Accreditation Assessor of the Higher Education Relevance and Quality Agency (Ministry of Health) December2008-present.
- Rendering professional supports to other university nursing development
 - Guest lecturer for the Adult health Nursing Students- Jimma University 2009-2011.
 - External Examiner for the Undergraduate Nursing Students 2006- 2010-Jimma University graduates.
 - External Examiner for the Post Graduate Adult Health Nursing Students 2011&2012 graduates.
 - External Examiner for the Undergraduate Nursing Students 2006 graduates-Hawassa University.
 - External Examiner for the Post Graduate Nursing Students-2012 graduates-University of Gondar.
 - Guest lecturer for the Undergraduate Nursing Students- Haromaya University 2006 & 2017-on the Course Nursing Education and Curriculum Development.

Workshops and Conferences Attended:

January 29-29/2016-Certificate of attendance on Grant Writing for Biomedical researches

organized by CHS, AAU in collaboration with Emory University, USA at Addis Ababa, Ethiopia.

August 24-28/2015 Certificate of attendance on Effective Oral presentation and Successful scientific writing for Health Profession, organized by CHS, AAU in collaboration with Emory University, USA at Addis Ababa, Ethiopia.

February 18-22, 2008 Certificate of attendance on Students performance Assessment methodology, By JHPIEGO Ethiopia, Bahir Dar, Ethiopia.

December 11-20, 2007-Certificate of attendance on Research updates and data analysis by UoG, Gondar, Ethiopia.

October 20-22, 2007- Certificate of attendance on Standard Based Educational Management and Recognitions, by JHPIEGO Ethiopia and UoG, Gondar, Ethiopia.

June 4-15, 2007-Certificate of Pre-service Education Effective Teaching Skills.

May 6-12, 2007- Study tour to Lusaka, Zambia on Preservice Education on HIV/AIDS.

January 15-26, 2007- Certificate of Standardization Workshop for HIV/AIDS prevention, Care and Treatment knowledge and Skills for Nurses organized by JHPIEGO, Ethiopia.

January 13, 2007- Awarded letter of Appreciation for excellent contribution in the Pre-service HIV/AIDS Education need assessment by JHPIEGO, Ethiopia.

November 19-30, 2006-Consultancy, Need Assessment Study on Pre- Service HIV/AIDS Education at institutional Level, University of Gondar, Department of Nursing.

October 2006- Consultancy, National Need Assessment on Pre- Service HIV/AIDS Education in Nursing Curriculum for JHPIEGO, Ethiopia.

April 10-14/2006- Certificate of Attendance on prevention of mother to child transmission of HIV organized by JHPIEGO and University of Gondar.

May 1-10/2006- Leadership and Management project Development in Collaboration with Royal College of Nursing and University of Hospital at UOG, Gondar.

Nov.18.2005- Certificate of attendance in Leadership and Management Workshop, MCON, Manipal, India.

April 13-17.2004- Certificate for conducting Leadership and Management Workshop to the Nursing Staff of the University Hospital, MCON, Manipal, India.

Sept. 21.2003- Certificate of attendance, the history of Indian Sciences, Technology and Medicine, Conference, MAHE, Manipal, India

March 7 – 8, 2003- National Workshop on Curriculum of BSc. Physiotherapy Training, GCMS, Gondar, Ethiopia

December 19-20, 2002- Preparation of RH Teaching Manual for the EPHTI, Addis Ababa, Ethiopia.

September 16 - 17, 2002- Review Workshop on Post-abortion Care Training Module for Health Workers in Ethiopia. Gondar, Ethiopia

September 3 - 8, 2002- Intra-institutional Module Development (EPI, Bacterial Meningitis) Workshop. Sponsored by TCC, Teda, Gondar, Ethiopia.

June 21 – 22, 2002- XIIth Staff and Students Research Conference, GCMS, Gondar, Ethiopia.

April 5 – 8, 2002- Intra-Institutional Proposal Development Workshop on Reproductive Health. Sponsored by TCC. Teda, Gondar, Ethiopia.

March 1 – 2, 2002- National Workshop on Curriculum of Post- Basic Anesthesia B.Sc. Training. GCMS Gondar, Ethiopia.

February 4 – 8, 2002- Reproductive Health Workshop Co- sponsored by GCMS and TCC, Gondar, Ethiopia.

December 29 – 31, 2001- Workshop on Designing Reproductive Health Proposal Sponsored by TCC. Addis Ababa, Ethiopia.

June 25 – 26, 2001- Annual Staff and Students Research Conference, GCMS, Gondar, Ethiopia.

March 25 – 28, 2001- National Workshop on Curricula of Medicine, BSc. Health Officer, Diploma Clinical Nursing, Physiotherapy, Environmental Health at the Debre-zeit Institute of Management.

March 2- 4, 2001- Intra - Institutional Lecture Notes Development Workshop. Sponsored by TCC. Gondar, Ethiopia.

January 8 – 13, 2001- Inter-Institutional Distance Learning Workshop, Sponsored by TCC. Addis Ababa, Ethiopia.

Oct. 23 - Nov.3, 2000- Fifth Curriculum Development and Staff Strengthening Workshop. Co-sponsored by the GCMS and The Carter Center (TCC), Gondar, Ethiopia.

Oct. 11- 15, 2000- Intra- Institutional Module Development Workshop. Co-sponsored by GCMS and TCC. Bahir Dar, Ethiopia.

Short Term Trainings:

July-4-6/2014- Certificate of training on Fundamentals of Leadership organized by Center for African Leadership studies, Bishoftu, Ethiopia.

Feb. 8-12/2014- Certificate of leadership, Management and Governance

March 16-28/2014- Certificate of Preceptorship Training, Cape Town, SA.

April 22-30/2010- Certificate of Geriatric Medicine, Alexandria, Egypt.

Jan 24-Feb 9/2011- Certificate of TOT on the National Comprehensive HIV Care/ ART Training Manual Organized by the FMOH in Collaboration with AAU-MARCH Project, Addis Ababa, Ethiopia

May 7-8. 2005- Certificate in Mechanical Ventilation Workshop, Mahe, India.

December 14- 19. 2003- Certificate in Holistic Health Care Training, Medical Mission

Sisters, Poone, India.

October 18- Nov. 23, 2002- Educational Visit and Training on Patient Care & Infection Control and Certificate of HIV/ AIDS Awareness Training at Leicester Infirmary Hospital, University of Leicester, England

July 16 - 27, 2001- Certificate in Teaching Methodology. Jimma University in collaboration with The Carter Center, Jimma, Ethiopia

January 29 -Feb.9, 2001- Certificate Facilitating Training IMCI Training, GCMS, Gondar, Ethiopia.

March 24 – July 30, 2000- Certificate in Computer Training, GCMS, Ethiopia.

September 18 - 22, 2000- Certificate in Facilitator Course on IMCI, GCMS.

September 1 - 16, 2000- Certificate in Integrated Management of Childhood Illnesses (IMCI), GCMS, Gondar, Ethiopia.

March 20 – April 3, 1995- Certificate in Leadership and Management (Gondar –Sussex and Kent Institute Link) Gondar, Ethiopia.

January 1 – 13, 1995- Certificate in Accident and Emergency Management by Tropical Health Education Trust's (Gondar-Lecister Link), Gondar, Ethiopia.

September 7- Nov.7, 1991- Certificate in Teaching Methodology, Ministry of Health, Addis Ababa, Ethiopia.

Publications

1. **Daniel Mengistu Bekele**, Rebecca A Gary, Dejuma Yadeta Goshu, Alemayehu Worku Yalew, and Melinda K Higgins (2022). Low cardiovascular risk reduction behaviors among Hypertensives attending follow-up care at a tertiary-level Hospital in Addis Ababa, Ethiopia. Green Publication; International Journal for Research in Health Sciences and Nursing, 8:11
2. **Daniel Mengistu Bekele**, Dejuma Yadeta Goshu, Alemayehu Worku Yalew, Melinda K Higgins, Rebecca A Gary (2022). Dovepress; Integrated Blood Pressure Control 2022:15, 81–96
3. Getachew Zewdu Chekol, **Daniel Mengistu** and Addisu Walelign Tadesse (2022). Knowledge of Diabetes Mellitus Complications and Associated Factors Among Type-2 Diabetic Patients in Public Hospitals of Addis Ababa, 2020. *Frontiers in Public Health*; Volume 9,1-9
4. Betelhem Mesfin Demissie, **Daniel Mengistu Bekele**, Teshome Habte, Addisu Dabi Wake (2021). Knowledge, Attitude and Associated Factors Towards Heart Failure Management Among Nurses Working in the Cardiac Unit of Selected Government Hospitals in Addis Ababa, Ethiopia: A Cross-Sectional Study. Dove press, *Nursing: Research and Reviews* 2021:11 41–53
5. Addisu Dabi Wake, Daniel Mengistu Bekele, Yohannes Ayalew Bekele, Techane Sisay Tuji and Desalegn Tariku Jaleta (2021). The effect of the sociodemographic determinants of self-monitoring of blood pressure. *JCardiovasc Med Cardiol* 8(2): 032-037. DOI: <https://dx.doi.org/10.17352/2455-2976.000166>
6. Zerko Wako, **Daniel Mengistu**, Negalign Getahun Dinegde, Tseganesh Asefa, Mulugeta Wassie (2021). Adherence to Adjuvant Hormonal Therapy and Associated Factors Among Women with

- Breast Cancer Attending the Tikur Anbessa Specialized Hospital, Addis Ababa Ethiopia, 2019: A Cross-sectional Study. Dovepress: Breast Cancer: Targets and Therapy;13: 383–392.
7. Sitotaw Molla Mekonnen; **Daniel Mengistu Bekele**; Fikrtemariam Abebe Fenta; and Addisu Dabi Wake (2021). The Prevalence of Necrotizing Enterocolitis and Associated Factors Among Enteral Fed Preterm and Low Birth Weight Neonates Admitted in Selected Public Hospitals in Addis Ababa, Ethiopia: A Cross-sectional Study. *Global Pediatric Health*; 8:1-14
 8. Addisu Dabi, **Daniel Mengistu**, Techane Sisay, (2020). Knowledge and Attitude of Self-Monitoring of Blood Pressure Among Adult Hypertensive Patients on Follow-Up at Selected Public Hospitals in Arsi Zone, Oromia Regional State, Ethiopia: A Cross-Sectional Study. Dove Press: *Integrated Blood Pressure Control*;13 1–13
 9. Yibeltal Asmamaw, **Daniel Mengistu**, Birhanu Wondimeneh, and Zeleke Argaw (2019). Mother to Child Transmission of HIV and Associated Factors among HIV Exposed Infants at Public Health Facilities, Dessie Town, Ethiopia. *HIV/AIDS - Research and Palliative Care* 2019;11 343–350.
 10. Shimeles Tsegaye, **Daniel Mengistu**, and Teklemariam Gultie (2018). Knowledge and attitude towards cervical cancer screening and associated factors among female Hawassa University, College of Medicine and Health Sciences students. *MOJ Public Health*. 7(3):151–158.
 11. **Debela Gela and Daniel Mengistu (2018)**. Self-management and associated factors among patients with end-stage renal disease undergoing hemodialysis at health facilities in Addis Ababa, Ethiopia. *International Journal of Nephrology and Renovascular Disease*: 11 329–336.
 12. Girma Alemu Wami, **Daniel Mengistu**, and Gebre Gelan Gudisa (2018). Knowledge, practice and associated factors of adult intensive care nurses' on prevention of ventilator associated pneumonia in Addis Ababa Public Hospital, Addis Ababa, Ethiopia. *International Journal of Clinical Dermatology*: 1(1): 15-21.
 13. Hiwot Abera, **Daniel Mengistu**, and Asres Bedaso (2017). Effectiveness of planned teaching intervention on knowledge and practice of breast self-examination among first year midwifery students. *PLoS ONE*
 14. Abel Tibebe, **Daniel Mengistu**, Lemma Negesa (2017). Adherence to recommended lifestyle modifications and factors associated for hypertensive patients attending chronic follow-up units of selected public hospitals in Addis Ababa, Ethiopia; Dove press.
 15. Abel Tibebe, **Daniel Mengistu**, Lemma Negesa (2017). Adherence to prescribed antihypertensive medications and associated factors for hypertensive patients attending chronic follow-up units of selected public hospitals in Addis Ababa, Ethiopia; *IJHS*.
 16. Andreas Tefera and **Daniel Mengistu** (2017). Knowledge and attitude towards nursing clinical preceptorship among Ethiopian nurse educators: An institution-based cross-sectional study.
 17. Abebe Dilie and **Daniel Mengistu (2015)**. Assessment of Nurse' knowledge, attitude and perceived barriers to expresses pressure ulcer prevention practices in Addis Ababa Government Hospital, Addis Ababa, Ethiopia: Hindawi Publishing Corporation; *Advances in Nursing*..
 18. Haymanot Zeleke, **Daniel Mengistu**, Girma Alem: Assessment of Nurses Preparedness and Identifying Barriers to Care of Women exposed to Intimate Partner Violence in East Gojjam Zone, Ethiopia, 2014. *Journal Nursing and Care*.
 19. Reta Tsegaye Gayesa, **Daniel Mengistu**, and Carolyn Moorhead (2013). Desire for fertility and associated factors among people living with HIV/AIDS (PLWHA) in selected Antiretroviral Therapy (ART) clinics of Horro Guduru Wollega Zone, North West Oromia, Ethiopia: A cross-sectional study. *International Journal of Pharmaceutical Sciences and Research*: Vol. 4, Issue 6 (published on-line).
 20. Weyzer T. Tsehay, **Daniel Mengistu**, Emebet Birhanu, and Kalayou K. Berhe (2013). Assessment of Preference and Its Determinant Factors to Ward Modern Contraceptive Methods among Women of Reproductive. *International Journal of Family Medicine* Article ID

317609. Hindawi Publishing Corporation <http://dx.doi.org/10.1155/2013/317609>.
(Published on-line).

21. Reta Tsegaye Gayesa, Daniel Mengistu Family Planning Needs among People living with HIV/AIDS (PLWHA). LAP LAMBERT Academic Publishing. ISBN N) 978-3-659-35682-7.
22. Student Nurses and Midwives Rural Attachments in Ethiopia: The Experiences of School of Nursing, College of Health Sciences, Addis Ababa University: International Presentation (oral presentation) at the *NEPI Summit, Johannesburg, January 2015*.
23. **Daniel Mengistu** and Equinet Misganaw. Lecture Note on Public Health Nursing (2006). University of Gondar.
24. Melkie Edris, Amsalu Feleke, Dr Solomon Amsalu, **Daniel Mengistu**, Mamo Wubshet, Tesfaye Tilaye, Gashaw Andargie, Baye Gelaw, Abebaw Eredi, Kassa Woreta, takele Tadesse, Prof. Yigzaw Kebede Module on EPI for the Ethiopian Health Center Team(2007). University of Gondar

References

- 1.Rebecca Ann Gary, RN, PhD, FAHA, FAAN, Professor. Nell Hodgson Woodruff School of Nursing, Emory University, 1520 Clifton Road NE, Atlanta, GA 30322, Email: ragary@emory.edu
2. Fekadu Aga, RN, BSC,N, MSC.N., PhD, Associate Professor, Dean, School of Nursing and Midwifery, College of Health Sciences, Addis Ababa University
3. Amaha Mekasha, MD, Pediatrician, MSc in Medical Education, Professor of Pediatric, Head, Department of Pediatric, School of Medicine, College of Health Sciences, Addis Ababa University

APPENDIX-Q:

Curriculum Vitae of Advisory Team

Rebecca Ann Gary, RN, PhD, FAHA, FAAN

Associate Professor (Tenured)
Nell Hodgson Woodruff School of Nursing
Emory University
1520 Clifton Road NE

Atlanta, GA 30322

Tel: (404) 727-8360
Email: ragary@emory.edu

EDUCATION

06-1977	Medical College of Georgia, Augusta, GA	BSN
08-1979	University of Alabama, Birmingham, AL	MSN, Clinical Specialist Critical Care
05-2003	University of North Carolina Chapel Hill, North Carolina	PhD
05-2006	Post-doctoral Education, Emory University	

LICENSES AND CERTIFICATIONS

1975-Present	Registered Nurse, Georgia	80149-2
2009	Cognitive Therapy, Beck Institute for Cognitive Therapy and Research	

HONORS AND AWARDS

1977	Magna Cum Laude	
1982	Sigma Theta Tau	
1983	Outstanding Young Woman	
2003	UNC Graduate School Dean's Award for Graduate Student Research Benefiting North Carolina	
2003	Arteriosclerosis/Heart Failure Research Prize	

2005	Heart Failure Society Nursing Research Award Finalist
2008	American Heart Association Young Investigator Award
2009	Fellow American Heart Association
2012	Fellow American Academy of Nursing

PROFESSIONAL POSITIONS

Month, Year	Position	Institution
08/1975 08/1976	- Staff Nurse ICU	South Georgia Medical Center
10/1976 08/1977	- Staff Nurse ICU	Talmadge Memorial Hospital
08/1977 08/1978	- Staff Nurse ICU	Lake City Veterans Hospital
08/1978 08/1979	- Staff Nurse ICU	Birmingham Veterans Hospital
09/1979 08/1980	- Clinical Coordinator Med/Surg ICU	South Georgia Medical Center
08/1980 06/1984	- Assistant Professor	University of Florida
01/1981 10/1984	- Staff Nurse (PT) SICU	Shands Teaching Hospital & Clinics
11/1984 01/1987	- Instructor	King Khaled Eye Specialist Hospital
05/1987 05/1991	- Education Coordinator	King Faisal Hospital & Research Center

06/1992 07/1996	– Coordinator Distance Learning Center	King Faisal Hospital & Research Center
06/1997 08/1999	– Staff Nurse (PT)	University of North Carolina Hosp.
03/1997 12/2001	– Staff Nurse (PT)	Chapel Hill, North Carolina Interim Health Care
09/1996 05/1997	– Teaching Assistant	University of North Carolina
07/1999 05/2000	– Research Assistant	University of North Carolina
08/2003 05/2004	– Assistant Professor	Medical College of Georgia
08/2004 08/2005	– Postdoctoral Fellow	Nell Hodgson Woodruff School of Nursing, Emory University
08/2005 Present	– Assistant Professor	Nell Hodgson Woodruff School of Nursing, Emory University
07-2011 Present	– Associate Professor (Tenured)	Nell Hodgson Woodruff School of Nursing, Emory University

SCHOLARSHIP: GRANTS AND OTHER FUNDING

Research Grants Funded (*in reserve chronological order*)

Fatigue in Head and Neck Cancer: Role of Pro- and Anti-Inflammatory Signaling (Gary,Xiao)

University Research Center Pilot Award

\$30,000

5/1/2017-4/30/2018

Healing Hearts and Mending Minds in Older Persons Living with HIV (Waldrop-Valverde, Gary, Co-PI's)

Role: Co-PI

1R01NR014973-01 NIH/NINR

\$2,867,392

Grants Submitted

Exercise and fatigue in patients with head and neck cancer: efficacy and mechanisms (Xiao, Gary, Schmitz, co-PIs)

R-01

NCI 6/17-7/22

Multi-site with Penn State
<u>Scored, not funded</u>
Does home-based exercise reduce fatigue and inflammation in patients with head and neck cancer receiving IMRT: effects and biological mechanisms? (Xiao/Gary Co-PI) NCI 4/1/17-3/31/22 <u>1R01CA215673-01</u>
Home Based Aerobic Exercise Intervention for African Americans with MCI(Goldstein/Gary) NINR R01NR016722 7/2016
Preferences for end of life care in patients and caregivers with advanced heart failure (Gary) 1 IP2 P1000404-01 PCORI \$657,000 12/05/2011
Center for Personalized Exercise to Self-Manage Fatigue in Chronic Illness Faulkner M and Gary RA P-30 NIH/NINR (Co- PIs)
Optimizing Exercise Adherence and Outcomes in Patients with Heart Failure (Gary) 1R01NR012511-01 NIH/NINR \$2,543,326 02/05/2010
Efficacy of trial of Exercise and CBT for Depression in Heart Failure (AFFECT-HF) (Gary) R-01 (R01NR010387-01A2) NIH/NINR \$1,147,571 2008-2010
Preferences for end of life care in patient with their caregivers with advanced heart failure (Gary) NIH/PCORI \$676,000
<i>Educational, Training and Program Grants Funded (in reverse chronological order)</i>
T-32 Dunbar PI Training in Interventions to Improve Outcomes in Chronic Conditions Co-Investigator 07/01/2011-06/30/16
Gary, R. and Dougherty, M. (1998). A feasibility study of the prevalence of hypoalbuminemia and corresponding physical and nutritional support available to elderly adults discharged from the hospital following an acute medical illness. Predoctoral Traineeship (T-32), University of North Carolina at Chapel Hill.
Gary, R. and Dougherty, M. A comparison of bioimpedance and anthropometric measurements in rural frail older women. Predoctoral Traineeship (T-32), University of North Carolina at Chapel Hill. \$30,000.00
<u>Completed</u>
Center for Affect and CognitionWaldrop-Valverde, D. (PI) A Comparison of Magnetic Resonance Imaging in Persons with Heart Failure to Healthy Aged Matched Controls. Gary, RA (PI),

2006-2008

(Dunbar)

Testing the feasibility of telemonitoring for monitoring exercise adherence, symptom severity and HF self-care practices. Funded by Cardicom, Inc. Amount: \$5,000.00 Role: PI 2006-2007
A Family Partnership Intervention in Heart Failure (Dunbar) Co-Investigator, 5% 5R01 NR008800 NIH/NINR 2004-2009
AHA Beginning Great in Aid 0465203D Exercise and cognitive behavioral therapy as an intervention for depression in heart failure patients (Gary) \$110,000 2004-2006
Kellett Scholarship for Aging \$3000 2001-2002
Kellett Scholarship for Aging \$4000 1999-2000
Kellett Scholarship for Aging \$800 1998-1999
Glaxon-Wellcom Scholarship \$2500

SCHOLARSHIP: PUBLICATIONS

Original Articles in Peer-Reviewed Journals (*in reverse chronological order; please include the PubMedCentral ID Number (PMCID) if available*)

Butts B, Butler J, Dunbar SB, Corwin E, **Gary RA**. [Effects of Exercise on ASC Methylation and IL-1 Cytokines in Heart Failure](#). *Med Sci Sports Exerc*. 2018; [Epub ahead of print]. PMID:29683921

Gary RA, Dunbar SB, Higgins MK, Corwin E, Hepburn K, Miller AH. An intervention to improve physical function and caregiving perceptions in family caregivers of persons with heart failure. *Journal of Applied Gerontology*, 2018;733464817746757. PMID:29347863

Owen MI, Braun LT, Hamilton RJ, Grady KL, **Gary RA**, Quest TE. J Card Fail. 2017;23(11):826-827. doi: 10.1016/j.cardfail.2017.08.453. PMID:28842379

Butts B, Butler J, Dunbar SB, Corwin E, **Gary RA**. ASC Methylation and Interleukin-1 β Are Associated with Aerobic Capacity in Heart Failure. *Med Sci Sports Exerc*. 2017 doi: 10.1249/MSS.0000000000001200. [Epub ahead of print] PMID:28072632

5. Butts B, **Gary RA**, Dunbar SB, Butler J. Methylation of Apoptosis-Associated Speck-Like With a Caspase Recruitment Domain and Outcomes in Heart Failure. *J Card Fail*. 2016 22(5):340-6. doi: 10.1016/j.cardfail.2015.12.004. PMID:26700661

Butts B, **Gary R**. J Cardiovasc Nurs. 2016 20 Things You Didn't Know About Exercise;31(5):387-9. doi:10.1097/JCN.0000000000000315. PMID:27513677

Butts B, **Gary RA**, Dunbar SB & Butler J. (2015). The importance of NLRP3 inflammasome in heart failure. *Journal of Cardiac Failure*, pii: S1071-9164(15). PMID: 25982825.

