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CARDIOVASCULAR DISEASE RISK FACTORS AMONG KOFORIDUA TECHNICAL UNIVERSITY STAFF: A CROSS-SECTIONAL INSTITUTIONAL-BASED STUDY

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DECLARATION

I hereby declare that this dissertation entitled "*Cardiovascular Disease Risk Factors Among Koforidua Technical University Staff: A Cross-Sectional Institutional-Based Study*" is my original work carried out under the supervision of Professor Francis Anto.

Related research works which served as sources of information were duly referenced.

Signed:  Date: 14/03/2025

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Signed:  Date: 14/11/2025

Prof. Francis Anto (Supervisor)

DEDICATION

I dedicate this work to God Almighty.

ACKNOWLEDGEMENT

I acknowledge that the LORD God is the source of knowledge and understanding in every kind of literature and wisdom. I am grateful for His grace and guidance in my academic and professional journey. I express appreciation to my family and senior friends for their immense support over the years.

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LIST OF ABBREVIATIONS

ART: Antiretroviral Therapy

BMI: Body Mass Index

CVD: Cardiovascular Diseases

RF: Risk Factors

DVT: Deep Vein Thrombosis

EPDC: Epidemiology and Disease Control

GHSERC: Ghana Health Service Ethical Review Committee

GHS: Ghana Health Service

HIV: Human Immune Deficiency Virus

KTU: Koforidua Technical University

LMIC: Low Middle-Income Countries

LVH: Left Ventricular Hypertrophy

MI: Myocardial Infarction

MOH: Ministry of Health

NCD: National Communicable Disease

NHIS: National Health Insurance Scheme

NSAIDs: Non-steroidal anti-inflammatory Drugs

OOP: Out of- Pocket Payment

PAD: Peripheral Artery Disease

SDG: Sustainable Development Goals

WHF: World Heart Federation

WHO: World Health Organization

DEFINITION OF TERMS

Cardiovascular disease	-	refers to a cluster of disorders of the heart and blood vessels.
Risk factor	-	defined as exposure or health condition that influence a person's susceptibility to developing a disease (health outcome).
Antihypertensive	-	drugs for high blood pressure treatment and control
Antidiabetics	-	drugs for diabetes treatment and control
Statins	-	refers to class of drugs that lower high blood cholesterol level
Body mass index	-	refers to the mass of individual in kilograms per height in meters squared. Used to assess weight status associated with health risk

ABSTRACT

Background: Cardiovascular diseases are a global health threat. Among the triple burden of disease faced in Africa, cardiovascular diseases account for more mortality than infectious diseases among the adult population. Cardiovascular risk factors also contribute to disability, absenteeism, and low productivity in the Ghanaian community. This current research assessed the prevalence of cardiovascular risk factors among Koforidua Technical University staff.

Methods: An institutional-based cross-sectional study was carried out among staff of Koforidua Technical University from August to October 2024. This study recruited participants by a stratified random sampling technique. Participants were categorized into two strata: teaching stratum and non-teaching stratum. A computer-generated random number method was employed to select independently126 individuals from the teaching stratum and another 126 individuals from the non-teaching stratum, for the sample size of 252 participants. Participants were randomly enrolled from clinic outpatient visits and offices. Data collected include a family history of CVD, current use of antihypertensive, and antidiabetic drugs. Measurements for anthropometric and blood pressure were performed using WHO guidelines. Logistic regression analysis in STATA 17 software was used to identify risk factors.

Results: The mean age of the 252 study participants was 44 years (range: 25 to 59). Most were males (71.4%), and 81.0% married. Key findings showed that 48.4% had a family history of CVD. Hypertension was found to be the most prevalent modifiable risk factor (40.5%), followed by obesity (33.7%) and diabetes, the lowest, at only 5.5%. A unit increase in age (≥30 years) increased the odds of developing high blood pressure by 72%, while each additional outpatient clinic visit reduced the odds by 78%. The socioeconomic factors associated with cardiovascular risk were marital status and accessibility to clinic services.