Butts B, **Gary RA**, Dunbar SB, Butler J. ASC Methylation and Outcomes in Heart Failure, J Card Fail. 2015 Dec 14. pii: S1071-9164(15)01213-0. doi: 10.1016/j.cardfail.2015.12.004.

Butts B, **Gary RA**, Dunbar SB & Butler, J. (2015). The importance of NLRP3 inflammasome in heart failure. Journal of Cardiac Failure, pii: S1071-9164(15). PMID: 25982825.

Dunbar SB, Reilly CM, **Gary RA**, Higgins MK, Butts B, Culler S, Butler J. Randomized Clinical Trial of an Integrated Self-care Intervention for Persons with Heart Failure and Diabetes: Quality of Life and Physical Functioning Outcomes. Journal of cardiac failure. 2015; 21(9):719-29. PMID:26028261

Reilly CM, Dunbar SB, **Gary RA**, Culler S, et al. An Economic Evaluation of a Self-Care Intervention in Persons with Heart Failure and Diabetes. Journal of cardiac failure. 2015; 21(9):730-7. NIHMSID: NIHMS714516. PMID:26164214

Butts B and **Gary R**. [Coexisting frailty, cognitive impairment, and heart failure: implications for clinical care](#)Journal of clinical outcomes management : JCOM. 2015; 22(1):38-46.

Stamp KD, Dunbar SB, Clark PC, Reilly CM, **Gary RA**, Higgins M, Ryan RM. Family partner intervention influences self-care confidence and treatment self-regulation in patients with heart failure.European journal of cardiovascular nursing: journal of the Working Group on Cardiovascular Nursing of the European Society of Cardiology. 2014; 13(6):541-8.

Stamp KD, Dunbar SB, Clark PC, Reilly CM, **Gary RA**, Higgins M& Kaslow N. (2014). Family Context Influences Psychological Outcomes of Depressive Symptoms and Emotional Quality of Life in Patients with Heart Failure.The Journal of cardiovascular nursing. 2014; 29(6):517-27. PMID:24434821

Zeng B, Sun W, **Gary RA**, Li C, Liu T. Towards a conceptual model of diabetes self-management among Chinese immigrants in the United States. Int J Environ Res Public Health. 2014;11(7):6727-42. PMID:24978878

Gary RA, Brunn K. Aerobic exercise as an adjunct therapy for improving cognitive function in heart failure_Cardiol Res Pract. 2014;157508. PMID:25105053.

Dunbar SB, Clark PC, Reilly CM, **Gary RA**, Smith A, McCarty F, Higgins M, Grossniklaus, D, Kaslow N, Frediani J, Dashiff C.& Ryan R. (2013).A trial of family partnership and education interventions in heart failure.Journal of Cardiac Failure, 19(12), 829-4. PMID: 24331203.

Strath SJ, Kaminsky LA, Ainsworth BE, Ekelund U, Freedson PS, **Gary RA**, Richardson CR, Smith DT, Swartz AM, & American Heart Association Physical Activity Committee of the Council on Nutrition, Physical Activity and Metabolism and the Council on Clinical Cardiology (2013). A Guide to the Assessment of Physical Activity: Clinical and ResearchApplication, A Scientific Statement from the American Heart Association. Circulation, 128(20), 2259-79. PMID: 24126387.

Dunbar SB, Butts B, Reilly CM, **Gary RA**, Higgins MK, Ferranti EP, Culler S, & Butler J. (2013). A pilot test of an integrated self-care intervention for persons with heart failure and concomitant diabetes. Nursing Outlook, pii: S0029-6554(13), 00182-6. PMID:24211112.

Gary RA (2013). Aerobic exercise reduces depressive symptoms in patients with chronic heart failure. Evidence-based Mental Health, 16(2), 42. PMID: 23329053.

Frediani JK, Reilly CM, Higgins MK, Clark PC, **Gary RA**& Dunbar SB. (2013). Quality and adequacy of dietary intake in a southern urban heart failure population. The Journal of Cardiovascular Nursing, 28(2), 119-128. PMID: 22343212.

Gary R. (2012) Evaluation of frailty in older adults with cardiovascular disease: incorporating physical performance measures. The Journal of Cardiovascular Nursing, 27(2), 120-131. PMID: 22334147.

Gary RA, Cress ME, Higgins MK, Smith AL & Dunbar SB. (2012). A Combined Aerobic and Resistance Exercise Program Improves Physical Functional Performance in Patients with Heart Failure: a pilot study. Journal of Cardiovascular Nursing, 27(5), 418-430. PMID: 21912268.

Grossniklaus DA, Dunbar SB, **Gary R,** Tohill BC, Frediani JK, & Higgins MK (2012). Dietary energy density: a mediator of depressive symptoms and abdominal obesity or independent predictor of abdominal obesity? European Journal of Cardiovascular Nursing, 1(4):423-31. PMID:21530408.

Kaplan BG, Abraham C & **Gary R** (2012). Effects of participation vs. observation of a simulation experience on testing outcomes: implications for logistical planning for a school of nursing. International Journal of Nursing Education Scholarship, 29(9), Article 14. PMID: 22850068.

Gary RA, Cress ME, Higgins MK, Smith AL & Dunbar SB. (2012). A combined aerobic and resistance exercise program improves physical functional performance in patients with heart failure: a pilot study. The Journal of Cardiovascular Nursing, 27(5), 418-430. PMID: 21912268.

Gary RA (2011). Evaluation of frailty in older adults with cardiovascular disease: incorporating physical performance measures. The Journal of Cardiovascular Nursing, 27(2), 120-131. PMID: 22334147.

Gary RA, Cress ME, Smith AL, Higgins MK & Dunbar SB (2011). Combined Aerobic and Resistance Exercise Program Improves Task Performance in patients with heart failure. Archives of Physical Medicine and Rehabilitation, 92(9), 1371-1378. PMID: 21878207.

Gary RA, Dunbar SB, Higgins MK, Musselman DL & Smith AL (2010). Combined Exercise and Cognitive Behavioral Therapy Improves Outcomes in Patients with Heart Failure. Journal of Psychosomatic Research, 69(2), 119-131. PMID: 20624510.

Grossniklaus DA, Dunbar SB, **Gary RA,** Tohill B & Higgins MK (2010). Psychological Factors are Important Correlates of Dietary Pattern in Overweight Adults. Journal of Cardiovascular Nursing, 25(6), 450-460. PMID: 20938248.

Grossniklaus DA, **Gary RA,** Higgins MK & Dunbar SB (2010). Biological and Psychological Differences between Overweight Adults with and without Waist Circumference Risk. Research in Nursing and Health, 33(6), 539-55. PMID: 21053387. PMID: 21053387.

Reilly CM, Higgins M, Smith A, **Gary RA,** Robinson J, Clark PC, McCarty F, & Dunbar SB (2009). Development, Psychometric Testing, and Revision of the Atlanta Heart Failure Knowledge Test. Journal of Cardiovascular Nursing, 24(6), 500-509. PMID:19858959.

Gary RA & Davis LD (2008). Diastolic heart failure. Heart & Lung, 37(6), 405-416. PMID: 18992623.

Dunbar SB, Clark PC, Quinn C, **Gary RA** & Kaslow N. (2008). Family Influences on heart failure self-care and outcomes. Journal of Cardiovascular Nursing, 23(3), 258-265. PMID: 18437068.

Gary R & Lee SY (2007). Physical Function and Quality of Life in Older Women With Diastolic Heart Failure: Effects of a Progressive Walking Program on Sleep Patterns. *Progress in Cardiovascular Nursing*. 22(2), 72-80. PMID: 17541316.

Gary R (2006). Exercise self-efficacy in older women with diastolic heart failure. *Journal of Gerontological Nursing*, 32(7), 31-39. PMID: 16863044.

Gary R (2006). Self-care practices in women with diastolic heart failure. *Heart Lung*. 35(1), 9-19. PMID: 16426931.

Gary R, Sueta C, Dougherty M, Rosenberg B, Cheek D, Preisser J, Neelon V & McMurray R (2004). Home-based exercise improves functional performance and quality of life in women with diastolic heart failure. *Heart Lung*, 33(4), 210-218. PMID: 15252410.

Gary R, Sueta CA, Rosenberg B & Cheek D (2004). Use of the six-minute walk test for women diastolic heart failure. *Journal of Cardiopulmonary Rehabilitation*, 24(4), 264-268. PMID: 15286534.

Gary R & Fleury J (2002). Promoting physical activity in older women: Introduction. *Topics in Geriatric Rehabilitation*. 18: vi.

Gary R & Rosenberg B (2002). Considerations for implementing a low-intensity, home-based walking program in older women with diastolic heart failure. *Topics in Geriatric Rehabilitation*. 18, 34-51.

Gary R (2002). Promoting functional status through interdisciplinary collaboration: Introduction. *Topics in Geriatric Rehabilitation*, 17, Part II, pp. vi.

Gary R & Fleury J (2002). Nutritional Assessment: Key to successful rehabilitation in the elderly. *Topics in Geriatric Rehabilitation*, 17, 40-71.

Gary R (2002). Promoting functional status through interdisciplinary collaboration, *Topics in Geriatric Rehabilitation*, 7, Part I, pp. vi-vii.

Gary R, Marrone S & Boyles C. (1998). The use of gaming strategies in a transcultural setting. *Journal of Continuing Education in Nursing*, 29(5), 221-227. PMID: 9923232.

Gary R (1992). Nurse Development Program. *Nursing Administration Quarterly*, 16, 25-29.

Treloar D, Nalli B, Guinn P & **Gary R**. (1991). The effect of familiar and unfamiliar voice treatments on intracranial pressure in head-injured patients. *Journal of Neuroscience Nursing*, 23(5), 295-299.

Jackson C & **Gary R** (1991). Nursing: Attitudes, perceptions and strategies for progress in Saudi Arabia. *Annals of Saudi Medicine*, 11(4), 452-458. PMID: 17590766.

Gary R, Jermier-Jax B & Hickey A (1986). Stroke: The road back to recovery. *RN Part 2—Continuing Education Credit*, 49, 49-54.

Gary R, Jermier-Jax B & Hickey A (1986). Stroke: How to contain the damage (Continuing Education Credit). RN, 49(5), 36-42. PMID: 3635223

Gary R (1983). Care of patients with cerebral aneurysms. Journal of Association of Perioperative Registered Nurse, 37(4), 631-642.

GaryR (1981).Cerebral vasospasm: Issues, trends and interventions. Journal of Neurosurgical Nursing, 13, 256-264.

Book Chapter (*citations, in reverse chronological order*)

Gary R (2004). Physical activity recommendations and the cardiovascular patient. CV Nursing Secrets. L. Davis (Ed), 425-434.

Parker K, **Gary RA**& Dunbar SB (2009). Sleep in Cardiac Nursing (6th ed). Woods, S.L., Froelicher, E., Motzer, S., Bridges, E. (eds). Lippincott Williams and Wilkins 177-210.

Research Abstracts and Proceedings (*citations, in reverse chronological order*)

Gary RA, Waldrop-Valverde D, Paul S, Corwin EJ, Miller AH. Exercise and Cognitive Training as an intervention to improve neurocognitive function in persons with heart failure. American Heart Association Scientific Sessions, November 13, 2018.

Gary RA, Waldrop-Valverde D, Paul S, Corwin EJ, Hepburn K, Williams B. Exercise and Cognitive training to Improve neurocognitive outcomes in persons with heart failure. NINR, Advancing Science, Bethesda, MD May 2017

Gary RA, Waldrop-Valverde D and Paul S. Exercise to improve cognitive outcomes in cardiovascular disease. American Heart Association Scientific Sessions, November 12-16 2016

Gary RA, Dunbar SB, Butts B, Higgins MK, Hepburn K, Corwin EJ, Miller AH. Improving physical function and reducing cardiovascular disease risk among family caregivers of persons with heart failure. Council Academy of Nursing Science, September 2016. Washington DC

Gary RA, Dunbar SB, Butts B, Higgins MK, Hepburn K, Corwin E and Miller A. Improving Physical Function and Reducing Cardiovascular Disease Risk Among Family Caregivers of Persons with Heart Failure. American Heart Association Scientific Sessions, November 7-11 2015.

Gary, RA, Dunbar SB, Butts B, Higgins MK, Corwin E, Hepburn K, and Miller AH, MD. Improving physical function and reducing cardiovascular disease risk among family caregivers of persons with heartfailure. *Advancing Science, Improving Lives*, NINR's 30th Anniversary Scientific Symposium and Poster Session, October 13, 2015, NIH, Bethesda, MD.

Dunbar, SB, Clark, PC, Gary, RA, Smith AL, Reilly CM, McCarty, F, Robison, J Family Partnership and Education Interventions Reduce Dietary Sodium Intake by Patients with Heart Failure, presented at the Scientific Sessions, AHA, Nov 2009 Circulation

Dunbar, SB, Clark PC, Gary RA, Higgins M, McCarty F, Reilly, C, Robinson, J, Smith AL., Family focused Interventions improve HF Family members knowledge and supportive communication, oral abstract presentation, European Society of Cardiology, August 2009, Barcelona, Spain

Gary, R.A., Cress, M.E., Smith, A.L., Higgins, M.K. & Dunbar, S.B. (2009). Aerobic and resistance training improves functional performance and muscle strength in patients with HF. *Circulation*, 120, S511-S512.

Dunbar, S.B., Clark, P.C., Gary, R.A., Quinn, C., Reilly, C.M., Smith, A.L. & Higgins, M.K. (2009). HF caregiver outcomes and associated factors. *Journal of Cardiac Failure*, 15(6), S369

Grossniklaus, D.A., Frediani, J., Higgins, M.K., Gary, R. & Dunbar, S.B. (2009). Depressive symptoms and dietary patterns associated with cardio metabolic risk in overweight adults. American Heart Association Quality of Care and Outcomes Research in Cardiovascular Disease and Stroke, Washington D.C.

Grossniklaus, D.A., Tohill, B.C., Frediani, J., Higgins, M.K., Gary, R. & Dunbar, S.B. (2009). Depressive symptoms are important correlates of dietary energy density in overweight adults. Preventive Cardiovascular Nurses Association 15th Annual Symposium, Dallas, TX.

Grossniklaus, D.A., Tohill, B.C., Frediani, J., Lee, J., Higgins, M.K. & Gary, R. (2009). Depressive symptoms are important correlates of dietary energy density in overweight adults. Southern Nurses Research Society Annual Conference, Baltimore, MD.

Reilly, C.M., Frediani, J., Clark, P.C., Gary, R.A., Higgins, M., Smith, A.L. & Dunbar, S.B. (2008). Quality and Adequacy of Dietary Intake in a Southern Urban Heart Failure Population. American Heart Association Quality of Care and Outcomes Research in Cardiovascular Disease and Stroke, Washington D.C., April 25, 2009. *Circulation*, 117(2), 155.

Gary, R.A., Dunbar, S.B., Musselman, D.L., Cress, M.E. & Higgins, M.L. (2008). Use of the Symptom Interactional Framework to examine multidimensional domains of fatigue and depression in heart failure patients. *Journal of Cardiac failure*, 14(96), S292.

Dunbar, S.B., Clark, P.C., Gary, R.A., Reilly, C.M., Quinn, C., Smith, A.L. & Butler, J. (2008). A comparison of self-care behaviors and outcomes in HF patients with and without diabetes. *Journal of Cardiac failure*, 14(96), 292-S292.

Gary, R.A., Musselman, D.L., Dunbar, S.B., Cress, M.E. & Cotsonis, G.A. (2008). Combined exercise and cognitive behavioral therapy improves outcomes in heart failure patients. American Heart Association: Quality of Care and Outcomes, *Circulation*, 117(21), S118.

Gary, R.A., Robinson, J.M., Clark, P.C., McCarty, F., Smith, A.L. & Dunbar, S.B. (2007). **Biobehavioral Factors and Heart Failure Medication Adherence.** *Circulation*, **116**,II, 486.

Gary, R.A., Dunbar, S.B., Clark, P.C. & Cotsonis, G.A. (2007). Gender is not associated with Depression in heart failure. *Journal Cardiac Failure*, 319, S166.

Gary, R.A., Cress, M.E., Hayes, D.M. & Moore, T.L. (2007). Performance of physical activities of daily living among New York Heart Association Class II and III heart failure patients. *Journal Cardiac Failure*, 346, S174.

Cress, M.E., Hayes, D.M., Moore, T.L. & Gary, R.A. (2007). Physical Functional Performance in Patients with Class II and III Chronic Heart Failure. *Medicine and Science in Sports and Exercise*, 39(5), S287.

Gary, R. & Lee, S.Y. (2005). Sleep patterns, quality of life and physical function in older women with diastolic heart failure: effects of a progressive walking program. *Heart Failure Society of America*, 011, S93.

Gary, R., Dougherty, M., Rosenberg, B., Cheek, D.A., Preisser, J., Neelon, V., McMurray, R. & Sueta, C.A. (2005). Low to moderate intensity exercise improves exercise tolerance and quality of life in women with diastolic heart failure. *Circulation*, 108, 503.

Gary, R., Dougherty, M. & Sueta, C. (2003). The six-minute walk test as an outcome measure for exercise intervention effectiveness in older women with diastolic heart failure. *Gerontologist*, 43, 496.

Dissertation

An evaluation of the effectiveness of home-based exercise in older Women with diastolic heart failure. Under the direction of Dr. Molly Dougherty. Accepted by Graduate School at the University of North Carolina at Chapel Hill, April 2003

SCHOLARSHIP: PRESENTATIONS

International Presentations (citations, in reverse chronological order)

Gary RA, Dunbar SB, Higgins MK, Hepburn K, Miller A, Corwin E and Bauer-W S. Physical and psychosocial characteristics of family givers of persons with heart failure(2013, July) Sigma Theta Tau International's 24th International Nursing Research Congress, Prague, Czech Republic.

Dunbar, SB, Clark PC, Gary RA, Higgins M, McCarty F, Reilly, C, Robinson, J, Smith Al., Family focused Interventions improve HF Family members knowledge and supportive communication, oral abstract presentation, European Society of Cardiology, August 2009, Barcelona, Spain

Gary, R.A., Dunbar, S. & Murray, J. (2009). Research Workshop, Addis Ababa University, School of Nursing Faculty, Ethiopia, funded by the Institute of Developing Nations, Emory University. Atlanta, GA

Dunbar, S.B., Gary, R.A., Clark, P.C., McCarty, F., Smith, A., Reilly, C. & Quinn, C. (2008, September). Family functioning, self management, and outcomes in patients with heart failure, presented at the European Society of Cardiology. Munich, Germany, *European Heart Journal*, vol29.

Gary, R., Dougherty, M., Rosenberg, B., Cheek, D.A., Preisser, J., Neelon, V., McMurray, R. & Sueta, C.A. (2003, July). The effectiveness of home-based exercise in diastolic heart failure women. Sigma Theta Tau, Fourteenth International Research Congress on Evidenced Based Practice. St. Thomas Virgin Islands.

National Presentations (as APA citations, in reverse chronological order)

Butts, B., Gary, R., Reilly, C., Higgins, M., Butler, J., and Dunbar, S. Effects of an integrated self-care intervention on frailty risk in persons with heart failure and type 2 diabetes mellitus. Paper presented at: American Heart Association; November 2014; Chicago, IL.

Gary, R.A., Higgins, M.K., Cress, M.E., Smith, A.L. & Dunbar, S.B. (2012, September). Improved physical function confers greater quality of life benefits for NYHA class III then NYHA Class II patients. Heart Failure Society of American. Seattle, WA.

Cress, M.E., Gary, R.A. & Higgins, M.K. (2012, November). Clinically important effects of exercise on functional performance in patients with heart failure. Gerontological Society of America. San Diego, CA.

Gary, R.A., Cress, M.E., Smith, A.L., Higgins, M.K. & Dunbar, S.B. (2009, November). Aerobic and resistance training improves functional performance and muscle strength in patients with HF. American Heart Association. Orlando FL.

Gary, R.A., Dunbar, S.B., Musselman, D.L., Cress, M.E. & Higgins, M.L. (2008, October). The multidimensional domain of fatigue in patients with heart failure and depression. Council for the Advancement of Nursing Science. Washington, DC.

Gary, R.A., Musselman, D.L., Dunbar, S.B., Cress, M.E. & Cotsonis, G.A. (2008, October). Exercise and cognitive behavioral therapy improves depression and clinical outcomes in heart failure patients. Council for the Advancement of Nursing Science. Washington, DC.

Gary, R.A., Musselman, D.L., Dunbar, S.B., Cress, M.E. & Cotsonis, G.A. (2008, April). Combined exercise and cognitive behavioral therapy improves outcomes in heart failure patients. American Heart Association: Quality of Care and Outcomes Conference. Baltimore, MD.

Gary, R.A., Dunbar, S.B., Musselman, D.L., Cress, M.E. & Higgins, M.L. (2008, September). Use of the Symptom Interactional Framework to examine multidimensional domains of fatigue and depression in heart failure patients. 12thAnnual Heart Failure Society of America. Toronto, ON.

Dunbar, S.B., Clark, P.C., Gary, R.A., Reilly, C.M., Quinn, C., Smith, A.L. & Butler, J. (2008, September). A comparison of self-care behaviors and outcomes in HF patients with and without diabetes. 12thAnnual Heart Failure Society of America. Toronto, ON.

Gary, R.A., Robinson, J.M., Clark, P.C., McCarty, F., Smith, A.L. & Dunbar, S.B. (2007, November). **Biobehavioral Factors and Heart Failure Medication Adherence**. American Heart Association. Orlando, Florida.

Gary, R., Cress, M.E., Hayes, D.M. & Moore, T.L. (2007, September). Performance of physical activities of daily living among New York heart Association Class II and III heart failure patients. 11thAnnual Heart Failure Society of America. Washington, DC.

Gary, R., Dunbar, S.B., Clark, P.C. & Cotsonis, G.A. (2007, September). Gender is not associated with depressive symptoms in heart failure. 11thAnnual Heart Failure Society of America. Washington, DC.

Gary, R. & Dunbar, S.B. (2006, October). Exercise self-efficacy in older women with heart failure. Council for the Advancement of Nursing Science. Washington, DC.

Bittner, V., Dekkerlegand, J.L. & Gary, R. (2006, September). How to set up a home-based exercise program for heart failure patients. 10th Annual Heart Failure Society of America. Seattle, WA.

Gary, R. (2006, May). Depression and HF: preliminary findings. Boston Scientific/Guidant Corporation. Minneapolis MN.

Gary, R. & Lee, S.Y. (2005, September). Sleep patterns, quality of life and physical function in older women with diastolic heart failure: effects of a progressive walking program. 9th Annual Heart Failure Society of America. Boca Raton, Florida.

Schumacher, A., Gary, R.A. & Dunbar, S.B. (2005, September). Heart rate variability and sudden death Risk in women with heart failure. 9th Annual Heart Failure Society of America. Poster Presentation. Boca Raton, Florida.

Gary, R., Dougherty, M., Rosenberg, B., Cheek, D.A., Preisser, J., Neelon, V., McMurray, R. & Sueta, C.A. (2003, November). Home-based exercise improves functional performance and quality of life in women with diastolic dysfunction. American Heart Association Scientific Sessions. Orlando, Florida.

Gary, R., Dougherty, M. & Sueta, C. (2003, November). The Six-Minute Walk Test As An Outcome Measure for Exercise Intervention Effectiveness In Older Women With Diastolic Heart Failure. The 56th Annual Scientific Meeting of the Gerontological Society of America. San Diego.

Gary, R., Dougherty, M., Rosenberg, B., Cheek, D.A., Preisser, J., Neelon, V., McMurray, R. & Sueta, C.A. (2003, November). The effectiveness of home-based exercise in women with diastolic heart failure. Sigma Theta Tau, 37th Biennial Convention. Toronto, Canada.

Gary, R., Dougherty, M., Rosenberg, B., Cheek, D.A., Preisser, J., Neelon, V., McMurray, R. & Sueta, C.A. (2003, September). Home-based exercise improves functional performance and quality of life in women with diastolic heart failure. 7th Annual Scientific Heart Failure Society of America. Las Vegas, Nevada.

Local, State, and Regional Presentations (*as APA citations, in reverse chronological order*)

Gary RA, Waldrop-Valverde D, Paul S, Corwin EJ, Hepburn K, Williams B. Exercise and Cognitive training to Improve neurocognitive outcomes in persons with heart failure. Blue Bag Seminar, Nell Hodgson Woodruff School of Nursing, Emory University, Atlanta GA

Butts, B., Gary, R., Dunbar, S, and Butler, J. Patterns of ASC Methylation are Associated with Ejection Fraction, Quality of Life and Depression in Persons with Heart Failure. Poster presented at: Southern Nursing Research Society; February 2015; Tampa, FL.

Butts, B., Gary, R.A., Dunbar, S.B. & Higgins MK. (2014, February). Barriers to Exercise in Persons with Heart Failure and Type 2 Diabetes Mellitus. Southern Nursing Research Society. San Antonio, Texas, February 2014.

McGee, B., Donovan, M., Heath, A., Hitron, E., Rowland, A., Serieno, J., Scullin, R. & Gary, R. (2014, February). Post-Traumatic Stress Disorder Symptoms following Acute Myocardial Infarction as a Predictor of Future Health Outcomes. Southern Nursing Research Society. San Antonio, Texas.

Tomaso, S., Gary, R.A. & Higgins, M.K. (2014, February). The influence of exercise on physical and psychological function of family caregivers of persons with heart failure. Southern Nursing Research Society. San Antonio, Texas.

Butts B, Gary RA, Dunbar SB, Higgins MK, Miller A, Corwin E. (2013, April). Physiological and Psychosocial Risks for Poor Health and Cardiovascular Disease among Family Caregivers of Persons with Heart Failure. Emory School of Nursing Research Symposium.

Gary, R.A., Cress, M.E, Higgins, M.K., Smith, A.L., & Dunbar, S.B. (2012, February). A combined aerobic and resistance exercise program improves physical functional performance in patients with heart failure. Podium presentation. Southern Nursing Research Society. New Orleans, LA.

Dunbar, SB, Butler, JB, Reilly, CM, Gary, R, Higgins, MK Self Care Knowledge in persons with Heart Failure and Diabetes, Abstract submitted to the ESC and SNRS, May 2011.

Gary, R. (2009, January). Aerobic and resistance exercise in heart failure patients: preliminary findings. EPICORE, Emory University. Atlanta, GA.

Gary, R., Dunbar, S.B., Clark, P.C. & Cotsonsis, G.A. (2008, February). Gender is not associated with depressive symptoms in heart failure. Southern Nursing Research Society. Birmingham, AL.

Gary, R.A., Dunbar, S.B., Clark, P.C. & Reilly, C.M. (2008, February). Depression, physical function and quality of life in heart failure patients. Southern Nursing Research Society. Birmingham, AL.

Clark, P.C., Quinn, C., Gary, R., McCarty, F., Kaslow, N.J., Smith, A.L. & Dunbar, S.B. (2008, February). Influence of Perceived Support from Health Care Providers and Family on Depressive Symptoms in Patients with Heart Failure. Southern Nursing Research Society. Birmingham, AL.

Reilly, C.M., Clark, P.C., Gary, R.A, Grossniklaus, D., Lindsley, K., Smith, A.L. & Dunbar, S.B. (2008, February). Biobehavioral Correlates of Dietary Sodium Intake in Heart Failure Patients. Southern Nursing Research Society. Birmingham, AL.

Dunbar, S.B., Clark, P.C., Jacobson, K.L., McCarty, F., Smith, A.L., Kovalchick, L. & Gary, R. (2008, February). Health Literacy in HF Patients and Family Caregivers. Southern Nursing Research Society. Birmingham, AL.

Dunbar, S.B., Clark, P.C., Quinn, C., McCarty, F., Gary, R., Kaslow, N. & Dashiff, C. (2008, February). Family Functioning and Heart Failure Caregiver Outcomes. Southern Nursing Research Society. Birmingham, AL.

Gary, R. (2006, June). The psychometric testing of two fatigue instruments in heart failure patients. Nursing Research Conference, Emory University. Atlanta, GA.

Gary, R. (2006, March). Exercise and cognitive behavioral therapy as an intervention for depression in heart failure patients: preliminary findings. EPICORE, Emory University. Atlanta, GA

Gary, R. & Dougherty, M. (1997). A pilot study comparing bio-impedance and anthropometric measurements in rural frail elders. Southern Nursing Research Society. Fort Worth, Texas.

TEACHING ACTIVITIES

Courses Taught (Past 4 Years)

01-2018	NRSG 505 Research and Evidence Based Practice	Faculty
08-2017	NRSG 710---Health Outcomes Research	Co-coordinator
01-2016	NRSG 505---Research and Evidence Based Practice	Coordinator
08-2015	NRSG 710—Health Outcomes Research	Coordinator
01-2015	NRSG 505—Research and Evidence Based Practice	Coordinator
08-2014	NRSG 710-- Health Outcomes Research	Coordinator
01-2014	NRSG 507 – Theory and Research Applications	Coordinator
08-2013	NRSG 440 – Core Concepts II	Coordinator
01-2013	NRSG 507 – Theory and Research Applications	Coordinator
08-2012	NRSG 440 – Core Concepts II	Coordinator
08-2012	NRSG 763 - Research Seminar and Residency	Coordinator
01-2012	NRSG 340 – Core Concepts I	Coordinator
01-2012	NRSG 507 – Theory and Research Application	Coordinator
08-2011	NRSG 763 – Research Seminar and Residency	Coordinator
08-2011	NRSG 440 – Core Concept II	Coordinator
05-2011	NRSG 507 – Theory and Research Applications	Coordinator
01-2011	NRSG 471 – Professional Development IV: Politics and Public Policy	Leader/Mentor
01-2011	NRSG 340 – Core Concepts I	Coordinator
05-2010	NRSG 507 – Theory & Research: Applications	Coordinator
01-2010	NRSG 507 – Theory & Research: Applications	Coordinator
01-2010	NRSG 340 – Core Concepts I	Coordinator
08-2009	NRSG 440 – Core Concepts II	Coordinator
08-2009	NRSG 370 – Professional Development I: Foundations of Professionalism	Mentor Group Leader
01-2009	NRSG 474 – Research Honors	Coordinator
01-2009	NRSG 340 – Core Concepts I	Coordinator
08-2008	NRSG 473 – Research Honors	Coordinator
01-2008	NRSG 763 – Research Seminar & Residency I	Coordinator
01-2008	NRSG 474 – Research Seniors Honors	Coordinator
01-2008	NRSG 371H – Research Junior Honors	Coordinator
08-2007	NRSG 762 – Research Seminar & Residency I	Coordinator
08-2007	NRSG 473H – Research Senior Honors	Coordinator
08-2007	NRSG 370 – Professional Development I: Foundations of Professionalism	Mentor Group Leader
08-2007	NRSG 440 – Core Concepts II	PBL Leader
01-2007	NRSG 371H – Research Junior Honors	Coordinator
01-2007	NRSG 763 – Research Seminar & Residency I	Coordinator

08-2006	NRSG 762 – Research Seminar & Residency I	Coordinator
05-2006	NRSG 560B – Cardiovascular Topics: Independent Study MSN Course	Coordinator
01-2006	Tenure Track Research Sabbatical	
08-2005	Tenure Track Sabbatical	
05-2005	NRSG 507 – Theory & Research: Applications	Coordinator
01-2005	NRSG 371 – Professional Development II: Research	Coordinator
08-2004	NRSG 460M – Clinical Nursing III: Maturing & Aging Adults and Family	Coordinator

Doctor of Philosophy in Nursing Advisement

2017	Faculty Dissertation Chair, Lemlem Beza
2016	Faculty Dissertation Chair, MK Findley
2016	Faculty Dissertation Chair, Emebet Woldaramian
2015	Faculty Dissertation Chair, Daniel Mengistu
2015	Faculty Dissertation Co-Chair, Fekadu Aga
2014	Faculty Dissertation Chair, Blake McGee
2013	Faculty Dissertation Co-advisor, Brittany Butts
2011	Faculty Dissertation Chair, Tingting Liu
2006	Faculty Member, Daurice Grossniklaus
2005	Reader, Amy Valderamma

PROFESSIONAL AND UNIVERSITY SERVICE ACTIVITIES

Membership in Professional Organizations

American Heart Association
American Nurses Association
Heart Failure Society of America
Sigma Theta Tau
Gerontological Society of America
Council for the Advancement of Nursing Science

Manuscript Reviewer

European Journal of Cardiovascular Nursing
Heart Lung: Journal of Acute and Critical Care
Heart
Journal of Cardiovascular Nursing
Journal of Cardiac Failure
Archives in Physical Medicine and Rehabilitation
Western Journal of Nursing Research
Women's Health International

Regional Committee Appointments

2009-2013 *Greater Southeast Affiliate Research Committee, American Heart Association*

National Committee Appointments

2014-present CVSN Cardiovascular disease in older populations Committee
2012-Present Scientific Sessions, American Heart Association , Abstract Reviewer
2009-Present Cardiovascular Nursing Council Committee Member, Awards Committee
2008-Present Cardiovascular Nursing Council Committee Member, Care of the Complex Patient
2007-Present Epidemiology, Prevention, Outcomes and behavioral science peer review group

Emory University Service

2006-2012	Scientific Advisory Council member, Atlanta Clinical Translational Science Institute (formerly General Clinical Research Committee)
2012-Present	Scientific Advisory Council Member, Atlanta Clinical Translational Science Institute, ADHOC Member
2012-2015	Member, University Senate and Faculty Council Member, Center for faculty Development and Excellence, Board Member

Nell Hodgson Woodruff School of Nursing Service

2007-2009	Member, Curriculum Committee
2009-2011	Chairperson, Curriculum Committee
2011-2012	Co-Chairperson, Admission Committee
2012-2014	FULD Scholar, Selection Committee
2012-2014	Woodruff Scholar, Selection Committee
2012-2014	Chairperson, Admission Committee
2014-Present	Chairperson, Student Success and Monitoring Committee
2012-2013	FACPT Committee
2012-2013	PhD SACS Review Committee
2012-Present	PhD Curriculum Committee
2012-2014	PhD Admission Committee
2013-Present	T-32 Executive Board Member Search Committee PhD Executive Committee
2016-2018	Ad hoc BSN Curriculum Committee Research Committee Chair person

Curriculum vitae

PERSONAL DATA

Name Dejuma Yadeta Goshu
Birth Date Nov. 06/ 1975
Nationality Ethiopian
Address E-mail: dejuya@yahoo.com
Tel 251-911-41-10-81

EDUCATIONAL BACK GROUND

Post Graduate Education

January 2013- June 2013 **Vietnam Heart institute**, Hanoi, Vietnam
Percutaneous Cardiovascular interventions
Jan. 2011- December 2012 **Addis Ababa University**, Addis Ababa, Ethiopia
Subspecialty in Cardiology
January 2004- August 2007, **Addis Ababa university (A.A.U)**- Specialty
Certificate in Internal medicine

Medical Education

1995-2000, Gondar University, Ethiopia: Medical Doctor
Secondary school Sire High School, Wollega ,Ethiopia
Elementary Sire Elementary School

WORK EXPERIENCE

From 2000-2004 -As lecturer in Dilla Health sciences college, Ethiopia

From 2004-2007: -Worked as medical resident in Tikur Anbessa Hospital

-As part time physician at international cardiovascular &
Medical center

Since 2007 I am working as consultant cardiologist and Head Division of Cardiology at Addis Ababa University.

COMMUNITY WORK

Founding member and President of Society of cardiac Professional Ethiopia.

Member of Guideline development Committee at FMOH

Activist for Rheumatic heart Disease prevention in Ethiopia and Africa

Project coordinator “ *Improving RHD control in Ethiopia*”

RESEARCH AND PUBLICATIONS:

Spectrum of cardiovascular Disease in Tikur Anbessa Hospital

Spectrum of cardiovascular Diseases in six major hospitals of Ethiopia

Clinical Characteristics of Rheumatic heart Disease in Africa

Outcomes of Global registry of Rheumatic heart disease.

Prevalence of Rheumatic Heart disease in Ethiopian School Children

Humanitarian Cardiology and Cardiac Surgery in Ethiopia

Low fruit and vegetable intake and its associated factors in Ethiopia

Magnitude and determinants of physical inactivity in Ethiopia

Prevalence of Khat chewing and associated factors in Ethiopia

The hidden magnitude of raised blood pressure and elevated blood glucose in Ethiopia

Tobacco use and its predictors among Ethiopian adult

Urinary sodium excretion and determinates among adults in Ethiopia

Rheumatic heart disease Training Manual for Mid level health worker

Hypertension Training Material For midlevel Health workers

TRAININGS & WORKSHOPS

Training on echocardiography at Telaviv university ,Israel

Training on CPR at Telaviv university ,Israel.

Antiretroviral Treatment, Organized by HAPCO & MOH, Ethiopia

Methodology of teaching organized by Carter center, Ethiopia

Pre service Effective teaching Skills course by Jhpiego Ethiopia

Neurology for Non neurologist organized by Ethiopian Medical Association

Symposium on Cardiovascular Disease prevention & management

TOT on Methodology of teaching organized by ICAP, Ethiopia

LANGUAGES

Fluent in English, Afan Oromo & Amharic

REFERENCES

Dr Senbeta Guteta, Cardiologist, Addis Ababa University. Tel 251-11-551-12-11

Dr. Bekele Alemayehu, Cardiologist, Addis Ababa University, Tel 251-11-551-12-11

Dr Addisu Melkie , Nephrologist and Head department of Internal Medicine, Addis Ababa University, Tel 251-11-551-12-11

ABRIDGED CURRICULUM VITAE

I. BIOGRAPHICAL DATA

Name: Alemayehu Worku Yalew Present Rank: Full Professor
 Cell: + 251 91 140 56 52 E-mail: alemayehuww@yahoo.com alemayehu.worku@acu.edu.et

II. EDUCATION

- a) 1993 - 1997 PhD, University of Leipzig, Germany. With Distinction.
- b) 1991 - 1992 MSc, University of Leipzig, Germany
- c) 1984-1988 BSc, Addis Ababa University, Ethiopia. With Distinction.

III. PROFESSIONAL EMPLOYMENT RECORD

- a) Since March 20, 2015: member of the department of preventive medicine, School of Public Health, College of Health Sciences Addis Ababa University with the academic rank of Professor of Public Health/Biostatistics.
- b) July 9, 2002 – March 28, 2015: member of the Department of Preventive Medicine, School of Public Health, College of Health Sciences, Addis Ababa University with the academic rank of Associate Professor of Bio-Statistics.
- c) November 1999 – June 2002: member of the Department of Community Health, FoM, with the academic rank of Assistant Prof. of Bio-Statistics
- d) October 1997 – October 1999 worked as an Assistant Prof. of Bio-Statistics in the Gondar College of Medical Sciences, Gondar University
- e) October 1988 – August 1990 worked as instructor of Bio-Statistics in the Gondar College of Medical Sciences, Gondar University

IV. BOARD MEMBER

- A) Board member of the INDEPTH Network
- B) Member of the Global Data and Safety Monitoring Board (DSMB) of NIMH (National Institute of Mental Health, USA) for "Task Sharing for the Care of Severe mental disorders (SMDs) in a low income country: a randomized, controlled non inferiority trial (TaSCS)"
- C) Member of the Data and Safety Monitoring Board (DSMB) for "A double blind randomized placebo controlled trial of adjuvant therapy with minocycline for schizophrenia (The MINOS Trial)"
- D) Member and chairman of the Data and Safety Monitoring Board (DSMB) for "Introducing medical abortion services into the Ethiopian Health System: An implementation pilot to assess clients' and providers' perspectives and health facilities readiness".
- E) Member of the Data and Safety Monitoring Board (DSMB) of TDR/WHO for "A two arm single blinded randomized comparison of four fixed dose combinations versus standard treatment anti-TB drugs for treatment of pulmonary tuberculosis"
- F) Member of the Data and Safety Monitoring Board (DSMB) of DNDI (Drug for Neglected Diseases Initiative) for "An Open-label, sequential stop, safety and efficacy study to determine the optimal single dose of AmBisome for patients with Visceral Leishmaniasis".

V. RESEARCH AND PUBLICATIONS

More than 170 publications in peer reviewed journals and cowriter of more than 5 program reports

VI. AWARDS AND RECOGNITIONS

- Received the 2011 Ethiopian Public Health Association Senior Researcher Gold Medal Award for the outstanding performance and contribution to public health research in Ethiopia
- 13th World Congress on Public Health certificate of appreciation for participation as a reviewer to the success of the congress, 2012
- The Ethiopian Public Health Association Certificate of recognition for contribution to the success of the 13 World Congress on Public Health, 2012
- Special Certificate of Recognition for immense contribution as an advisor for first PhD dissertation defense undertaken at the Institute of Public Health, University of Gondar, 2013
- Special Certificate of Recognition for effective preparation and delivery of post graduate supervision and training of University of Gondar Staff, UoG, 2013
- Addis Ababa University, College of Health Sciences last 10 years best researcher award, 2014
- Certificate of Recognition of contributions towards the development and expansion of the School of Public Health, College of Health Sciences, Addis Ababa University
- Certificate of Recognition of Dedicated 17 years of Academic Services to the School of Medicine, College of Health Sciences, Addis Ababa University, 2014

MELINDA K. (DENNY) HIGGINS, PHD

Associate Research Professor
Nell Hodgson Woodruff School of Nursing
Emory University
Telephone: 404-727-5180
Email: melinda.higgins@emory.edu

Education

Dates	Institution and Location	Degree (major)
1985 - 1989	Saint Andrews Presbyterian College, Laurinburg, NC	BS (Double Major: Math and Chemistry)
1989 - 1994	University of South Carolina, Columbia, SC	PhD (Chemometrics/Analytical Chemistry)
1994 - 1995	University of South Carolina, Columbia, SC	MS (Statistics)

Licenses and Certifications

Date	Certification
1998	Project Director (Georgia Tech Research Institute)
1997-2012	SECRET Security Clearance (Georgia Tech Research Institute)
2001-2012	TOP SECRET (SCI/DCID b/4) Security Clearance (Georgia Tech Research Institute)

Honors and Awards

Year	Award
2018	ASA Award for Outstanding Chapter Service
1995	First Place Annual Student Paper Competition SC Chapter of the American Statistical Association
1994	Mu Sigma Rho (Statistical Honor Society), Inducted
1994	Professional Women on Campus Award for an Outstanding Paper by a Woman Graduate Student, University of South Carolina, Columbia, SC
1989	Mobay Fellowship, University of South Carolina, Columbia, SC
1989	Inducted into Alpha Chi (Chemical Honor Society)

Professional Positions

Dates	Position	Institution
04/2007 - current	Associate Research Professor	Emory University
07/2005 - 01/2011	Principal Research Scientist	Georgia Tech Research Institute
07/2000 - 06/2005	Senior Research Scientist	Georgia Tech Research Institute
07/1995 - 06/2000	Research Scientist II	Georgia Tech Research Institute
10/1995 - 01/1996	Temporary Technical Advisor	Georgia Tech Research Institute
08/1994 - 09/1995	Professor of Record (Statistics 201)	University of South Carolina
08/1989 - 07/1994	Teaching Assistant, Honors Chemistry	University of South Carolina
08/1989 - 07/1994	Graduate Research Assistant	University of South Carolina
01/1990 - 07/1994	Assistant Instructor (Experimental Design for Productivity and Quality in Research)	Statistical Designs

Scholarship: Grants and Other Funding

Research Grants Under Review

Developing a Distance Education System to Train Savvy Caregiver Program Interventionists: Extending Access and Capacity in Community-Based Delivery of Evidence-Based Interventions

PI	Hepburn, Kenneth
Funding Agency	NIH
Role	Co-investigator
Percent Effort	7.5 %
Start Date	2018-09-01
End Date	2022-08-31
Proposed Funding	\$2,146,377

Stress and estrogen in aging

PI	Michopoulos, Vasiliki
Funding Agency	NIH
Role	Co-investigator
Percent Effort	10 %
Start Date	2018-07-01
End Date	2023-06-30
Proposed Funding	\$4,343,523

SUCCESSFUL Project (Sustained, Unbroken Connection to Care, Entry Services and Suppression + FUnctional Living)

PI	Spaulding, Anne
Funding Agency	NIH
Role	Co investigator
Percent Effort	20 %
Start Date	2018-07-01
End Date	2023-06-30
Proposed Funding	\$3,879,332

Research Grants Funded

Yoga for female veterans with PTSD symptoms and military sexual trauma exposure

PI Higgins, Melinda
Funding Agency US Dept of Veterans Affairs (VANAP/ IPA)
Role PI
Percent Effort 5 %
Start Date 2016-06-01
End Date 2020-05-31

Testing Tele-Savvy, an On-line Psychoeducation Program for Informal Alzheimer's Caregivers

PI Hepburn, Ken/Griffiths, Patty
Funding Agency NIH/NIA [1R01AG054079]
Role Co-Investigator
Percent Effort 10 %
Start Date 2016-08-01
End Date 2020-04-30

Early Life Stress and Adolescent Cocaine Abuse

PI Sanchez, M. & Howell, L.
Funding Agency NIH-NIDA, R01 DA038588
Role Co-Investigator
Percent Effort 5 %
Start Date 2014-09-30
End Date 2019-07-31

Stress and Obesity Synergize to Impair Neurobehavioral Development in Females

PI Wilson, M. & Sanchez, M.
Funding Agency NIH-NICHD, R01 HD077623
Role Co-Investigator
Percent Effort 5 %
Start Date 2013-07-10
End Date 2018-06-30