Conclusion: Significant predictors emerged as non-modifiable risk factors were age, sex, and family history of CVD. Hypertension was the topmost cardiovascular risk factor, followed by obesity and diabetes. Socioeconomic factors identified were the marital status and clinic services accessibility. This calls for the clinical implementation of secondary prevention of CVD by government policymakers to improve access to healthcare in institutional community settings.

CHAPTER ONE

INTRODUCTION

1.1 Study Background

Cardiovascular disease refers to a cluster of disorders of the heart and blood vessels. Coronary artery disease, stroke, heart failure, peripheral artery disease and other such cardiovascular diseases are the leading contributors to disease burden globally (Roth et al., 2020).

A recent report from the World Heart Federation (WHF) highlights a concerning trend: globally, the death rate from cardiovascular disease increased by 60% from 12.1 million in 1990 to 20.5 million in 2021. In low- and middle-income countries (LMICs) like Ghana, four out of five deaths in 2021 were due to CVD (WHF Report, 2023). Among the triple burden of disease faced in Africa, cardiovascular diseases account for more mortality than infectious diseases among the adult population. Cardiovascular disease risk factors also contribute to disability, absenteeism, and low productivity in Ghana.

Cardiovascular disease risk factors can be categorized into two: non-modifiable risk factors and modifiable risk factors. Non- modifiable risk factors include idiopathic, genetics, age, sex, and family history. While hypertension, obesity, diabetes, high blood cholesterol (dyslipidemia), tobacco smoking, physical inactivity, sedentary lifestyle, stress and socioeconomic factors are considered modifiable risk factors.

A study conducted in Ghana reported hypertension as the major CVD risk factor. This was followed by obesity, diabetes, and peripheral artery disease (Li et al., 2020). Similarly, Murray *et al.,* (2020), reported hypertension, obesity, diabetes, tobacco smoking, and air pollution as the

major CV risk factors that contribute to half of the global burden of disease. There are several evidence confirming the relationship between occupation and cardiovascular health outcomes. In a meta-analysis, Niedhammer et al. (2021) revealed a strong association between psychosocial work factors and cardiovascular diseases. The academic environment can be inherently stressful, with deadlines, research pressures, and administrative responsibilities contributing to high stress levels among university employees. Chronic stress and unhealthy eating patterns, such as high intake of processed foods and excessive intake of alcohol, and saturated fats, have been linked to cardiovascular problems, including hypertension and increased risk of heart disease. There are effective methods for reducing the CVD burden. These include early diagnosis and comprehensive care, individual strategies to modify risk factors for high-risk individuals, and population-wide efforts to reduce overall risk factor exposure (Wollum *et al.*, 2018). MacDonald *et al.*, 2017 recommended that targeted public health interventions may enhance the cardiovascular health of workers with different CVD risk factors employed in diverse occupational settings. Employees at educational institutions such as universities may face challenges in accessing regular healthcare due to their busy schedules or inadequate convenient healthcare facilities close to them. Early detection and management of cardiovascular risk factors, such as hypertension and diabetes, are crucial in preventing the progression to cardiovascular disease. Institutions can address this by providing access to workplace health services, performing health check-ups, and promoting regular health screenings for their staff. Capacity building and resourcing the primary healthcare centres with diagnostic tools will contribute to assessing CVD risk factors and facilitate basic prevention and treatment interventions of CVD early in Ghana because they are often the first point of call when the larger population wants to visit facilities for the first time (Doku et al., 2023). In Ghana, the problem has necessitated various stakeholders from the Ministry of Health of Ghana,

Ghana Health Service, and Ghana Heart Initiative to develop Guidelines to improve the risk assessment, prevention, and management of CVDs at all levels of care (MOH, 2021), but the implementation of this guidelines at the primary care level such as CHPS compounds and health centers, is yet to be known.