Audio Music Self-Management Program to Improve Antiretroviral (ART) Adherence in Rural GA

PI Holstad, Marcia
Funding Agency NIH, R01 NR012923
Role Co-Investigator
Percent Effort 10 %
Start Date 2012-09-01
End Date 2017-11-30

Defining a PD-specific breath fingerprint of underlying inflammatory and neurodegenerative processes

PI Tanscy, Malu
Funding Agency Michael J. Fox Foundation
Role Co-Investigator

Melinda Higgins, PhD – last updated 6/30/2018

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Role	Co investigator
Percent Effort	5 %
Start Date	2010-07-01
End Date	2015-06-30

Neonatal Programming of Growth and Maturation in Rhesus Monkeys

PI	Muir, Andrew B.
Funding Agency	NIH-NICHD, R21 HD075764
Role	Co investigator
Percent Effort	5 %
Start Date	2013-06-15
End Date	2015-05-31

African Health Workforce Project

PI	Rogers, Martha
Funding Agency	Association of Schools of Public Health, S5033
Role	Biostatistician
Percent Effort	5 %
Start Date	2013-08-15
End Date	2014-08-14

Pilot study to examine the contribution of a calculated three-dimensional radiation therapy (RT) dose distribution on the development of significant CVD events

PI	Reilly, Carolyn
Funding Agency	RTOG
Role	Co-investigator
Percent Effort	2.5 %
Start Date	2013-10-01
End Date	2014-05-31

Pregnancy Health Among Florida Farmworkers

PI	McCauley, Linda
Funding Agency	Centers for Disease Control (CDC), 5R21OH009830
Role	Biostatistician
Percent Effort	5 %
Start Date	2009-09-01
End Date	2013-08-31

Cost Effectiveness and Quality of Life in Heart Failure Patients with Diabetes

PI	Dunbar, Sandra
Funding Agency	NIH/NINR, R01NR011888
Role	Co investigator
Percent Effort	10 %
Start Date	2009-09-29
End Date	2013-07-31

Psychoneuroimmune Contributions to Postpartum Depression (NIH)

PI	Corwin, Elizabeth
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Funding Agency NIH, R01 NR011278
 Role Biostatistician
 Percent Effort 15 %
 Start Date 2012-01-01
 End Date 2013-06-30

Neurobiology of increased vulnerability to social stressors during adolescence

PI Wilson, Mark
 Funding Agency NIH/NIMH, 1R01 MH079100
 Role Biostatistician
 Percent Effort 10 %
 Start Date 2008-04-01
 End Date 2013-03-31

Psychosocial disruption of estrogen action on behavior

PI Toutexis, Donna
 Funding Agency NIH/NIMH, 1R01 MH081816
 Role Biostatistician
 Percent Effort 5 %
 Start Date 2009-05-01
 End Date 2013-02-28

A Pilot Analysis of Late-Prematurity and Birth History in Children with Autism (CHOA)

PI Darcy, Ashley
 Funding Agency Childrens Healthcare of Atlanta
 Role Biostatistician
 Percent Effort 2 %
 Start Date 2011-11-01
 End Date 2012-10-31

Prevalence and Correlates of Human Papillomavirus (HPV) Vaccination in Rural Areas

PI Thomas, Tami
 Funding Agency Robert Wood Johnson Foundation, 67983
 Role Biostatistician
 Percent Effort 2 %
 Start Date 2010-10-01
 End Date 2012-09-20

Nursing Care Interactive to Improve CMS Indicators

PI Hepburn, Ken
 Funding Agency Healthcare Interactive, AG023451
 Role Biostatistician
 Percent Effort 10 %
 Start Date 2011-11-15
 End Date 2012-08-31

CCD Statistical Modeling for the Chemical Companion

PI Higgins, Melinda

Funding Agency	Georgia Tech Research Institute
Role	PI
Percent Effort	25 %
Start Date	2011-06-20
End Date	2011-10-30

The Kenya Health Workforce Project

PI	Rogers, Martha
Funding Agency	Assoc. of School of Public Health, S3800 26/28
Role	Biostatistician
Percent Effort	5 %
Start Date	2011-09-28
End Date	2011-09-27

Improving Self Management and Outcomes in HF Patients with Diabetes

PI	Dunbar, Sandra
Funding Agency	NIH/NINR, 1R21NR011204
Role	Biostatistician
Percent Effort	2.5 %
Start Date	2009-09-01
End Date	2011-08-31

An Audio Music Self Management Adherence Program

PI	Holstad, Marcia
Funding Agency	NIH, 5R21NR01086202
Role	Biostatistician
Percent Effort	2.5 %
Start Date	2008-04-11
End Date	2011-06-30

Prevent and Reduce Adverse Health Effects of Pesticides on Indigenous Farmworkers

PI	McCauley, Linda
Funding Agency	Oregon Law Center/NIH Subcontract, 1R24MD002798
Role	Biostatistician
Percent Effort	7 %
Start Date	2009-04-01
End Date	2011-03-31

The Emory Alzheimer's Disease Center

PI	Levey, Allen
Funding Agency	NIH/NIA, 5CA025688
Role	Biostatistician
Percent Effort	5 %
Start Date	2005-06-01
End Date	2010-04-30

A Family Partnership Intervention for Heart Failure

PI	Dunbar, Sandra
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Funding Agency NIH/NINR, R01 NR008800
Role Biostatistician
Percent Effort 5 %
Start Date 2004-06-01
End Date 2009-11-30

Center for research on Symptoms, Symptom Interactions, and Health Outcomes (Pilot Award)

PI Hepburn, Ken
Funding Agency NIH/NINR, P20NR07798
Role Biostatistician
Percent Effort 14 %
Start Date 2008-07-01
End Date 2009-06-30

Integrated Statistical Framework for Assessing Symptom Clusters and Interactions

PI Higgins, Melinda
Funding Agency Emory University 5 32895
Role PI
Percent Effort 11 %
Start Date 2008-05-13
End Date 2009-06-30

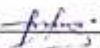
APPENDIX-R: Declaration

DECLARATION FORM

LETTER FOR DECLARATION (DISSERTATION WORK)

I, the under signed, declared 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.

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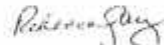
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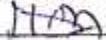
Date of submission: 02-8/2023

This dissertation has been submitted for examination with my approval as University Supervisor.

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APPENDIX-S: Similarity Checked by Turnitin

CARDIOVASCULAR DISEASE RISK REDUCTION BEHAVIORS,
KNOWLEDGE AND RISK PERCEPTION OF ADULT
HYPERTENSIVES IN ADDIS ABABA

by Daniel Mengistu

Submission date: 05-Jun-2023 10:10AM (UTC+0300)

Submission ID: 2109284609

File name: dissertation_book-final.docx (9.18M)

Word count: 74349

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APPENDIX-T: Original Publications

Low Subjective Cardiovascular Disease Risk Perceptions among Hypertensive Patients in Addis Ababa, Ethiopia

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Background: Accurate cardiovascular disease (CVD) risk appraisal is essential for hypertensive patients to identify correctly their risk status and take efficient behavioral measures timely to avoid major adverse outcomes. However, hypertensive patients' risk perceptions of CVD events in Ethiopia are unknown. Thus, the study aimed to compare the subjective CVD risk perception level of patients with the nonlaboratory Framingham Risk Score (nl-FRS).

Methods: A cross-sectional design was used. The Attitudes and Beliefs about Cardiovascular Disease Risk Questionnaire and the nl-FRS were used to compare subjective versus objective measures of CVD risk. Agreement between participants' risk perceptions and the nl-FRS were examined using the kappa statistic. Bivariate chi-square test and multinomial logistic regression analyses were run to identify factors associated with risk perceptions. The statistical significance was set at a p-value < 0.05 level.

Results: Participants (n=377) had a mean age of 53.61 ± 12.80 -years, range (18–82 years), 51.2% were males, 42.7% had less than high school education, 45.1% achieved target BP control, and mean HTN duration was 8.01 ± 6.07 years. The majority (58.62%) of the participants had a low subjective risk perception of CVD events (mean 17.79, 95% CI: 17.43–18.15). Approximately three-fourths (72.4%) had a moderate nl-FRS risk calculation (mean, 13.84, 95% CI: 13.36–14.33). Agreement between participants perceived-risk and the nl-FRS was poor (kappa = 0.0002, standard error = 0.023, p = 0.99). Participants' CVD risk-perception inaccuracy was also high (76%) primarily due to underestimation. Hypertension duration, frequency of physician visits, and level of diabetes control were significant predictors of CVD risk underestimation.

Conclusion: Hypertensive patients had inaccurate and low subjective risk perceptions of CVD events compared to moderate objective risks identified using the nl-FRS. Planned education on HTN and CVD risk factors is essential to improve patients' CVD risk perception to reduce adverse CVD events.

Keywords: hypertension, risk-perception, CVD

Background

Adverse cardiovascular disease (CVD) outcomes such as stroke and acute myocardial infarction (AMI) are serious and often life-threatening occurrences related to uncontrolled hypertension (HTN). Cardiovascular disease remains the single largest cause of death and disabilities worldwide with over 17 million deaths each year, representing nearly 30% of all deaths and 10% of the global disease burden (GDB).^{1–4} Over 80% of these deaths occur in low and middle-income countries (LMICs).^{3,5,6} Of the 17 million CVD worldwide deaths each year, HTN is estimated to cause more than half (9.54 million) of these deaths.^{4,6–8} Hypertension is the strongest contributor to adverse CVD outcomes (such as stroke, coronary heart disease [CHD], heart failure [HF], end-stage renal disease, and peripheral vascular disease).^{9–15} Of the major cardiovascular (CV) events; 51% and 45% of stroke and CHD deaths, respectively, occurred due to HTN.⁶ The

prevalence of HTN has remained high and approximately 30% of adults worldwide currently live with HTN.¹⁶ In Ethiopia, the prevalence of HTN is estimated to be between 13% - 30%,¹⁷⁻²⁵ which would likely be higher if the more recent blood pressure (BP) risk classification 130/80 by the Joint National Committee (JNC 8) was applied.²⁶

According to the Framingham Heart Study, individuals who are normotensive at age 55 years (men) and 65 years (women) have a 90% lifetime risk for developing HTN.²⁷ Because longevity is increasing in LMICs²⁸ due to several factors, it is expected that there will be a dramatic rise in the number of persons with hypertension who are at risk for adverse CVD events and outcomes over the next several decades.²⁹⁻³²

Studies have consistently reported that hypertensive patients often have inaccurate subjective risk perceptions of adverse CVD event^{33,34} and underestimate their risk when compared to objective measures such as the FRS.³⁵⁻³⁷ For example, despite an increased risk of CVD events from comorbidities such as diabetes and unhealthy lifestyle behaviors (smoking), hypertensive patients were unable to provide an accurate risk estimate^{33,38,39} even in high-income countries (HICs) such as the Netherlands,³³ US,⁴⁰ and Switzerland.⁴¹

Research on CVD risk perceptions in Africa is very limited. A study by Ajayi et al in Nigeria showed the poor perception of stroke risk among hypertensive patients³⁷ which is similar to several studies conducted in HICs.^{33,35,42} Studies examining subjective self-risk perceptions of CVD outcomes among hypertensive patients are currently non-existent in Ethiopia and are also scarce in Africa. Inaccurate CVD risk perceptions may also hinder behavioral strategies shown to be effective for high BP control resulting in higher CVD mortality rates. The primary aim of the current study was to compare hypertensive patients' subjective risk perceptions with an objective measure of CVD risk using the nl-FRS 10-year CVD risk score. A secondary aim was to determine the accuracy of subjective CVD risk perceptions among adult hypertensive participants attending follow-up care at a cardiology tertiary care outpatient clinic in Addis Ababa, Ethiopia.

Methods and Materials

Study Area, Design, and Period

A cross-sectional study was conducted between February and August 2020 among 384 adult hypertensive participants attending follow-up care at a large, academic, and tertiary care outpatient clinic in Addis Ababa, Ethiopia.

Eligibility Criteria

The inclusion criteria were: 1) 30 years of age or older, 2) a minimum of three-follow-up visits in the hypertension clinic, 3) able to hear and respond appropriately to questions in the local language (Amharic), 4) not pregnant, 5) no history of CVD event, 6) no major active Axis I psychiatric condition or cognitively impaired, and 7) no history of a terminal illness such as cancer.

Sample Size Determination and Sampling Technique

The sample size was determined based on one sample *t*-test (as the below formula) with the assumptions of observations are independent; data fit the normal distribution; homogeneity of variance and the power set at 0.80 ($\beta=0.2$) and α (two-sided) set at 0.05 and standardized effect size of 0.15 (small)⁴³ and considering a further 10% non-response rate for potential missing data due to the interview format.

$$\text{Sample size, } n = (Z_{\alpha/2} + Z_{\beta})^2 / d^2$$

Where $Z_{\alpha/2} = 1.96$ (from Z table) at type 1 error of 5%

$Z_{\beta} = Z_{0.20} = 0.842$ (from Z table) at 80% power

$ES^2 = \text{effect size (small, 0.15)}$

$n = (1.96 + 0.842)^2 / (0.15)^2 = 348.94 + 35 \text{ (10\% non-response)} = 384$ We used the hypertensive patient's clinic follow-up registry that had the list of 1200 patients on follow-up to obtain the representative sample and recruited 384 participants for the study using the systematic random sampling technique.

Data Collection Technique and Procedure

Potential hypertensive participants were approached by Bachelor's degree qualified trained data collectors after receiving their routine follow-up care from their clinic providers. Two data collectors and one supervisor, who were trained for two days on data collection and mock exercised the interview technique and physiologic measurement procedures collected the data in a prearranged private room by a face-to-face interviewer-administered using the standardized instruments. To ensure the data quality, the instruments were translated from their original English language to the local language (Amharic) and then back to English by professional translators; the translations were very consistent. The Amharic version was used for the data collection. The instruments were piloted on 10% of the Ethiopian hypertensive patient sample at a similar tertiary level hospital to determine potential participants' understanding of questionnaire contents. Additionally, the principal investigator monitored the data collection process and checked for data completeness, consistency, and accuracy daily.

Ethical Clearance and Consent of Participants

The study was approved by the institutional review board (IRB) of the College of Health Sciences of Addis Ababa University (AAU) (IRB protocol # 09/81) and complied with the Declaration of Helsinki. All participants reviewed and provided written consent before any study activities.

Measurements and Operational Definition

Sociodemographic and clinical variables included: age, gender, marital status, educational status, and income. The clinical and health status profile included: a history of the previous hospitalization related to CVD, co-morbidities, family history of HTN, antihypertensive and other medications, lifestyle factors such as smoking, dietary intake (number of daily fruits and vegetables), and physical activity (average time spent in moderate-intensity activities). Physiological measurements included BP measurement, weight, and height.

ABCD Risk Questionnaire: Participants' subjective self-risk perception of CVD events was measured by the ABCD Risk Questionnaire, an 8-item questionnaire that has internal consistency reliability of 0.85.^{44–46} Permission to use the questionnaire was obtained from the British Medical Journal Publishing Group Ltd. The scores on the questionnaire range from 0-to 32, with higher scores showing that patients perceive a greater risk of having an adverse CVD event (a heart attack and stroke). For interpretations, participants' total scores were categorized based on percentiles using the SPSS statistical software as low (0–17.00); moderate (17.10–19.00); and high (19.10 –32.0) for their subjective risk perceptions.

Non-laboratory-based risk estimations (nl-FRS): The Framingham 10-year CVD risk estimation uses both laboratory and non-laboratory-based risk estimations. Studies have shown that the two methods are highly correlated ($r = 0.88$ to 0.986) in terms of risk assessment and that the nl-FRS predicted CVD outcomes as accurately as laboratory tested.^{45,46} Although no studies have validated the nl-FRS in the Ethiopian population, it has been validated in South Africa.⁴⁶ The nl-FRS uses the same clinical measurement parameters as the FRS (sex, age, SBP, diabetes, current smoking, anti-hypertensive medication), and the lipid laboratory values are replaced by BMI. In the present study, we calculated the nl-FRS based on sex, age, SBP (treated), presence or absence of diabetes, smoking status, and BMI.⁴⁷ Then, we categorized participants' CVD event risk using the conventional threshold of CVD risk stratifications as low (<10%), moderate (10–19%), and high risks ($\geq 20\%$),^{47,48} which is consistent with the original FRS instrument.

Data Analysis

We analyzed the data after entering coded data into Epidata version 3.1 and cleansed and then exported it to SPSS version 25.00 statistical software package. Descriptive univariate analysis was run to examine the data and its plausible values, and assumptions of the logistic regression model. Perceived subjective risk and objective nl-FRS were examined using descriptive statistics, computed for the composite scores, and percentiles determined. Accordingly, patients were placed on three ordinal risk statuses as low, moderate, and high CVD risk. The levels of agreement between subjective perceptions and objective nl-FRS risk scores were calculated using Cohen's Kappa statistics. Participants were

categorized as: underestimation (low subjective CVD risk compared to the nl-FRS), agreement (subjective CVD risk agrees to the nl-FRS), and overestimation (subjective CVD risk is higher than nl-FRS). Bivariate chi-square test and multinomial logistic regression analyses were used to identify predictor variables associated with the risk perceptions (outcome variable). Variables with p-values < 0.3 in the bivariate chi-square test were considered in the final multinomial logistic regression model, and finally variables with a p-value of < 0.05 level were considered statistically significant. Odds ratio (OR) at 95% CI was considered to declare that there exist the predictor variable effects on the outcome variable. The findings are summarized below.

Results

Participants enrolled (n= 377) were predominately male (51.2%, n= 193) with a mean age of 53.61 ± 12.80 years, (range, 30–82 years) (Table 1). Three-fourths (75.3%) were married, 42.7% had less than 8th-grade education, 47.5% had a monthly income between 3001–6000 ETB (~85–171 USD), and 38.15% had a family history of HTN. Nearly three-quarters (72.10%) of them were attending follow-up care every two months for HTN. Only less than half (45.1%) achieved target BP control though the mean (134.18 ± 16.02 mmHg) SBP measurement showed patients had a BP level within the recommended range based on the current local and international HTN management guidelines.^{49–51} Over half (56.23%) of the participants had comorbidities; diabetes was the most common (48.11%). Over three-fourths (76.7%) reported their physician providers were the main source of information regarding the seriousness of HTN. Overweight and obesity were common with 60% having a mean BMI of 26.02 ± 4.09 Kg/M². The mean and median duration of HTN was 8.01 ± 6.07 and 6.00 years, respectively (range, 1–30 years). The sociodemographic and clinical characteristics of participants are shown in Table 1 below.

Table 1 Sociodemographic and Clinical Characteristics of Adult Hypertensive Patients Attending CV Follow-Up at a Tertiary Outpatient Clinic in Addis Ababa, Ethiopia, 2020 (n=377)

Characteristics	Frequency	Percentage
Age in year (Mean $\pm$ SD)	53.61 $\pm$ 12.8	
30–39	56	14.9
40–59	188	49.87
≥ 60	133	35.2
Gender		
Male	193	51.2
Female	184	48.8
Marital status		
Single	52	13.8
Married	284	75.3
Divorced	21	5.6
Widowed	18	4.8
Separated	2	0.5
Educational status		
Cannot read and write	26	6.9
Elementary	135	35.8
High school	133	35.3
Diploma & above	83	22
Monthly income in ETB		
<1000	118	31.3
1000–3000	179	47.5
3001–6000	60	15.9

(Continued)

Table 1 (Continued).

Characteristics	Frequency	Percentage
6001–10,000	12	3.2
>10,000	8	2.1
Family history of HTN		
Yes	144	38.20
No	233	61.80
Physician visit frequency		
Every month	20	5.3
Every 2 months	272	72.1
Every 3 months	53	14.1
Every 4 months	14	3.7
Longer than 4 months	18	4.8
Target BP controlled		
Yes	170	45.1
No	207	54.9
Duration of HTN in years		
1–4	132	35.0
5–9	109	28.9
10–14	71	18.8
15–19	32	8.5
20+	33	8.8
BMI		
Underweight	10	2.7
Normal weight	141	37.4
Overweight	171	45.4
Obese	55	14.6
Source of information on the seriousness of HTN		
Physician	289	76.7
Nurse	65	17.2
Media	7	1.8
Others	5	1.3
From ≥ 2 sources	11	2.9
Comorbidity list (total 212)		
Diabetes	102	48.11
HHD	28	13.21
CKD	23	10.85
Others	59	27.83

Note: Target BP controlled (<140/90 mm Hg, or <130/80 mm Hg if CKD and/or diabetes).

The mean CVD risk perception was 17.79 (range 8–32), 95% CI: 17.43–18.15, showing the majority (58.62%) of the participants had a low subjective self-risk perception of having an adverse CVD event. In addition, based on the nl-FRS, 72.4% were at moderate risk (mean 13.84, 95% CI: 13.36–14.33, range 1–25) for experiencing an adverse CVD event over the next 10 years. The nl-FRS risk estimates (low, moderate, and high) are depicted in [Figure 1](#).

The inter-observation reliability of Cohen's Kappa statistics agreement ([Table 2](#)) between participants' perceived and the nl-Framingham risk estimate showed no agreement between them ($k = 0.0002$, $SE = 0.023$, $p = 0.99$).

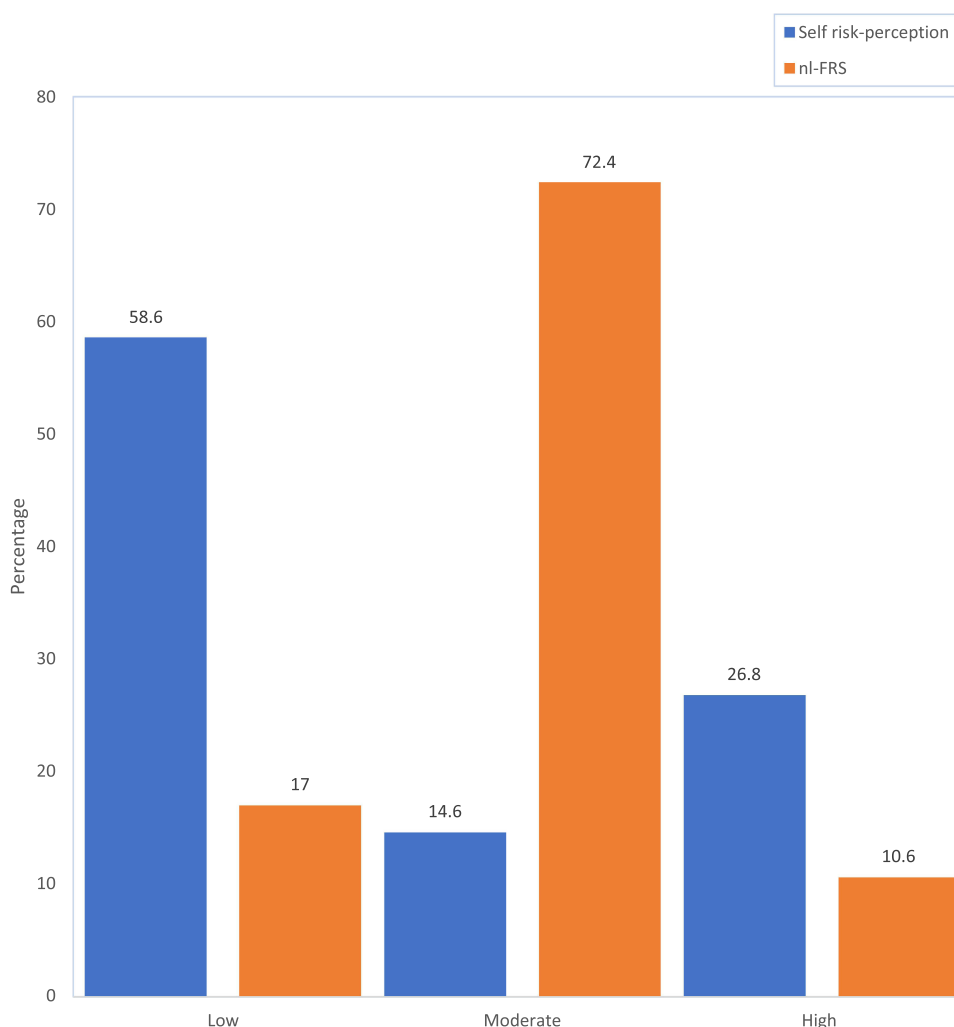


Figure 1 Bar graph showing subjective risk perception vs nl-FRS 10-year estimated CVD event among adult hypertensive patients attending CV follow-up care at a tertiary outpatient clinic in Addis Ababa, Ethiopia, 2020 (n= 377). Blue color: self-risk perception. Orange color: nl-FRS.

Overall, over three-quarters of the participants had inaccurate subjective perceptions of CVD risk levels, with most underestimating their risk. The objective risk using the nl-FRS, however, showed a moderate level of risk was present.

Table 2 Crosstabulation Showing Cohen's Kappa Agreement Between the Self-Perceived CVD Risk Outcome and NI-FRS 10-Year CVD Risk Estimated for Hypertensive Patients Attending CV Follow-Up at a Tertiary Hospital in Addis Ababa, Ethiopia, 2020 (n = 377)

		nl- FRS 10-Year CVD Risk Estimate, n (%)			Total	The Agreement, n (%)			Kappa	p-value
		Low	Moderate	High		Corresponded	UE	OE		
Perceived CVD risk	Low	36 (56.25)	162 (59.34)	23 (57.5)	221 (58.62)	88 (23.34)	189 (50.13)	100 (26.53)	0.0002	0.99
	Moderate	12 (18.78)	39 (14.29)	4 (10)	55 (14.59)					
	High	16 (25)	72 (26.37)	13 (32.5)	101 (26.79)					
Total		64 (100)	273 (100)	40 (100)	377 (100)					

Note: Standard error (SE = 0.023).

Abbreviations: UE, underestimated; OE, overestimated.

The bivariate chi-square test analyses of independent variables, the frequency of physician visits for HTN, and the duration of HTN were significantly associated with risk perceptions (Table 3). However, there were no observed associations between risk perceptions and sociodemographic or clinical variables.

All independent variables with p-values less than 0.3 were considered in the final multinomial logistic regression analysis model to test their association and strength of the association with the risk perception category. All the model data assumptions were checked with no violations identified. Multinomial logistic regression analyses (Table 4) showed inaccurate (overestimated) risk perception that was significantly associated with frequency of physician visits every two and three months, controlled diabetes, and HTN duration of 10–14 years. Similarly, inaccurate (underestimated) risk

Table 3 Bivariate Chi-Square Test Showing the Association Between Risk Perception Category (Kappa Agreements: Accurate, OE, and UE) and Independents Variables N = 377

Variable	KA			Total n(%)	χ^2	df	p-value
	Accurate (%)	OE n(%)	UE n(%)				
Marital status							
Single	10(19.2)	10(19.2)	32(61.5)	52(100)	4.916	4	0.296
Married	67(23.6)	76(26.8)	14(49.6)	284(100)			
Others	11(26.8)	14(34.1)	16(39)	41(100)			
Total	88(23.1)	100(26.5)	189(50.1)	377(100)			
Age (adults)							
Young	12(21.4)	12(21.4)	32(57.1)	56(100)	5.153	4	0.272
Middle age	46(24.5)	58(30.9)	84(47.7)	188(100)			
Elder	30(22.6)	30(22.6)	73(54.9)	133(100)			
Total	88(23.1)	100(26.5)	189(50.1)	377(100)			
Regular PA							
No	9(14.5)	14(22.6)	39(62.9)	62(100)	5.326	2	0.07
Yes	79(25.1)	86(27.3)	150(47.6)	315(100)			
Total	88(23.3)	100(26.5)	189(50.1)	377(100)			
Diabetes controlled diabetic							
No	21 (25.6)	21(25.6)	40(48.8)	82(100)	8.105	4	0.088
Yes	9 (37.5)	1(4.2)	14(58.3)	24(100)			
No diabetes	58(21.4)	78(28.8)	135(49.8)	271(100)			
Total	88(23.3)	100(26.5)	189(50.1)	377(100)			
HTN duration (in years)							
1–4	34(25.8)	30(22.7)	68(51.5)	132(100)	18.371	8	0.019*
4–9	23(21.1)	29(26.6)	57(52.3)	109(100)			
10–14	8(11.1)	21(29.6)	42(59.2)	71(100)			
15–19	10(31.3)	13(40.6)	9(28.1)	32(100)			
20+	13(39.4)	7(21.2)	13(39.4)	33(100)			
Total	88(23.3)	100(26.5)	189(50.1)	377(100)			
Physician visit Frequency							
Every month	3(13.6)	1(13.6)	16(72.7)	22(100)	13.78	6	0.032*
Every 2 months	63(23.2)	78(28.7)	131(48.2)	272(100)			
Every 3 months	9(17)	15(28.3)	29(54.7)	53(100)			
Every 4 months/longer	13(43.3)	4(13.3)	13(43.3)	30(100)			
Total	88(23.3)	100(26.5)	189(50.1)	377(100)			
Comorbidity							
N0	32(19.4)	47(28.5)	86(52.1)	165(100)	2.626	2	0.27
Yes	56(26.4)	53(25)	103(48.6)	212(100)			
Total	88(23.3)	100(26.5)	189(50.1)	377(100)			

Note: *Bold figures indicate significant findings.

Abbreviations: KA, Kappa agreement; OE, overestimation; UE, underestimation; df, degree of freedom.

Table 4 Multinomial Logistic Regression Analyses of Predictors of CVD Risk Perception Category (Accurate, UE, and OE) of Hypertensive Patients Attending CV Follow-Up Care at a Tertiary Clinic in Addis Ababa, Ethiopia, 2020 (n = 377)

KA		P-value	AOR	95% Confidence Interval for AOR	
				Lower Bound	Upper Bound
OE	Intercept	0.029			
	Physician visit- every month	0.200	3.783	0.495	28.892
	Physician visit- every 2 months	0.018	4.338	1.292	14.566*
	Physician visit- every 3 months	0.013	6.331	1.483	27.029*
	Physician visit- every 4months and beyond		1		
	Marital status-single	0.493	0.633	0.171	2.341
	Marital status-married	0.716	0.839	0.327	2.152
	Marital status-others		1		
	No comorbidity	0.495	1.277	0.633	2.579
	Have a comorbidity		1		
	Not engaged in PA	0.396	1.509	0.583	3.904
	Engaged in PA		1		
	Diabetes-not controlled	0.725	0.859	0.368	2.004
	Diabetes controlled	0.036	0.100	0.012	0.862*
	No history of diabetes		1		
	HTN duration 1–4 years	0.427	1.574	0.514	4.820
	HTN duration 5–9 years	0.144	2.366	0.746	7.505
	HTN duration 10–14 years	0.027	4.320	1.184	15.769*
	HTN duration 15–19 years	0.189	2.370	0.655	8.584
	HTN duration 20+ years		1		
UE	Young adults	0.952	1.034	0.350	3.054
	Middle-age adults	0.517	1.254	0.633	2.486
	Elders		1		
	Intercept	0.047			
	Physician visit -every month	0.052	4.656	0.988	21.934
	Physician visit - every 2 months	0.163	1.883	0.774	4.579
	Physician visit- every 3 months	0.045	3.211	1.029	10.023*
	Physician visit- every 4 months and beyond		1		
	Marital status-single	0.142	2.429	0.743	7.938

(Continued)

Table 4 (Continued).

KA		P-value	AOR	95% Confidence Interval for AOR	
				Lower Bound	Upper Bound
	Marital status-married	0.257	1.690	0.683	4.182
	Marital status-others		I		
	No comorbidity	0.205	1.512	0.798	2.867
	Have a comorbidity		I		
	Not engaged in PA	0.025	2.585	1.125	5.939*
	Engaged in PA		I		
	Diabetes- not controlled	0.464	1.326	0.623	2.821
	Diabetes - controlled	0.788	0.870	0.315	2.404
	No history of diabetes		I		
	HTN duration 1–4 years	0.081	2.342	0.901	6.088
	HTN duration 5–9 years	0.023	3.176	1.174	8.590*
	HTN duration 10–14 years	0.002	6.354	2.004	20.145*
	HTN duration 15–19 years	0.905	0.926	0.265	3.242
	HTN duration 20+ years		I		
	Young adults	0.634	0.796	0.311	2.037
	Middle-age adults	0.179	0.660	0.360	1.210
	Elders		I		

Notes: I (reference group). *Bold texts and figures indicate significant findings.

Abbreviations: KA, Kappa agreement; OE, overestimated; UE, underestimated.

perception was significantly associated with frequency of physician visits every three months, not engaged in PA, HTN duration of 5–9 years, and the HTN duration of 10–14 years.

Patients who had the clinic follow-up every two and three months overestimated their CVD risk four to six-fold (OR: 4.34, 95% CI: 1.29–14.57, $p = 0.018$ and OR: 6.33, 95% CI: 1.48–27.03, $p = 0.013$), respectively compared to those who had the four months or longer. Patients with controlled diabetes were 90% less likely to overestimate their CVD risk (OR: 0.10, 95% CI: 0.01–0.86, $p = 0.036$) compared to those with no history of diabetes. Physician visits every three months were associated with a three times greater likelihood (OR: 3.21, 95% CI: 1.03–10.02, $p = 0.045$) to perceive lower CVD risk compared to those with the frequency of visits every four months or longer.

Patients who did not engage in regular PA tended to underestimate almost three times (OR: 2.58, 95% CI: 1.13–3.94, $p = 0.025$) their CVD risk compared to those engaged in regular PA. Patients with HTN duration of 5–9 years and 10–14 years tend to underestimate their CVD risk about three times and six times (OR: 3.17, 95% CI: 3.18–8.59, $p = 0.023$ and OR: 6.35, 95% CI: 2.00–20.14, $p = 0.002$, respectively) compared to those with HTN duration of 20 years or more.

Discussion

The primary aim of the study was to compare subjective perceptions with an objective measure of CVD risk using the nI-FRS among adult hypertensive patients attending follow-up care at a tertiary outpatient clinic in Addis Ababa, Ethiopia. The major findings of the study were low subjective risk perception (underestimation) of CVD events, moderate risk of

future CVD adverse events based on the nl-FRS, and lack of agreement between participants' subjective perceptions and an objective nl-FRS measure.

The mean CVD risk perception suggests most participants had low subjective risk perceptions. Studies measuring risk perceptions among hypertensive patients are limited in Ethiopia. Several studies that have examined hypertensive patients' risk perceptions in other countries, however, have reported similar findings with 46%⁵² and 41%⁵³ of participants having low CVD risk perceptions of adverse events. Several other HTN studies also reported comparable findings (64–65%) of low CVD risk perceptions.^{54,55} Although plenty of studies since Weinstein (1980)⁵⁶ refer risk underestimation to as “optimistic bias”,^{53,56–58} which is an error in an individual's judgment tending to rate oneself above average for positive events and below average for the negatives,⁵⁶ risk perceptions are threat specific, rather than reflecting a general sense of optimism or pessimism.⁵⁹ The finding of low CVD risk perception in this population in Ethiopia is very concerning since all patients were receiving care at a large academic tertiary care level clinic where they are more likely to be informed about risk factors being referred from smaller, community-level hospitals.

The finding that many participants had low rates of BP control (45.1%) and were not engaged in CVD reduction behaviors (52.52%) may be attributed to a lack of knowledge. Only a small proportion of participants perceived their CVD risk at moderate (14.6%) and high (26.8%) levels. This differed from the study of Lefler et al who showed rural, lower socioeconomic residents had higher CVD risk perceptions⁵³ in a small sample of older age patients. Participants in the current study lived in a large urban area and were younger but most also had a lower education level, which may be a key factor in patients being unable to correctly perceive their CVD risks. Further studies are needed to determine which strategies work best among individuals with low educational levels to improve CVD risk knowledge and perceptions.

Based on the nl-FRS, nearly three-quarters of participants were at moderate CVD risk. Although the discussion of this finding was restricted by the lack of studies in Ethiopia for comparison, the findings were inconsistent with studies in Brazil and South Korea that found most participants to be at low CVD risk based on the nl-FRS (77.9% and 54.2%, respectively).^{55,60} The differences may be due to demographic variations of risk factors among participants across countries. For example, the mean age in the present study was higher than in Brazil and South Korean studies.^{55,60} Interestingly, those who were at high (10.6%) CVD risk in the present study were comparable to previous studies finding 7.7%⁵⁵ and 12.6%.⁶⁰ However, this is far less when compared to the proportion (41%) of patients with other chronic conditions such as rheumatoid arthritis who misperceived their CVD risk mainly of the risk overestimation,⁶¹ which may be due to the physical limitations posed on those patients by the disease.

The subjectively-perceived CVD risk kappa agreement or accuracy with the nl-FRS 10-year CVD risk estimated was poor ($k = 0.002$, $p = 0.99$) with a low rate (23.34%) of accuracy (Table 2), which is alarming for patients receiving long-term follow-up care at a tertiary clinic. In several previous studies, rates of patients who had accurate risk perceptions were consistently low and comparable with the present finding.^{62–65} However, some prior studies have documented higher rates of agreement between patients' risk perceptions and their laboratory FRS^{52,55} than the current study findings. For instance, compared to the present study, most participants in the Katz et al 2015⁵⁵ study were higher in socioeconomic status and patients with lower socioeconomic status were also found to have less accurate CVD risk perceptions.⁶⁶ The majority of our study participants had inaccurate risk-perception of CVD risk, mainly due to CVD risk underestimation, which is also consistent with several studies that reported poor risk-perceptions agreement between patients' perceived and their FRS 10-year CVD risk calculated with tendencies for optimism (risk underestimation).^{5,52,54,61–73} The finding of consistently low agreements between patients' subjectively perceived and objectively predicted CVD risk in the present and several previous studies' findings may signal the importance of appraising patients' CVD risk factors. The paramount importance of studies of risk perceptions is their ability to uncover individuals' risk appraisal of a disease threat or a health condition and the ability to self-evaluate and construe its potential health consequences.^{59,74} This is apparent from the Health Belief Model (HBM), which has been widely used in health and behavioral research, that the concept of individual perception of susceptibility and seriousness of the disease threat is recognized as the key components for optimal behavior changes.⁷⁵ That means perceptions of risk were conditional factors for behavioral change to occur, but alone were not sufficient for individuals to engage to the recommended actions.^{76,77} It is generally believed that an individual seeks preventive care including health screening if he/she has sufficient motivation for the health issue of concern. On the other hand, this motivation is enhanced if he/she

believes that he/she is susceptible (perceived susceptibility) to a serious health condition or its aftermaths (perceived severity) and that undertaking the recommended preventive behavioral action will avert or mitigate the known risk, taking into account the relative advantages of the actions to be taken over barriers to actions.^{73,75} Thus, Lowering CVD risk through lifestyle changes and the avoidance of adverse events requires an accurate estimation of CVD risk.

The FRS laboratory and non-laboratory-based results' comparability is limited in Africa to one study,⁷⁸ but has been compared in other countries with acceptable reliability.⁴⁶ Validated CVD risk tools are currently lacking in Ethiopia and the eastern sub-Saharan Africa population. Studies of CVD clinical characteristics using the FRS (including Africa) showed a high correlation between non-laboratory-based and laboratory-based scores ($r = 0.88\text{--}0.986$), the nl-FRS predicted CVD outcomes as accurately as a laboratory.^{45,46} The use of the nl-FRS is ideal in LMICs like Ethiopia where laboratory assessments are cost-prohibitive since most tests are not covered by insurance, requiring out-of-pocket payment and there is a lack of available laboratories, especially in rural geographic areas.

Participants who had the clinic visits every two and three months overestimated (Table 4) their CVD risk by four and six-fold respectively, compared to those who visited less often. Patients may perceive their HTN as more of a health threat requiring more attention when they were put on a more frequent clinic schedule. CVD risk overestimation is thought to be more health-protective and preferred compared to underestimation,⁷⁹ since it may trigger patients to participate in positive healthy behaviors to reduce the likelihood of adverse CVD outcomes. It is also possible that those with more frequent clinic visits received a higher level of provider support concerning risk reduction behaviors (diet, PA, body weight, medication adherence including monitoring of side effects and dose adjustments), which may translate to the adoption of healthier behaviors, improved blood pressure control and in turn lower CVD risk.

Hypertensive patients with controlled diabetes (Table 4) were 90% less likely to overestimate their CVD risk compared to those with no history of diabetes. Previous studies have shown that patients with a history of diabetes had higher CVD risk-perception^{66,69} and in some studies overestimated their CVD risk.³³ It is well established that Type II diabetes mellitus (T2DM) is a strong risk factor for the development of CVD. The reason for higher risk perception may be related to ongoing provider communication of the likelihood of developing heart disease in the presence of T2DM. It is also possible that family members or significant others who developed CVD because of T2DM received or requested more targeted education on risk reduction.

In the present study, hypertensive patients with a duration of 10–14 years overestimated their CVD risk as nearly four times higher than those with a 20-year or greater history. This was consistent with a study in Nepal that reported a significant association between HTN duration of 10–15 years and overestimation of CVD risk.⁸⁰ In the present study, the duration of HTN exhibited a U-shaped pattern with 10–14 years as the peak, which suggests the importance of disease over time on CVD risk perceptions. In the original Framingham Heart Study, the progression of HTN to target organ diseases (TOD) such as HF and other CVD complications had a mean of 14 years.⁸¹ In comparison, over 78 months, in a retrospective follow-up study of hypertensive patients in Gondar (Ethiopia) that examined the progression of HTN, CVD complications were present at the time of diagnosis,⁸² which are likely due to late clinical presentation of HTN and/or late health-seeking behavior of the patients and reinforces why HTN is called “the silent killer”.⁸³ In addition, the study showed lower rates of HTN complications in the first three years of treatment but after seven years, the risk of developing complications increased threefold.⁸² Poor HTN control, low treatment adherence rates, and late diagnosis in Ethiopia may explain the differences in clinical presentation and outcomes. Treatment of CVD is not necessarily associated with reduced risk. A retrospective, large cohort study ($n = 3150$) of adults in Brazil followed for two years to examine the progression of CVD risk using the FRS showed those classified as moderate to high risk at year one follow-up showed a 31% increase in CVD risk at year two.⁸⁴ In addition, 66% of those who were classified as high CVD risk in the first assessment did not exhibit improved risk status at year two follow-up.⁸⁴ Specifically, the Brazil study showed poorer serum lipid levels and no significant mean BP changes.⁸⁴ Regular risk assessments that integrate patient education and self-management strategies are essential to reduce the potential adverse CVD outcomes among hypertensive patients. In the present study, the finding of significant relationships between participants' underestimation and overestimation of subjective risk perceptions with HTN duration and frequency of physician visits was a counterintuitive finding, which may be encountered due to prevalent poor CVD risk perceptions.⁸⁵

The present findings of prevalent subjective CVD risk underestimation and poor kappa agreement between the subjective and objective CVD risk measures may be related to the less common occurrence of CVD risk in the general population as CVD is in the emergent phase in Ethiopia with less coverage by media in creating public awareness on the seriousness and escalating nature of CVD, which was evidenced by participants source of information, and lack of a single lipid test for most of the participants. In this case, participants' unrealistic CVD risk underestimation may be due to a general lack of information and awareness, which is also supported by literature that low education and literacy skills were associated with unrealistic risk underestimation.⁸⁶ Regular risk assessments that integrate patient education and self-management strategies are essential to reduce the potential adverse CVD outcomes among hypertensive patients.

Strengths of the Study

To our knowledge, this is the first study to examine subjective CVD risk perceptions using self-report measures compared to an objective, nl-FRS calculation among hypertensive patients receiving outpatient tertiary level care in Ethiopia. The findings provide important insights and directions for further research and the need for large-scale national campaigns on HTN and CVD risk reduction. The sample size was large and adequately powered. The random selection of participants for the study reduced the likelihood of selection bias.

Limitations

The study was conducted at one academic referral center which limits generalization to other populations in Ethiopia. The cross-sectional design also limited the causality of the association between low-risk perceptions and objective nl-FRS measures.

Conclusions and Implications

In summary, in the present study, higher proportions of participants had low-risk perceptions despite having moderate to high objective CVD risks as determined by the nl-FRS. This shows a need for greater CVD risk factor knowledge and awareness as a national priority. In addition, primary care and community clinics are important venues to educate the public on blood pressure awareness since most of the population in Ethiopia uses these services versus academic tertiary care centers. Incorporating risk reduction strategies and the importance of managing HTN to prevent CVD adverse outcomes should begin early with risk assessment beginning in adolescents and young adults.

The findings suggest that most hypertensive patients underestimated their CVD risk and were at moderate risk for CVD events when compared to an objective measure, the nl FRS. The study established a clear need for education on CVD risk reduction strategies that will enable hypertensive patients to more accurately recognize CVD risk factors that would improve outcomes in this rapidly emerging population in Ethiopia.

Abbreviations

AAU, Addis Ababa University; ABCD, attitude and beliefs about cardiovascular disease; AMI, acute myocardial infarction; AOR, adjusted odds ratio; BMI, body mass index; BP, blood pressure; CHD, coronary heart disease; CI, confidence interval; CKD, chronic kidney disease; CV, cardiovascular; CVD, cardiovascular disease; ETB, Ethiopian Birr; FRS, Framingham Risk Score; GDB, global disease burden; HF, heart failure; HHD, hypertensive heart disease; HICs, high income countries; HTN, hypertension; IRB, institutional review board; JNC, Joint National Committee; K, Kappa; KA, kappa statistics; Kg, kilogram; LMICs, low and middle-income countries; M², meter square; mmHg, millimeter of mercury; MNLR, multinomial logistic regression; ni-FRS, non-laboratory Framingham Risk Score; OE, overestimation; OR, odds ratio; AOR, adjusted odds ratio; PA, physical activity; SBP, systolic blood pressure; SE, standard error; T2DM, type 2 diabetes; TOD, target organ disease; UE, underestimation; US, United States; USD, United States" Dollar.

Data Sharing Statement

The original data supporting the findings of this manuscript can be accessed from the primary author upon a reasonable request.

Ethical Approval and Informed Consent

The study was approved by the institutional review board (IRB) of the College of Health Sciences of Addis Ababa University (AAU) (IRB protocol # 09/81) and complied with the Declaration of Helsinki. All participants reviewed and provided a signed consent before any study activities.

Consent for Publications

All the study participants have approved reporting the results of the research to be published in journals and conference presentations.

Acknowledgments

We thank the BMJ Publishing Group Ltd for permitting us to use the Attitudes and Beliefs about Cardiovascular Disease (ABCD) risk questionnaire. The research team would like to acknowledge Addis Ababa University for funding for the data collection of this research. We thank the study participants for their time.

Funding

Addis Ababa University has funded for data collection of this research.

Disclosure

The authors report no conflicts of interest in this work.

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LOW CARDIOVASCULAR RISK REDUCTION BEHAVIORS AMONG HYPERTENSIVES ATTENDING FOLLOW-UP CARE AT A TERTIARY-LEVEL HOSPITAL IN ADDIS ABABA, ETHIOPIA

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ABSTRACT

Introduction: Cardiovascular disease (CVD) outcomes in hypertensives are substantially influenced by risk-reduction behaviors. Even though hypertensives in Ethiopia have a high prevalence of behavioral risks for negative CVD outcomes, little is known about risk-reduction behaviors in this population. Therefore, this study aimed to investigate the CVD risk reduction behaviors among adult hypertensives in Addis Ababa, Ethiopia.

Method: A cross-sectional design was used. A sample of 384 hypertensives was selected using a systematic random sampling technique from the hypertension clinic registry. Epi data version 3.10 was used to clean the data, and SPSS version 25.0 was used for analysis. Descriptive statistic was used to determine participants' CVD risk reduction behavioral status. Bivariate chi-square test and ordinal logistic regression analyses were run to identify variables associated with participants' ranked CVD risk reduction behavioral status at the p-value < .05 cutoff for statistical significance.

Results: The mean ($\pm$ standard deviation) age of participants was 53.61 ($\pm$ 12.34) years, (range, 30-82 years), and 51.2% were males. The majority (56.5%) of them were at low CV risk reduction practices. Only 45.1% were at target BP control. The absence of comorbidities ($p < .001$), clinic visits every 3 months for hypertension ($p = .041$), normal body mass index ($p = .008$), hypertension duration of 5–9 years ($p = .034$), and young age adults ($p = .041$) were the characteristics significantly associated with the high CVD risk reduction practice.

Conclusion: Hypertensives' adoption of CVD risk reduction behaviors was low, with a variety of unmanaged risk factors and a few cardioprotective behaviors. Healthcare providers may improve patients' CV risk-reduction behavior through teaching lifestyle changes and more frequent clinic visits.

Keywords: Comorbidity, Body mass index, Hypertension, CVD, Risk reduction behavior, Ethiopia.

INTRODUCTION

Cardiovascular disease (CVD) remains the single largest cause of death and disabilities worldwide with over 17 million deaths each year, representing nearly 30% of all deaths with 10% global disease burden (GDB) (1,2). Over 80% of these fatalities occur in low and middle-income countries (LMICs) (3,4). Hypertension (HTN) is the primary cause of unfavorable CVD outcomes (such as stroke, coronary heart disease, heart failure, end-stage renal disease, and vision impairment) (5,6) and is estimated to cause 9.54 million deaths, of the 17 million CVD worldwide deaths each year (2,4).

In Sub-Saharan Africa (SSA), CVD is the most rapidly growing non-communicable disease (NCD) (7,8) accounting for more than 38% of the deaths which is estimated to rise in near future (9). According to WHO estimates (10), Ethiopia is demonstrating a steady shift from communicable diseases towards an increasing epidemic of NCDs mainly CVD (10). Although there is limited data in Ethiopia, CVD morbidity and mortality are high (25%) among patients with HTN (8,10,11).

Besides HTN, there are several well-established modifiable and non-modifiable risk factors contributing to CVD. The major modifiable behavioral risk factors including physical inactivity, tobacco use, unhealthy diet, and heavy alcohol use explain 80% or greater of the CVD burden (12). The lack of adherence to these modifiable lifestyle risk factors leads to other major proximal-risk factors for CVD and its adverse events including overweight/obesity, HTN, hyperglycemia, and dyslipidemia (12,13). Importantly, CVD often develops from the interaction of complex and multi-factorial mechanisms that include non-modifiable risk factors, physiological alternations, and socioeconomic status.

Accumulating evidence reveals a wide prevalence of risk factors and unsatisfactory CVD outcomes among hypertensive patients in Africa and other LMICs (2,8,14). Despite the enormous developments in the area of drug treatment and behavioral strategies for CVD reduction, hypertensives' primary and secondary CVD behavioral preventive measures adoption are reported to be suboptimal (15). This clearly emphasizes the saying "Knowing is not enough; we must apply." And "Willing is not enough; we must do." (16,17). Countries with limited resources, and yet facing the emerging epidemic of CVD and its catastrophic events critically need to design effective prevention strategies with the priority focus on at-risk community groups. Multiple health behavioral practices are needed to improve CVD outcomes that include healthy eating habits, engagement in physical activity, abstaining/quitting smoking, alcohol moderation, and visiting HCPs regularly are fundamental for the prevention and reduction of CV risk factors (17,18).

However, various factors are known to influence behavioral practices among hypertensives including knowledge of CVD, medication side effects (19), health insurance (20), sociodemographic and clinical characteristics (21), attendance to scheduled appointments (20), perceptions of risk (20), and sources of cues for behavioral actions (22). Furthermore, among hypertensives in Ethiopia, up to 40% were reportedly non-adherent to recommended therapies and in some studies, up to 80% had uncontrolled blood pressure (BP) (23,24) indicating a high risk for adverse CVD outcomes. On the other hand, individuals who adopted healthy behavioral practices (medication adherence, body weight control, regular physical activity, heart-healthy diet, moderation of alcohol, smoke cessation, and stress management) were effective in reducing adverse CVD outcomes (25). On the contrary, abundant evidence shows that behavioral risks for adverse CVD outcomes are widely prevalent among hypertensives in Ethiopia (24,26) and patients' risk reduction behaviors are largely unknown. Therefore, the study aimed at determining the status of CVD outcome risk reduction behavioral adoption and its determinants among adult hypertensives in Addis Ababa, Ethiopia.

METHODS AND MATERIALS

A cross-sectional study design was utilized and data were collected between February and August 2020 from hypertensives attending the outpatient cardiac clinic at Tikur Anbessa Specialized Hospital (TASH) in Addis Ababa, the largest tertiary hospital in Ethiopia. The sample consisted of 384 participants selected by the systematic random sampling technique from 1200 hypertensives on the clinic follow-up registry list. The inclusion criteria were: (a) age 30 years or older; (b) a minimum of three follow-up visits in the clinic; (c) the ability to hear and respond to questions in the local language (Amharic); (d) not pregnant; (e) no history of a CVD event such as myocardial infarction or stroke; and (f) the absence of a significant active Axis I psychiatric condition. Data were collected by three bachelor-prepared research assistants, who were trained for two days on study data collection methods, through face-to-face interviewer-administered standardized instruments that were translated by trained translators from English to Amharic (local language) and back to English. The translations were very consistent. The instruments were pilot tested in 10% of the Ethiopian hypertensives at another tertiary hospital to determine potential participants' understanding of the questionnaires. The independent variables included: 1. Sociodemographic (age, gender, marital status, level of education, and income information were based on self-report); 2. Clinical profiles (participants' self-reports on the interview questionnaire and reviews of their medical records provided information on the duration of HTN, co-morbidities, prior CVD-related hospitalization, antihypertensive medications, and family history of HTN, frequency of clinic visits, traditional medicine use for HTN, and sources of information on the seriousness of HTN, and measurement of BP, height, weight, and body mass index (BMI) using standard protocols). The BP was measured five minutes after participants completed the interview questionnaire, sitting in an armchair and feet flat on the floor using a standardized aneroid sphygmomanometer of normal

cuffs for adults by auscultatory method at the right brachial artery. Two readings were taken five minutes apart. If the two readings varied by > 5 mmHg a third reading was obtained. The average of the last two readings was used for the analysis. Values were interpreted as controlled BP if SBP <140 mmHg (<130 mmHg for patients with diabetes and CKD comorbidities), DBP <90 mmHg (<80 mmHg for patients with diabetes and CKD comorbidities), and uncontrolled if SBP ≥ 140 mmHg (≥ 130 mmHg for patients with diabetes and CKD comorbidities), DBP >90 mmHg (>80 mmHg for patients with diabetes and CKD comorbidities) based on current Ethiopian HTN management protocol and other international guidelines (27,28). Without wearing shoes, height was measured with a handheld stadiometer and recorded to the closest 0.5 cm. Weight was recorded to the closest 0.1 Kg using a calibrated weight scale. Body mass index was computed by dividing weight (in Kg) by height (in M^2), and values were then classified using the Centers for Disease Control and Prevention (CDC) system (29); 3. Screening for depressive symptoms (was done using Patient Health Questionnaire nine [PHQ-9] Amharic language version (30)), The tool has an internal consistency of Cronbach's alpha 0.85 and has been used in Ethiopia. Scores range from 0 to 27. A score of ≥ 10 reflects moderate depressive symptoms while a score of ≥ 20 indicates severe symptoms. Patients with PHQ-9 scores ≥ 20 were discarded from the analysis because of the possibility of data bias; and 4. CVD-risk perception assessment (was done using the Attitude and Beliefs about Cardiovascular Disease [ABCD] Risk Questionnaire (31)). The questionnaire has Cronbach's alpha reliability of 0.85. Scores on the scale range from 0 to 32, with higher scores indicating that patients believe they are more likely to experience negative CVD events. The participants' risk was classified using percentiles as low (0–17.0), moderate (17.1–19.0), and high (19.1 - 32.0). Permission to use the ABCD questionnaire was obtained. The dependent variable: CVD risk reduction behaviors were measured by an eight behavioral practice items tool (1. regular exercise, 2. current smoking, 3. alcohol consumption, 4. fruits and vegetable consumption, 5. salt intake, 6. Medication adherence, 7. glycemic control [if diabetic], and 8. stress management). The tool was adapted from the WHO instrument for stepwise surveillance for chronic disease risk factors (32) and other previous studies based on a literature search (33,34). Items 1-6 had a response of yes (score of 1) or no response (score of 0), with item 2 reversed scored. Item 7 values were scored as <100 mg/dl (scored 1), and ≥ 100 mg/dl (scored 0). For item 8: the 10-item perceived stress scale (PSS), which has a Cronbach's alpha reliability of 0.85 and scores ranging from 0 to 40, was used. The PSS scores were initially interpreted as 0–13 (low stress), 14–26 (moderate stress), and 27–40 (high or severe stress) and then divided into two categories: managed stress (low stress, and scored 1), and unmanaged stress (moderate and high stress, scored 0). Finally. The scores of the 8 behavioral questions were added together to get the tool's overall composite score. The possible scores obtained range from zero to eight. Higher scores suggest that patients have adopted greater numbers of CVD risk reduction behaviors, whereas lower scores indicate that patients were at risk for potential CVD outcomes. Finally, from the composite score, the percentile was generated through the SPSS software to determine patients' CVD risk reduction behavioral status and place them in low, moderate, and high groups. The tool has a Cronbach's alpha .715 composite reliability that was computed from the pilot study.

STATISTICS

Epidata version 3.1 was used for data cleaning and SPSS version 25.00 statistical software package was used for the analysis. Both descriptive and inferential statistics (a two-sample t-test, bivariate chi-square test, and ordinal logistic regression model) analyses were used. All the test/model assumptions were ascertained showing no violations. The level of statistical significance was set at $p < .05$ level and the odds ratio (OR) at 95% CI was considered to declare that there exist independent variables effects on the CVD risk reduction behavioral practice. The findings are summarized in tables, graphs, and text.

Ethical approval: The study was approved by the Institutional Review Board (IRB) of Addis Ababa University, Ethiopia (IRB protocol # 09/81) and complied with the Declaration of Helsinki.

RESULTS

Data from 377 (98.18%, total $n=384$) were included in the analysis. The mean ($\pm$ SD) age was 53.61 (± 12.34) years, (range, 30-82 years). Table 1 below presents the data of participants' sociodemographic and clinical characteristics.

Table1. Sociodemographic and clinical characteristics of study participants (n=377).

Characteristics	Frequency	Percentage
Age category (in years)		
30-39 (young adults)	56	14.9
40-59 (middle-aged adults)	188	49.87
≥ 60 (elders)	133	35.2
Gender		
Male	193	51.2
Female	184	48.8
Marital status		
Single	52	13.8
Married	284	75.3
Divorced	21	5.6
Widowed	20	5.3
Educational status		
Cannot read and write	26	6.9
Elementary	135	35.8
High school	133	35.3
Diploma & above	83	22
Monthly income in ETB		
<1000	118	31.3
1000-3000	179	47.5
3001-6000	60	15.9
≥6001	20	5.3
Family history of HTN		
Yes	144	38.2
No	233	61.8
Frequency clinic visit for HTN		
Every month	20	5.3
Every 2 months	272	72.1
Every 3 months	53	14.1
Every 4 months or longer	32	8.5
Duration of HTN in years		
1-4	132	35.0
5-9	109	28.9
10-14	71	18.8
15-19	32	8.5
20+	33	8.8
Source of information on the seriousness of HTN		
Physician	289	76.7
Nurse	65	17.2
Media	7	1.8
Others	16	4.2
Comorbidity list (n = 212)		
Diabetes	102	48.1
HHD	28	13.2
CKD	23	10.9
Others	59	27.8
Current number of BP medications		
Single drug	138	36.6
Two drugs	172	45.6
≥3drugs	67	17.8
BMI		
Underweight	10	2.6
Normal	141	37.4
Overweight	171	45.4
Obese	55	14.6
Target BP controlled		
Yes	170	45.1
No	207	54.9

Note: ETB (Ethiopian Birr), BP (blood pressure), HTN (hypertension), HHD (hypertensive heart disease), CKD (chronic kidney disease), BMI (body mass index). Target BP controlled (<140/90 mm Hg, or <130/80 mm Hg if CKD and/or diabetes).

The mean ($\pm$ SD) CVD risk reduction behavioral practice score was 5.23 ± 1.16 , range (2-8), and there were no significant mean differences based on gender; two-sample $t(375) = -1.245$, $p = .214$. Based on percentile scores participants' CVD risk reduction behaviors, the majority (56.5%, $n = 213$) of them were at low CVD risk reduction practices. The participants' ranked CVD risk reduction behaviors status is depicted in Figure 1 below

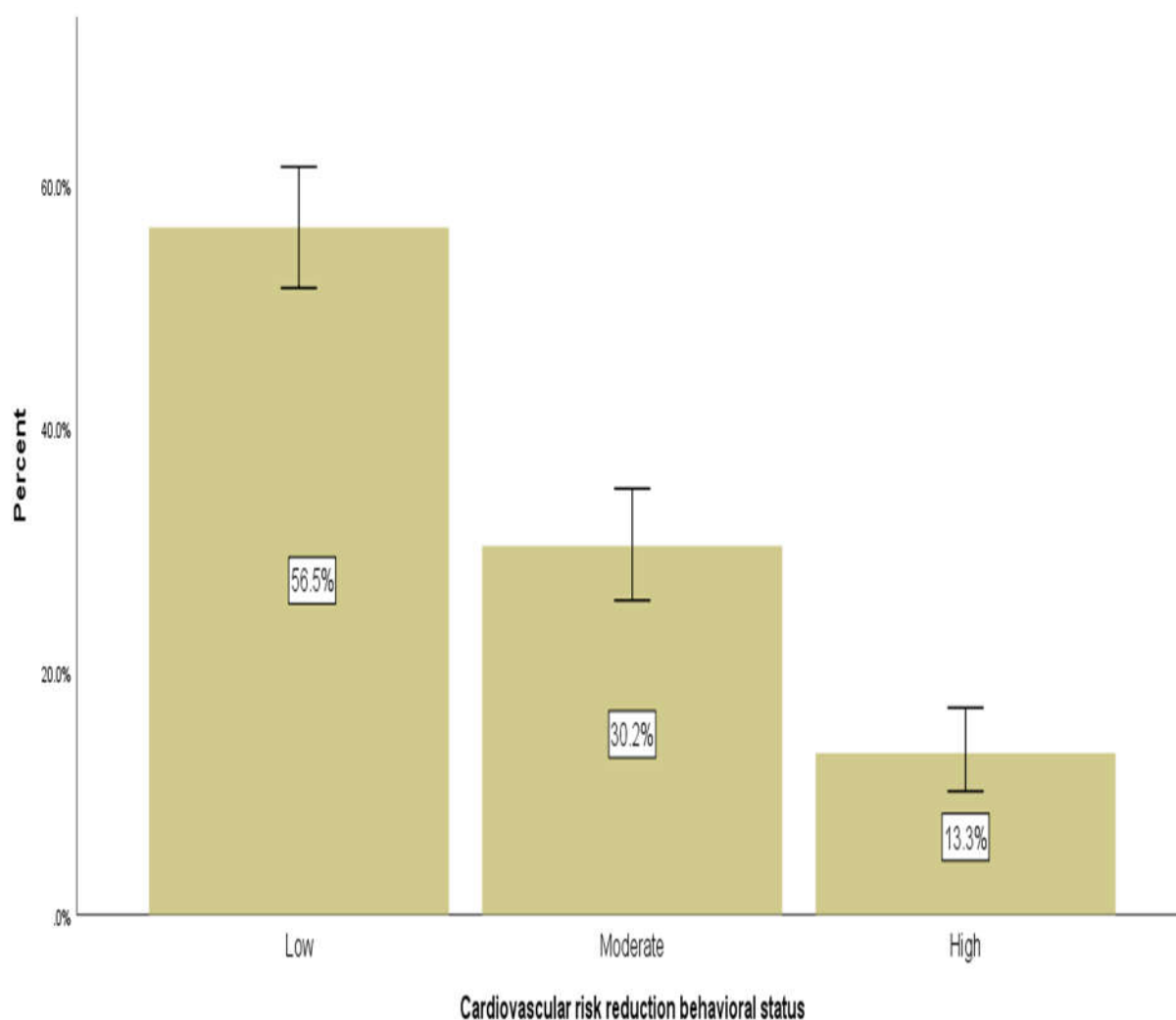


Figure 1. Bar graph showing the percentages of low, moderate and high (with error bars) CVD risk reduction behavioral practice status of study participants

Further analyses of participants' specific CVD risk reduction behavior practices (Table 2) revealed some encouraging but still several poor practices. Higher rates of CVD reduction behaviors were observed regarding physical activity (PA), no smoking, and medication adherence. However, the rates of behavioral practices for numerous CV preventive behaviors, such as limiting salt in the diet, eating enough fruits and vegetables, managing stress, alcohol moderation, and a comorbid diabetes control were low.

Table 2. CVD risk reduction behavioral practice domains of study participants.

Behavior	Yes n(%)	No n(%)
Engaged in regular PA		
Male	163 (84.45)	30 (15.54)
Female	152 (82.61)	32 (17.39)
Total (n = 377)	315 (83.55)	62 (16.44)
Current smoking		
Male	16 (9.29)	177(91.7)
Female	6 (3.26)	178 (96.74)
Total (n = 377)	22 (5.83)	355 (94.16)
Controlled diabetes		
Male	9 (13.64)	57 (86.36)
Female	8 (20)	32 (80)
Total (n = 106)	17 (16.04)	89 (83.96)
Dietary salt intake (<5 to 6 gm/d)		
Male	82 (42.49)	111 (57.51)
Female	76 (42.31)	108 (58.69)
Total (n = 377)	158 (41.91)	219 (58.09)
Fruit and vegetables (>5 servings/d)		
Male	56 (29.01)	137 (70.98)
Female	54 (29.34)	130 (70.65)
Total (n = 377)	110 (29.18)	267 (70.82)
Medication adherence		
Male	178 (92.2)	15 (7.8)
Female	169(91.8)	15 (8.2)
Total (n = 377)	347 (92)	30 (8)
Alcohol moderation		
Male	20 (10.36)	173 (89.64)
Female	9 (4.89)	175 (95.11)
Total (n = 377)	29 (7.69)	348 (92.31)
Managed stress		
Male	27 (13.99)	166 (86.01)
Female	13 (7.06)	171 (92.93)
Total (n = 377)	40 (10.61)	337 (89.39)

Note: n (number of sample), % (percentage) Engaged in regular moderate physical activity (PA) (walking for ≥ 30 minutes per day or cycling, gardening ≥ 5 times/week; or strenuous exercise: jogging, swimming, playing football for ≥ 4 hours/week). Current smoking (any form of tobacco smoking at least one cigarette per day during the previous 12 months including those who quitted within the past year). Diabetes controlled (current glycemic control: FBG <100 mg/dl). Dietary salt intake (<5 to 6 gm salt/ day add to diet). Medication adherence (self-reported strictly adhered: yes/no); Fruits and vegetable servings (had >5 servings/400-500gm) of fruits and vegetable/day (one serving is equivalent to one orange or one apple or one banana and three tablespoons of cooked vegetables); alcohol moderation (low to moderate alcohol intake within the past 12 months of 1drinks/day or <4 drinks/week for female, 1-2 drinks/day or < 4 drinks /week for male). Managed stress (computed from PSS). On bivariate chi-square test analysis (Table 3) of independent variables: age, monthly income, HTN duration, comorbidity, and BMI were significantly associated with CVD-risk reduction behaviors. However, all independent variables with p-values less than 0.25 were moved to the final ordinal logistic regression analysis model (Table 4) to test their strength of association with the CVD-risk reduction behavior.

Table 3. Bivariate chi-square test showing the association between CVD risk reduction behavior (high, moderate, and high) and independents variables of study participants (n = 377).

Variable	CVD risk reduction behavior practice				χ^2	df	p - value
	Low n(%)	Moderate n(%)	High n(%)	Total n(%)			
Age category					12.137	4	.016*
Young adults	24(42.9)	18(32.1)	14(25)	56(100)			
Middle-aged adults	110(58.5)	53(28.2)	25(13.3)	188(100)			
Elders	79(59.4)	44(33.1)	10(7.5)	133(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
Gender					.452	2	.798
Male	112(58)	56(29)	25(13)	193(100)			
Female	101(54.9)	59(32.1)	24(13)	184(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
Education level					5.320	6	.504
Cannot read and write	14(53.8)	4(42'3)	1(3.8)	26(100)			
Elementary	78(57.8)	41(30.4)	16(11.9)	135(100)			
High school	78(58.6)	38(28.6)	17(12.8)	133(100)			
College diploma & above	43(51.8)	25(30.1)	15(18.1)	83(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
Marital status					2.831	4	.586
Single	25(48.1)	21(40.4)	6(12.2)	52(100)			
Married	164(57.7)	82(28.9)	38(13.4)	284(100)			
Others	24(28.5)	12(29.3)	5(12.2)	41(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
Monthly income in ETB					14.002	6	.030
<1000	70(59.3)	40(39.9)	8(6.8)	118(100)			
1001-3000	104(58.1)	52(29.2)	23(12.8)	179(100)			
3001-6000	28(45.9)	17 (27.9)	16(26.2)	61(100)			
>6000	11(57.9)	6(31.6)	2(10.5)	19(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
Family Hx of HTN					.623	2	.732
No	128(54.9)	74(31.8)	31(13.3)	233(100)			
Yes	85(59)	41(28.5)	18(12.5)	144(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
HTN duration (in years)					12.769	6	.047
1-4	79(59.8)	33(25)	20(15.2)	132(100)			
5-9	54(49.5)	39(35.8)	16(14.7)	109(100)			
10-14	35(49.3)	24(33.8)	12(16.9)	71(100)			
15+ years	45(69.2)	18(27.7)	1(3.1)	65(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			
Comorbidity					26.364	2	.000*
N0	69(41.8)	65(39.4)	31(18.8)	165(100)			
Yes	144(67.9)	50(23.6)	18(8.5)	212(100)			
Total	213(56.5)	49(30.5)	49(13)	377(100)			
Traditional medicine uses for HTN					.583	2	.747
No	186(57.2)	98(30.2)	41(12.6)	325(100)			
Yes	27(51.9)	17(32.7)	8(15.4)	52(100)			
Total	213(56.5)	115(30.5)	49(13)	377(100)			

Table 3 continued

CVD risk reduction behavior practice						
Variable	Low	Moderate	High	Total	χ^2	Df p-value
Hx of hospitalization related to HTN					5.889	2 .053
No	150(53)	92(32.5)	41(14.5)	283(100)		
Yes	63(67)	23(24.5)	8(21)	94(100)		
Total	213(56.5)	115(30.5)	49(13)	377(100)		
Frequency of Clinic visits for HTN					12.588	6 .050
Monthly	11(50)	7(35)	2(10)	20(100)		
Bimonthly	154(56.6)	86(31.6)	32(11.8)	272(100)		
Every 3 months	28(52.8)	11(20.8)	14(26.4)	53(100)		
Every 4 months or longer	20(62.5)	11(34.4)	1(3.1)	32(100)		
Total	213(56.5)	115(30.5)	49(13)	377(100)		
Medication adherence					2.635	2 .268
Adherent	200(57.6)	104(30)	43(12.4)	347(100)		
Not adherent	13(43.3)	11(36.7)	6(20)	30(100)		
Total	213(56.5)	115(30.5)	49(13)	377(100)		
Depressive symptom					3.498	2 .174
Absent	50(49)	35(34.3)	17(16.7)	102(100)		
Present	163(59.3)	80(29.1)	32(11.6)	275(100)		
Total	213(56.5)	115(30.5)	49(13)	377(100)		
CVD risk-perception					.539	4 .970
Low	124(56.1)	68(30.8)	29(13.1)	211(100)		
Moderate	21(55.3)	13(11.6)	4(10.5)	38(100)		
High	68(57.6)	34(28.8)	16(13.6)	118(100)		
Total	213(56.5)	115(30.5)	49(13)	377(100)		
BMI					15.501	6 .017*
Underweight	5(50)	4(40)	1(10)	10(100)		
Normal	65(46.1)	54(38.3))	22(15.6)	141(100)		
Overweight	104(60.8)	44(25.7)	23(13.5)	171(100)		
Obese	39(70.9)	512(21.8)	4(7.3)	55(100)		
Total	213(56.5)	115(30.5)	49(13)	377(100)		

Note: ETB (Ethiopian Birr), Hx (history), HTN (hypertension), BMI (body mass index), CVD (cardiovascular disease), χ^2 (chi-square), df (degree of freedom), *(Bold figures indicate significant findings).

In ordinal logistic regression analysis, the absence of comorbidity, clinic visits of every three months, normal BMI, HTN duration of 5-9 years, and young age adults were the statistically significant positive predictors of participants' high CVD risk reduction behavioral practice. The presence of depressive symptoms though did not reach the statistically significant level ($p = .053$) and was a negative predictor of the high CVD risk reduction behavioral practice.

The odds of practicing high CVD risk reduction behaviors were three times higher on average for patients with no comorbidity as compared to the combined low and moderate category CVD risk reduction behavioral practice adaptors of patients with comorbidities. The odds of practicing high CVD risk reduction behaviors were almost three times higher on average for patients who visit the HTN clinic every three months as compared to the combined low and moderate category CVD risk reduction behavioral practice adaptors of patients who visits the clinic every four months or longer. The odds of practicing high CVD risk reduction behaviors were almost three times higher on average for patients who maintained normal body weight as compared to the combined low and moderate category CVD risk reduction behavioral practice adaptors of obese patients. The odds of practicing high CVD risk reduction behaviors were two times higher on average for patients with the HTN duration of 5-9 years as compared to the combined low and moderate category CVD risk reduction behavioral practice adaptors of patients with the HTN duration of 15 years or longer. The odds of practicing high CVD risk reduction behaviors were two times higher on average for young adult patients as compared to the

combined low and moderate category CVD risk reduction behavioral practice adaptors of old age adult patients. The below table (Table 4) depicts participants' findings of the ordinal logistic regression analysis.

Table 4. Ordinal logistic regression analysis of predictors of the high CVD risk reduction behavior practice of study participants

Predictor variables		AOR	95% CI		p-value
			Lower	Upper	
Threshold	CVD-risk reduction behavior practice (Low)	6.235	1.121	34.678	.037
	CVD-risk reduction behavior practice (moderate)	40.628	7.041	234.421	.000
	CVD-risk reduction behavior practice (high)	1	.	.	
Age category	Young adult	2.025	1.030	3.982	.041
	Middle adult	1.062	.655	1.720	.808
	Older adult	1	.	.	
Monthly income in ETB	≤ 1000	1.046	.359	3.046	.934
	1001-3000	1.152	.405	3.281	.791
	3001-6000	2.664	.874	8.114	.085
	>6,000	1	.	.	
Comorbidity	No	3.015	1.931	4.707	.000
	Yes	1	.	.	
HTN duration (years)	1-4	1.263	.643	2.477	.498
	5-9	2.091	1.059	4.130	.034
	10-14	2.034	.983	4.211	.056
	15+	1	.	.	
Clinic visits for HTN and related problems	Monthly	1.227	.379	3.971	.733
	2 months	.1.114	.504	2.462	.789
	3 months	2.682	1.040	6.916	.041
	4 months and longer	1	.	.	
Hospitalization related to HTN	No	1.503	.886	2.551	.131
	Yes	1	.	.	
BMI Kg/M ² category	Underweight	2.058	.538	7.882	.292
	Normal	2.593	1.282	5.245	.008
	Overweight	1.781	.891	3.558	.102
	Obese	1	.	.	
PHQ-9 (Scale)		.927	.858	1.001	.053

AOR (adjusted odds ratio), CI (confidence interval) CVD (cardiovascular disease), ETB (Ethiopian Birr), HTN (hypertension), BMI (body mass index), Kg (kilo gram), M² (meter squared, PHQ (patient health questionnaire) *(Bold figures indicate significant findings).

DISCUSSION

The present study examined the adult hypertensives' CVD risk reduction behavioral practice and its predictors among those attending follow-up care at a tertiary care outpatient cardiology clinic in Addis Ababa, Ethiopia. The major findings were low CVD risk reduction behavioral practice for the majority of participants. This suggests a higher rate of unmanaged risk factors for future adverse CVD events, and that high CVD risk reduction practice was significantly associated with the absence of comorbidity. Clinic visits every three months, normal BMI, HTN duration of 5-9 years, and young age adults were also predictors of higher CVD risk prevention behaviors.

The finding of low CVD risk reduction practice is consistent with several hypertensives' previous low self-care behavioral practice studies' in peripheral hospitals in Ethiopia (35,36), other African countries such as Tanzania (37), Asian countries such as Nepal (38), Indonesia (39), Pakistan (40), and West Bengal (41). However, compared to some previous individual and meta-analyses study findings of 16%-44% positive risk reduction practices (42,43) in Ethiopia, the present finding

showed higher proportions of hypertensives had adopted the recommended lifestyle on CVD risk factors. In general, findings from the literature and the present study suggest low CVD risk reduction behavioral adoption among those at risk for adverse CVD events in Ethiopia. Adoption of healthy lifestyles is supposed to be the first line of management for hypertensives with further added benefits of reducing CVD risk (44). Although CVD risk stratification guideline is emerging for use at the primary health care level in Ethiopia (45), its availability is low in many Eastern SSA countries including Ethiopia (46).

Further examination of participants' specific CVD risk reduction behavior practices (Table 2) revealed some encouraging but also poor practices. Higher CVD reduction behaviors were observed regarding PA, no smoking, and medication adherence rates. However, for many CV protective behaviors: dietary salt restriction, servings of fruits and vegetables, stress management, and alcohol moderation, the rates of behavioral adoption were low.

In the ordinal logistic regression model, several participants' sociodemographic and clinical factors were identified to significantly influence their high CVD reduction behaviors.

Participants who have no comorbidities were three times more likely to have practiced the high CVD risk reduction behavior as compared to those with comorbidities. Although the impact of comorbidity on CVD risk reduction behavior has not been widely examined but may compete with other chronic conditions, it is more difficult to adhere to the recommended guidelines (47). Our finding is supported by previous studies findings that hypertensives with comorbidity were 72% less likely to have practiced CVD reduction (48,49). Furthermore, comorbidity such as depression was linked to poorer prognostic risk (49), which may be due to its deleterious effect and poor adherence to CVD risk reduction behaviors. Over two-thirds (70%) of our study participants had depressive symptoms indicating it should be routinely assessed in hypertensives. The high burden of comorbidities may reduce patients' motivation for risk reduction behavior due to its psychological and/or physical burdens. Contrary to our findings, however, earlier studies have shown that hypertensives with comorbidities had a considerably higher adherence rate to the necessary lifestyle adjustments than those with HTN alone (50). Comorbidities may incite patients to take their health seriously and engage in risk-reducing behavior, which may help to explain this discrepancy. Early comorbidity screening, HTN monitoring, risk factor evaluation, and intensive multifactorial lifestyle modification may help hypertensives experience less comorbidity development and its burden.

The observed significant associations between patients' high CVD reduction and every three-month clinic follow-up visit in the present study may suggest that patients had a reasonable concern for the reduction of adverse CVD outcomes based on their previous assessments and knowledge gained regarding risk factors and the required behavioral adjustment from the HCPs during the follow-up. Hypertensives may benefit from regular interval assessments (including analysis and interpretation of their current symptom experiences, physical examination, and laboratory work-up). Furthermore, obtaining advice and reinforcements on behavioral risk reduction (diet, PA, body weight control, medication adherence including monitoring of side effects and dose adjustments), as part of the routine health communication with their HCPs may have accounted for the high-risk reduction behavior of I practice. Even though studies on this topic have yielded few results, the frequency of clinic visits may be a reflection of patients with CVD's health-seeking behaviors, related to patients' perceptions that their BP and symptoms are under control, that clinic visits have been scheduled at regular intervals by doctors, or related to the COVID-19 pandemic season. According to the current HTN management guidelines (51), clinic visits every 2-4 months should be conducted for patients who have achieved the target BP control. However, only 14.1% of our study participants had every three months follow-ups visits, while nearly three-quarters (72.1%) of them, and in other studies, the majority of hypertensives (52,53) had the visit follow-up clinic scheduled monthly and/or bimonthly for HTN that may suggest patients were being monitored more closely to achieve BP control that required medication adjustment (based on patients' adherence and possible drug side effects) and evaluation of target organ disease and the co-existence of comorbid conditions. Hypertensives-HCP visits should go beyond BP monitoring and medication refills. Rather, the visit should provide the opportunity to improve the CVD risk reduction behavioral adoption and should be a key patient education goal during the clinic follow-up visits and is an area of future research.

Participants with normal body weight were nearly three times more likely to have high CVD risk reduction behaviors compared to obese participants. The present finding is supported by previous research that a normal BMI is a predictor of adequate self-care management among hypertensives (54) and that hypertensives with a normal BMI were more likely to adhere to self-management behaviors (55). The development of obesity is multifactorial including being sedentary, genetic predisposition, and environmental contributors (such as socioeconomic, behavioral, and epigenetics) (56). The finding that the majority (60%) of our study participants were overweight or obese indicates the importance of weight control in this population. (36,40,44). According to data from the SSA (57) obesity is a health concern, and certain African nations, like Nigeria, have higher rates of obese hypertensives (58). It was well documented that weight reduction among hypertensive adults was accompanied by BP reduction (59). Interventions that target patients' behaviors favoring for weight management in overweight and obese such as heart healthy diet and a low-salt diet along with continued BMI assessments during the clinic return visits are crucial to reduce the potential adverse CV risk, particularly for patients with additional signs of metabolic syndrome.

The significant association between the high CVD risk reduction behavior and the HTN length of 5-9 years as opposed to 15 years or longer seems appropriate. In the original and Framingham Heart Offsprings Study of a large sample of participants aged 40-89 years the progression from HTN to CHF and other CVD complications occurred on average at 14 years with a peak 5 years survival of only 24% of males and 31% of females (60). Due to the disease's asymptomatic progression and the potential late health and sickness behaviors of our study participants, complications could parallel the 5-9 years of HTN length in our participants with possible symptom experiences that could serve as a warning for patients to heavily engage in risk reduction behavior. We also noted a shorter mean and median HTN duration in the current study, which is consistent with several previous studies of hypertensives in Ethiopia (53,61). Furthermore, nearly two-thirds (63%) of our study participants had an HTN duration of < 10 years which conforms to previous research (52,53). All that is in support of the 5-9 years HTN length to match the likely time for appearances of HTN complications and may trigger patients for high CVD risk reduction behavior.

When depressive symptoms were present, the high CVD risk reduction behavioral practice was 9% less likely to happen; nonetheless, this finding was statistically insignificant despite having clinically substantial implications. The combination of depressive symptoms with HTN may operate as a deterrent to patients engaging in CVD risk-reduction activity, which could have detrimental effects and impair the clinical outcome of CVD (62,63). This finding can act as an important reminder for HCPs who monitor hypertensives, to use a depression screening tool to detect depressive symptoms as soon as possible and refer patients to get psychiatric guidance to improve CVD risk reduction behavior with the ultimate goal of preventing negative CV outcomes.

CONCLUSIONS

Hypertensives' practice of CV risk reduction behaviors was low, with a variety of unmanaged risk factors and few cardioprotective behaviors. The absence of co-morbidities, maintaining a healthy weight, having HTN for 5-9 years, scheduled clinic visits every three months, and being a young adult were predictive of high-risk reduction behaviors. HCPs may improve patients' CV risk reduction behavior through lifestyle changes and this needs to be addressed during the scheduled clinic return visits. Furthermore, patients' risk factors appraisal, early comorbidity assessment (including depressive symptoms) particularly among the elder, and adequate treatment or referral for better evaluation may help improve healthy lifestyle practices for improved prevention of future CV events in hypertensives. Lifestyle behaviors known to avert adverse CVD events such as reduced salt intake, adequate fruit and vegetables servings, glycemic control, overweight/obesity, and stress reduction measures are the key areas to focus on for HCPs during patients' follow-up clinic visits.

Limitations of the study

The study was a single-site cross-sectional that restricts the generalization of the findings to other hospital hypertensive attendees.

Authors contributions: BDM and GRA contributed to the conceptualization, data collection, analyses, and draft writing of the manuscript. GDY, YAW, and HMK contributed to the methodological design, critical revision, and edition of the final version. All authors have agreed on the final version of the manuscript.

Declaration of conflicting interests: The authors declare no potential conflicts of interest with respect to this research.

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SUBOPTIMAL TARGET BLOOD PRESSURE CONTROL AND ITS ASSOCIATION WITH THE SOCIODEMOGRAPHIC AND CLINICAL PROFILES OF HYPERTENSIVES ATTENDING A TERTIARY LEVEL HOSPITAL IN ADDIS ABABA, ETHIOPIA

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Abstract

Background: Hypertensives' target blood pressure control remains suboptimal in many countries worldwide. Hence, determining patients' factors affecting target blood pressure control is critical.

Objective: The objective of study was to examine hypertensives' target blood pressure control and its associations with their sociodemographic and clinical characteristics.

Methods: The study employed a cross-sectional design. For the face-to-face data collection with standardized questionnaires, 384 hypertensives attending a tertiary-level hospital were selected using a systematic random sampling technique. Descriptive statistics were used to determine the target blood pressure control status and bivariate chi-square test and binary logistic regression were used to identify factors significantly associated with the target blood pressure control.

Results: The study consisted of nearly equal proportions of male (51.2%) and female (48.8%) participants with a mean age ($\pm$ SD) of 53.61 ± 12.34 years. Only 45.1% had achieved target blood pressure control. Absence of comorbidity (AOR = 1.911, 95% CI: 1.256, 2.908, $p = .002$), good medication adherence (AOR = 2.535, 95% CI: 1.078, 5.960, $p = .033$), and normal body mass index (AOR = 1.675, 95% CI: 1.094, 2.564, $p = .018$) were factors significantly associated with the achievement of the target BP control.

Conclusion: Intervention targeting hypertensives' body weight control, early comorbidity screening and management, and strict adherence to antihypertension medication may improve patients' blood pressure control status and should be among the priority of the hypertension care clinic specialists' team.

Keywords: Hypertension, blood pressure control, body mass index, comorbidity, clinical profile.

INTRODUCTION

The prevalence of hypertension (HTN) is high with approximately 1.3 billion of the world's adult population affected [1] and is estimated to exceed 1.5 billion by 2025 [2,3]. Although the prevalence of HTN is slightly decreasing in high-income countries (HICs) with an estimated 349 million people, in contrast, it is rapidly increasing in low and middle-income countries (LMICs) with an estimated 1.04 billion people living with it currently [2]. In Sub-Saharan Africa (SSA), HTN currently affects over 20 million people and is the leading cardiovascular disease (CVD) risk factor, and is the most common reason for hospitalizations with poor clinical outcomes [4,5]. In Ethiopia, the prevalence of HTN is estimated to be between 13-30% [6,7] and is directly linked to higher CVD morbidity and mortality [5]. According to the Framingham Heart Study, individuals with a normal BP at the age of 55 years (men) and 65 years (women) have a 90% lifetime risk for developing HTN [8], which suggests that there will be an increase in the number of persons with HTN and with improving longevity an increase in the number of elderly adults at risk for adverse CVD outcomes.

Uncontrolled BP is the strongest contributor to adverse CVD outcomes (such as stroke, coronary heart disease [CHD], and heart failure [HF]) [9,10]. Of the major cardiovascular (CV) events; 51% and 45% of stroke and CHD deaths, respectively, occurred due to HTN [11] with an overall huge (80%) CVD burden occurring in LMICs [11]. In Addis Ababa, Ethiopia, of 51% of total adult noncommunicable diseases (NCDs) deaths, CVD was the leading one (24%) with most of these deaths occurring in young and middle-aged adults [12] mainly due to uncontrolled BP [13] indicating that with the dramatic rise of CVD, Ethiopia will continue to bear a large disease burden [14,15]. Furthermore, among persons diagnosed with HTN in Ethiopia, up to 40% were reportedly non-adherent to pharmacological therapy, and in some studies, up to 80% had uncontrolled BP [16,17] indicating a high risk for adverse CVD outcomes.

The main goal of early HTN detection, therapy, and target BP control is to reduce the risk of CVD events in the hypertensive population. High BP has been shown to hasten the progression of atherosclerosis and destabilize vascular lesions, precipitating acute coronary events and directly causing myocardial ischemia (MI) even in the absence of CHD [18]. Even among patients with comorbidities like diabetes, early BP control in the first year following HTN start was associated with improved benefits and fewer major CV events [19] compared to patients with uncontrolled BP, who had significantly higher rates of major CV events (RR = 1.30, 95% CI: 1.01–1.69, P = 0.04) [19].

In many countries, the target BP control rate for hypertensives is still suboptimal. Unsatisfactory BP control rates (33% and 38% in HICs and LMICs, respectively) were seen in observational studies and a systematic review that examined the differences in HTN prevalence, its management and control across LMICs and HICs countries. [20,21]. In Ethiopia, previous researches reported a suboptimal BP control rate among hypertensives despite being on pharmacological treatment and follow-up mostly in secondary level hospitals [17,22–24]. In general, inadequate education, low medication adherence, a poor understanding of the goal BP, drug side effects, and inadequate support from medical professionals were the main causes of poor high BP control [20].

The rate of target BP control among patients with HTN and its association with the patients' sociodemographic and clinical profiles were not examined in previous studies, particularly among those receiving referral and tertiary level outpatient clinic care in Addis Ababa, Ethiopia. A better recognition of patients' sociodemographic and clinical characteristics that contribute to BP control are important for hypertension care clinic team to direct patient tailored interventions to achieve target BP control and avoid adverse CVD outcomes.

OBJECTIVES:

1. To examine the target blood pressure achievement status among hypertensives attending tertiary level hospital in Addis Ababa, Ethiopia.
2. To identify the demographic and clinical variables strongly associated with target blood pressure achievement among hypertensives attending tertiary level hospital in Addis Ababa, Ethiopia.

METHODS AND MATERIALS

Study design and setting

The cross-sectional study design was used. The study was conducted at a large academic and tertiary level Tikur Anbessa Specialized Hospital (TASH) in Addis Ababa, Ethiopia, and data were collected between February and August 2020.

Participants and eligibility criteria

The study participants were adult hypertensives attending to the outpatient Cardiac Clinic follow-up care of TASH. the inclusion criteria were: age of 30-year or older; a minimum of three follow-up visits in the clinic; the ability to hear and respond to questions in the local language (Amharic). The exclusion criteria were: pregnancy, active psychiatric condition, and aphasia.

Sample size determination

The sample size was determined based on one sample t-test (as the below formula) since it was part of the main Ph.D. dissertation project with the assumptions of observations are independent; data fit the normal distribution; homogeneity of variance and the power set at 0.80 ($\beta=0.2$) and α (two-sided) set at 0.05 and standardized effect size of 0.15 (small) [25] and considering a further 10% non-response rate for potential missing data due to the interview format.

Sample size, $n = (Z\alpha/2 + Z\beta)^2/d^2$

Where $Z_{\alpha/2} = 1.96$ (from Z table) at type 1 error of 5%

$Z_{\beta} = Z_{0.20} = 0.842$ (from Z table) at 80% power

$ES^2 = \text{effect size (small, 0.15)}$

$n = (1.96 + 0.842)^2 / (0.15)^2 = 348.94 + 35 \text{ (10\% non-response)} = 384$

Sampling technique

The hypertensive patient clinic follow-up registry list containing 1200 patients was used to choose the sample using the systematic random sampling technique.

Data collection technique and data quality assurance procedure

Three research assistants who are Bachelor's degree holder and trained for two days on methods of data collection collected the data. Data were collected in a prearranged private room through a face-to-face interviewer-administered using the standardized instruments. To ensure the data quality, all instruments were translated from their original English language to the local language (Amharic) and then back to English by professional translators. The instruments were pilot tested in 10% of the Ethiopian hypertensive patients at a similar tertiary level hospital to determine potential participants' understanding of content included on the questionnaires. The principal investigator monitored the data collection process and checked for data completeness, consistency, and accuracy daily.

Variables and their measurements

Independent variables: Sociodemographic: Participants self-reported information on age, gender, marital status, level of education, and income on the interview questionnaire.

Clinical profiles: Participants' self-reports on the interview questionnaire and reviews of their medical records provided information on co-morbidities, prior CVD-related hospitalization, antihypertensive medicines, and family history of HTN. Participants' BP, height, weight, were measured with precision. The body mass index (BMI Kg/M^2) was computed and values were classified using the Centers for Disease Control and Prevention (CDC) system [26]. Lipid data (total cholesterol, triglyceride, HDL-c, and LDL-c values of the last 12 months), and current FBG, values were obtained from the patient's medical records.

Patient Health Questionnaire nine (PHQ-9): Screening for depressive symptoms was assessed by the PHQ-9 Amharic language (local language) version [27]. The tool has an internal consistency of Cronbach's alpha 0.85. Scores range from 0 to 27. A score of 10 or higher reflects moderate depressive symptoms while a score of ≥ 20 indicates severe symptoms.

Dependent variable: Target blood pressure control: The BP was measured five minutes after participants completed the interview questionnaire, sitting in an armchair and feet flat on the floor using normal cuffs for adult standardized aneroid sphygmomanometer by auscultatory method at the right brachial artery. Two readings were taken five minutes apart. If the two readings varied by more than 5 mmHg a third reading was obtained. The average of the last two readings was used for the analysis. Values were interpreted as target BP controlled if: SBP < 140 mmHg (< 130 mmHg for patients with diabetes and chronic kidney disease [CKD]), DBP < 90 mmHg (< 80 mmHg for patients with diabetes and CKD), and target BP uncontrolled if SBP ≥ 140 mmHg (≥ 130 mmHg for patients with diabetes and CKD), DBP > 90 mmHg (> 80 mmHg for patients with diabetes and CKD) based on current Ethiopian HTN management protocol and other international current practice recommendations [28].

Statistical analysis

Epidata version 3.1 was used to cleaned data and SPSS version 25.00 statistical software package was used for the analysis.

Descriptive: univariate analysis was run to examine data and its plausible values, assumptions of the logistic regression model, and to measure the variability in participants sociodemographic and clinical characteristics.

Inferential: Chi-square test was used to examine the association between sociodemographic and clinical profiles with target BP control. Variables that had p-values < 0.25 in the bivariate chi-square test analyses were moved into the final binary logistic regression model to ascertain predictors of target BP control. Variables with a p-value of < 0.05 level in the final regression model were considered statistically significant. Odds ratio (OR) at 95% CI was considered to declare that there exist the predictor variable effects on the target BP control. The findings are summarized in tables, graphs and text.

Ethical clearance

The study was approved by the institutional review board (IRB) of the College of Health Sciences of Addis Ababa University (AAU) (IRB protocol # 09/81). All participants reviewed and provided a signed consent before any study activities.

RESULTS

Data from 377 (98.18%) of the 384 participants were included in the analysis. Based on PHQ-9 scores of ≥ 20 , data from seven participants were omitted from the study due to the likelihood of data bias. Men (51.2%, $n=193$) made up slightly more than half of the participants. The participants' mean age ($\pm$ SD) was 53.61 ± 12.34 years (range, 30-82 years). The mean age ($\pm$ SD) at the time of the HTN diagnosis was 45.60 ± 12.57 years that suggests young age HTN onset. Less than half (45.1%) of the participants achieved target SBP control while 66.84% achieved target DBP control. Overall, the

proportion of patients with both systolic and diastolic BP control was low (45.1%). The mean ($\pm$ SD) and median duration of HTN were 8.01 ± 6.07 and 6 years, respectively, (range, 1-30 years). Data of the sociodemographic and clinical characteristics of participants are shown in Table 1 below.

Table1. Sociodemographic and clinical characteristics of the participants (n=377).

Characteristics	Frequency	Percentage
Age category		
30-39	56	14.9
40-59	188	49.87
≥ 60	133	35.2
Gender		
Male	193	51.2
Female	184	48.8
Marital status		
Single	52	13.8
Married	284	75.3
Divorced	21	5.6
Widowed	20	5.3
Educational status		
Cannot read and write	26	6.9
Elementary	135	35.8
High school	133	35.3
Diploma & above	83	22
Monthly income in ETB		
< 1000	118	31.3
1000-3000	179	47.5
3001-6000	60	15.9
≥ 6001	20	5.3
Family history of HTN		
Yes	144	38.20
No	233	61.80
Physician visit frequency		
Every month	20	5.3
Every 2 months	272	72.1
Every 3 months	53	14.1
Every 4 months or longer	32	8.5
Target BP controlled		
SBP: Yes	170	45.1
No	207	54.9
DBP: Yes	252	66.8
No	125	33.2
Duration of HTN in years		
1-4	132	35.0
5-9	109	28.9
10-14	71	18.8
15-19	32	8.5
20-24	26	6.9
25+	7	1.9
BMI		
Normal weight	151	40.0
Overweight	171	45.4
Obese	55	14.6
Source of information on the seriousness of HTN		
Physician	289	76.7
Nurse	65	17.2
Media	7	1.8
Others	16	4.2
Comorbidity list (total 212)		
Diabetes	102	48.11
HHD	28	13.21
CKD	23	10.85
Others	59	27.83
Number of current BP medications		
One	138	36.60
Two	172	45.60
≥ 3	67	17.80
Adherence to med		
No	30	92.04
Yes	347	7.06

Note: Target BP controlled (<140/90 mm Hg, or <130/80 mm Hg if CKD and/or diabetes); CI (confidence interval).

Slightly over a third of participants had been diagnosed in the last 4 years. Overall, a staged pattern decline was observed as the duration of HTN extends. The proportion of patients with the duration of 14 and beyond years were remarkably low (Figure1).

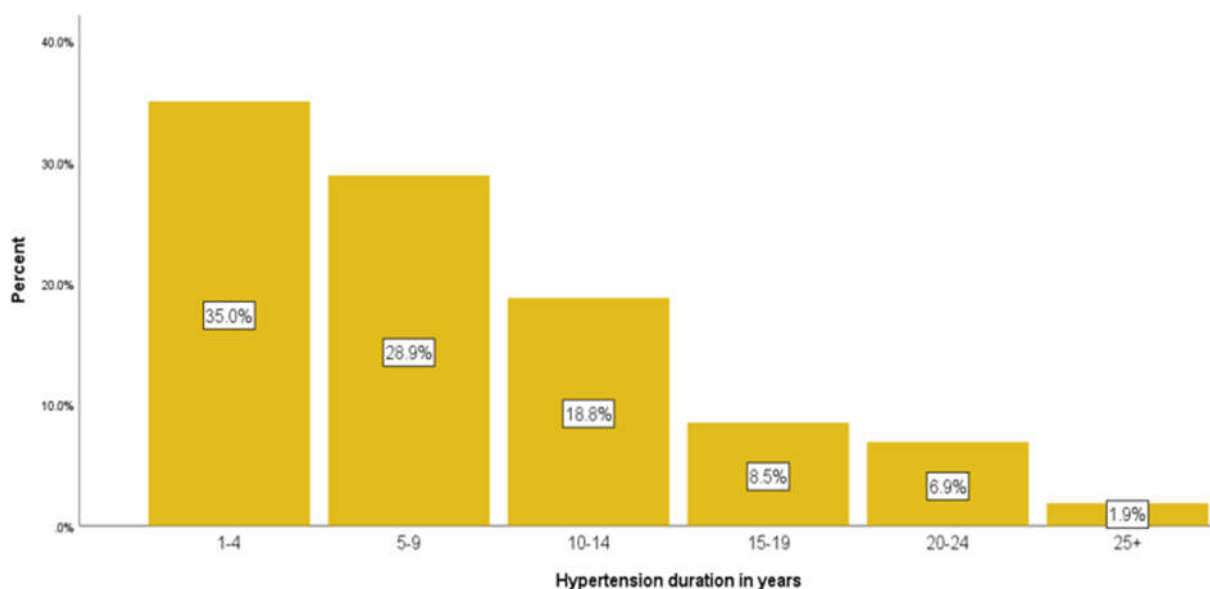


Figure 1. Bar graph showing participants hypertension duration since diagnosis (n = 377).

The overall target BP control rates were much higher among patients with HTN alone and/or having comorbidities other than diabetes or CKD. In fact, hypertensives with diabetes and CKD comorbidities had worse target control rates in both the systolic and diastolic BP. This observation is illustrated in the below bar graph (Figure 2).

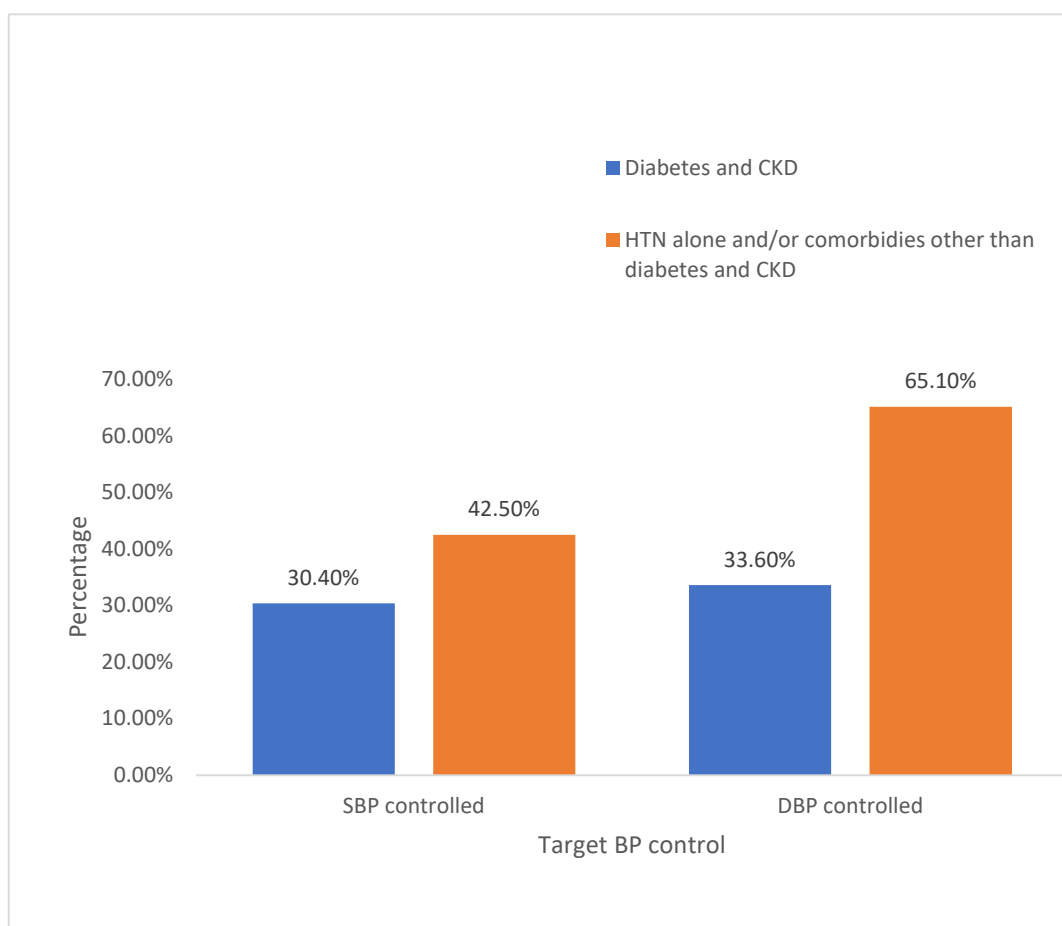


Figure 2. Target SBP and DBP achieved among hypertensives with diabetes and CKD Vs those with HTN alone and/or comorbidities other than diabetes and CKD (n = 377).

Fewer than half (57%) of patients had a record of their lipid profile check (Table 2). The mean ($\pm$ SD) HDL-c level was 44.58 ± 12.64 . The mean ($\pm$ SD) LDL-c level exceeded the normal range 116.51 ± 43.08 . The mean ($\pm$ SD) FBG was 152.78 ± 53.92 showed the existence of uncontrolled glycemia among patients with comorbid diabetes, the data are depicted in Table 2.

Table 2. Study Participants' Clinical profiles

Variable	N	Median	Mean $\pm$ SD	95% CI
Body weight (Kg)	377	70.00	69.97 $\pm$ 11.71	68.78, 71.15
Height (Cm)	377	165.00	164.02 $\pm$ 9.04	163.10, 164.94
BMI (Kg/M ²)	377	25.71	26.02 $\pm$ 4.09	25.61, 26.44
TC (mg/dl)	215	182.00	193.16 $\pm$ 83.39	181.95, 204.37
TG (mg/dl)	215	142.00	167.65 $\pm$ 103.16	153.78, 181.52
HDL-c (mg/dl)	215	42.00	44.58 $\pm$ 12.64	42.88, 46.27
LDL-c (mg/dl)	215	114.00	116.51 $\pm$ 43.08	110.72, 122.30
FBG (mg/dl)	102	140.00	152.78 $\pm$ 53.92	142.19, 163.37
Clinical Status	n	%		
BMI	377			
Overweight	171	45.1		
Obese	55	14.6		
TC	215			
>200mg/dl	80	37.2		
TG	215			
>150mg/dl	90	41.9		
HDL-c male	113			
<40mg/dl	49	43.4		
HDL-c female	102			
<50mg/dl	63	61.8		
HDL- both sexes	215			
>60mg/dl	20	9.3		
FBG	102			
>100mg/dl	87	85.3		

BMI (body mass index), TC (total cholesterol), TG (triglyceride), HDL-c (high density lipoprotein cholesterol), LDL-c (low density lipoprotein cholesterol), FBG (fasting blood glucose, SD (standard deviation), CI (confidence interval)

Table 3. Bivariate chi-square test showing the association between participants target BP control and their sociodemographic and clinical variables (n = 377)

Variable	Target BP		χ^2	df	p - value
	Controlled n (%)	Uncontrolled n (%)			
Gender					
Male	79 (40.9)	114 (59.1)	2.764	1	.096
Female	91 (49.9)	93 (50.5)			
Age					
Young adult	31 (18.2)	25 (12.1)	2.807	2	.245
Middle age	81 (47.6)	107 (51)			
Elder	58 (34.1)	75 (36.2)			
Family history of HTN					
Yes	58 (34.1)	86 (41.5)	2.182	1	.140
No	112 (65.9)	121 (58.5)			
Hospitalization related to HTN					
Yes	37 (21.8)	56 (27.1)	1.405	1	.236
No	133 (78.2)	151 (72.9)			
No of current BP medication					
One	73 (42.9)	65 (31.4)	5.631	2	.060
Two	68 (40)	104 (50.2)			
Three or more	29 (17.1)	38 (18.4)			
Medication adherence					
Adherent	162 (95.3)	8 (4.7)	4.470	1	.035*
Not adherent	185 (89.4)	22 (10.6)			
BMI					
Normal	80 (47.1)	71 (34.3)	6.329	1	.012*
Overweight/obese	90 (52.9)	136 (65.7)			
Frequency of clinic follow-up					
Every month	10 (5.9)	10 (4.8)	6.604	3	.086
Every 2 months	132 (77.6)	140 (76.6)			
Every 3 months	17 (10)	36 (17.4)			
Every 4 months/longer	11 (6.5)	21 (10.1)			
Comorbidity					
Yes	80 (47.1)	132 (63.8)	10.589	1	.001*
No	90 (52.9)	75 (36.2)			

χ^2 (chi-square), df (degree of freedom), * bold figures indicate significant p-values.

Independent variables with a p-value of $< .25$ in the chi-square test (Table 3) were transferred to a stepwise forward approach binary logistic regression to determine their effects on the probabilities that they have on the target BP control. The logistic regression model was statistically significant, Omnibus Test of Model Coefficient, $\chi^2(3) = 20.79$, $p < .000$. The Hosmer and Lemeshow Test of Model Fit also produced a nonsignificant value, $\chi^2(4) = .73$, $p = .947$ that means there was no difference between the observed and predicted model indicating the model adequately fits the data. History of no comorbidity, medication adherent, and normal BMI were statistically significant predictors of the target BP control in the adjusted regression model (Table 4).

Table 4. Binary logistic regression showing participants' predictors of the target BP control.

Variable	AOR	95% CI	p -value
Comorbidity			
No	1.911	1.256 - 2.908	.002
Yes	Reference		
Medication adherence			
Adherent	2.535	1.078 - 5.960	.033
Non adherent	Reference		
BMI			
Normal	1.675	1.094 - 2.564	.018
Overweight/obese	Reference		

CI = confidence interval; AOR= adjusted odds ratio. In adjusted for gender (male/female, referent: male), age category (young adult, middle age adult, older; referent: young adult), clinic follow-up (every month, every 2 months, every 3 months, every 4 months or longer; referent: every 4 months or longer), number of current BP medications (one, two, three or more; referent: one), hospitalization related to HTN (yes/no; referent: no), family history of HTN (yes/no; referent: no), comorbid diabetes and/or CKD present (no/yes; referent: yes), medication adherence (adherent/not adherent; referent: not adherent), BMI (normal/overweight or obese; referent: overweight or obese)

DISCUSSION

Achievement of target BP control is crucial to avert CVD in hypertensives. In this study, adult hypertensives getting specialized follow-up care were assessed for target BP control status and its relationships with their sociodemographic and clinical characteristics. The main findings were low target BP control achievement and that characteristics including normal BMI, absence of comorbid diabetes and/or CKD, and strict medication adherence were significantly related to achieving target BP control of participants.

In the present study, despite participants were receiving specialists' treatment and care, the target BP control rates were poor, especially for SBP, and did not differ by gender ($p = .196$). The findings are alarming since patients were being referred from general and community level hospitals when they failed to achieve optimal BP control and possibly had complicating conditions for their referral. The present finding is consistent with plenty of studies that have documented lower rates of target BP control among hypertensives receiving long-term follow-up care from hospitals [29,30]. The lower rate of BP control among hypertensives found in the current study and in several other earlier studies suggests that the problem was perennial and unwelcome, necessitating due consideration for the reduction of the harmful end of CVD caused in particular by the uncontrolled SBP. After the age of 50-year, SBP control is more crucial than DBP as a major CVD risk factor [31]. The different rates of target BP control between systolic and diastolic BP that we observed in our study are in line with several important findings from clinical trials and observational data that consistently showed that the target SBP control was less consistently attained than the target DBP control and that the poor SBP control was largely responsible for the overall low-rate target BP control [32]. This is mainly due to managing the SBP to the target level is more problematic than lower the DBP [33] since it requires two or more drugs in the majority to get it to the normal level [34]. Despite the fact that nearly half (Table 1) of the patients were taking two antihypertensive medications, and that those taking two drugs were more likely to have their blood pressure controlled than those taking only one, the target BP control associated with the patients' numbers of drugs used in our study did not reach the significant level ($p = .054$). In our binary logistic regression analysis, controlling for medication adherence and BMI, patients who had no comorbidity were nearly two times more likely to have target BP control compared to those with comorbidity. Patients with comorbid diabetes and CKD were less likely to have the target BP control possibly due to the complicating effects of the diseases on BP and pill burden from the numbers of disease conditions needing multiple drugs [35,36]. The finding of diabetes as the common comorbid condition in the present study is consistent with several previous studies [37] and documented among patients with lower rates of target BP control [38–40]. Hypertensives with comorbid diabetes were also at increased risk for microalbuminuria with progression to CKD, which was present in a tenth of the current study participants with poorer target BP control and potential for an increased risk of CVD complications and CV mortality at every BP level [41]. Though majority of our study participants had a reasonably good bi-monthly clinic-based follow-up, studies recommend much closer follow-up visits for better management of difficult to control HTN and comorbidities [28,42].

In the present study, patients who had a strict adherence to antihypertensive medications were two times more likely to have target BP control compared to those who were nonadherent to antihypertensive medications controlling for other variables in the model, which is consistent with earlier studies [43,44]. Previous studies reported the existence of

significant association between pill burden and lower rates of medication adherence [35,36]. Fixed dose combinations (though costly) was suggested to lower patients' pill burden, ease medication administration for caregivers and enhance medication adherence that improve the target BP control [36,45].

In present study, when other factors in the model were controlled, patients with normal BMI were nearly twice as likely to achieve target BP control as patients who were overweight or obese. The fact that there were more overweight and obese hypertensives in this study may indirectly explain why the BP control rate was low. Our finding is consistent with several previous studies [46–48].

The finding of majority (60%) of participants in the present study being overweight or obese shows a much prevalent modifiable CVD risk among the studied population, and is comparable to a recent study that reported a high (71.6%) overweight/obesity rate among hypertensives on a follow-up in Ethiopia [23]. Previous epidemiological studies in Ethiopia documented a higher (30%) prevalence of overweight and obesity among the urban population of Addis Ababa [7], which may also account for the high proportion of overweight and obesity in the present study. Other researches from lower levels and regional town hospitals in Ethiopia also showed considerable rates (38% - 48%) of overweight and obesity among patients with HTN with poorer BP control rates [37,49,50] though lower compared to the present finding. Similarly, South African and other large samples (n=30044) multi-sites African studies that examined the association between obesity and HTN discovered that hypertensives had a greater rate of obesity (70%) and a three-fold higher likelihood of having uncontrolled BP [51,52]. The present study was conducted at a tertiary level hospital where patients are primarily referred for better evaluation and likely have more risk factors than those monitored at the primary and secondary care levels and in urban Ethiopian settings (where the former studies were conducted), which may account for the present finding of a higher proportion of overweight and obesity. Given the higher prevalence of overweight and obesity in the study area and the present finding's confirmation of previously published data attesting to the association between overweight/obesity and low target BP control, our observation of a higher proportion of hypertensives who are overweight or obese with low target BP control is well-supported. The obesity link with high BP is currently better understood in that adipose tissue produce molecules that signal inflammation and oxidative stress in the adipose tissue that interact with microvascular endothelium resulting in microvascular resistance raising the BP [53].

CONCLUSIONS

Intervention targeting hypertensives' body weight control, early comorbidity screening and management, and strict adherence to antihypertension medication should be among the priority care of hypertensive clinic specialists' team. Large scale research that delves into root causes of low target BP control using a better methodological approach including both the office and ambulatory BP measurements is worth considering.

IMPLICATIONS

Since the study was carried out at the highest (a tertiary level) referral hospital care setting, the findings have a number of importance to practice, education, and future research policies. For the optimum management of HTN, the specialist team should focus on patients' self-sustained goal BP control. Evidence shows motivational and behavioral techniques were most effective in enabling patients to behavioral adjustments for risk factors and the difficult to control high BP, such as those overweight/obese, and patients with comorbid conditions [54,55]. There is also a need to advance the role of nurses and other HCPs in HTN care and management through a collaborative/interdisciplinary practice team approach, which was most successful in bringing BP under control in a short amount of time and was successful in reducing CV events [56]. Furthermore, to reach the goal BP for the specific adult group (young, middle-aged, and elderly adults) in hypertensives, future research should concentrate on the individual level assessment of self-efficacy on target BP; gender-specific risk, and lifestyle factors that cause HTN to begin at a young age.

LIMITATIONS OF THE STUDY

The study was a single site cross-sectional that restricts generalization of the findings to other tertiary level hospital hypertensive patient attendees.

AUTHORS CONTRIBUTIONS

DMB and RAG contributed to the conceptualization, data collection, analyses and draft writing of the manuscript. DYG, AWY, and MKH contributed to methodological design, critical revision and edition of the final version. All authors have agreed on the final version of the manuscript.

DECLARATION OF CONFLICT OF INTERESTS

The authors declare on potential conflict of interests with respect to this research.

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