Addressing cardiovascular risk factors among university staff is not only vital for the health and well-being of the staff themselves but also aligns with the broader goals of promoting a healthy campus environment. By implementing targeted interventions that address these risk factors and access to healthcare, universities can contribute significantly to control and prevent cardiovascular diseases and monitor results among employees to enhance productivity and a healthier community (Fuster, 2014). Hence, promoting ideal cardiovascular health and good ageing throughout life is essential. Socioeconomic factors remain fundamental drivers of ischemic heart disease, indicating that multi-sectoral interventions are needed to eradicate this disease (Gupta and Wood, 2019). Although some studies have attempted to provide a thorough understanding of the prevalence of CVD risk factors in Ghana, quite a few have focused on assessing the CVD prevalence at the institutional population-based level. In this study, we assessed cardiovascular risk factors among university employees and made some recommendations.

1.2 Problem Statement

Cardiovascular diseases pose a threat to global health. The WHO estimates that 17.9 million deaths worldwide in 2019 were attributable to CVD, accounting for 32% of all global deaths. Low- and middle-income countries accounted for three-quarters of these deaths (WHO, 2021). In Ghana, CVDs are the leading cause of morbidity and mortality accounting for more institutional deaths than malaria among the adult population (Ofori-Asenso & Garcia, 2016). Moreover, a recent

systematic and meta-analysis reported a 10.65% pooled prevalence of CVD in studies conducted using a cross-sectional study design (Doku et al., 2024). This is a significant public health concern. Hence, strategic interventions are urgently needed to address the underlying risk factors and improve health outcomes.

Li et al. (2020), reported hypertension, as the most known CVD risk factor among cardiometabolic factors in Ghana. Other risk factors include behavioral factors such as alcohol abuse, physical inactivity, and environmental factors, including stress and air pollution (WHF, 2023). Health illiteracy, limited access to healthcare, lack of CVD diagnostic equipment (Doku et al., 2023) and the high burden of infectious diseases like malaria, and HIV/AIDS, are known to be contributory factors to CVD risk (Appiah et al., 2019).

Though the Ghana Ministry of Health has adopted several health policies and interventions to curb the CVD burden, the outcome is negligible at the primary care level. These interventions are not limited to health promotion programs and effective case management of NCDs with national clinical guidelines (Ghana NCD Policy, 2022). Yet CVD often leads to mortality, long-term disability, reduced quality of life, premature retirement, absenteeism, reduced overall work performance (presenteeism), low productivity and economic burden on institutions (Gheorghe et al., 2018).

According to WHO, by 2025, premature CVD mortality should be decreased by 25% (WHO, 2016). To achieve this, existing gaps such as research and availability of data on CVD risk factors, and accessibility to healthcare need to be revised and addressed urgently. We, therefore, attempt to bridge this gap by evaluating the prevalence of cardiovascular disease and its risk factors among university staff. This will also help in making informed decisions on CVD risk factors prevention and control easy in the academic setting.

1.3 Justification

It is crucial to assess the cardiovascular disease risk factors prevalent among university staff in Ghana. This is a critical step in initiating institutional-based interventions to reduce the burden of CVD on the country's economy and institutions like public universities. A substantial amount of money is being spent on drug procurement and medical bills for students, staff, and their dependents. The workforce is also significantly affected by sick leave, absenteeism, presenteeism, and mortality due to CVD. Therefore, reducing the prevalence of CVD risk factors to reverse these negative effects and promote a healthier population is essential.

In a meta-analysis review, Niedhammer et al. (2021) asserted a clear and positive link between high-strain jobs with long working hours and cardiovascular diseases (congestive heart disease, and stroke) and risk factors such as obesity, depression, and physical inactivity among employees.

Identifying and understanding CVD risk factors among university staff can help institutions implement wellness programs and policies. This will improve employee cardiovascular health, reduce morbidity and mortality rates, and increase productivity. Health education, screening programs, promoting healthy lifestyle choices, and optimizing resource allocation are critical interventions. These strategies will encourage a healthier work environment and improve the overall well-being of university staff.

Agyekum and Akumiah (2023) found that the burden of cardiovascular diseases and mortality in Ghana is increasing faster than cardiovascular research. Institutions and policymakers need to improve primary preventive and management research for CVD risk factors to reduce this burden. This will increase productivity and contribute to long-term health benefits, ultimately helping to achieve the SDG 3 targets by 2030 (WHO SDG 3, 2024).

1.4 Conceptual Framework of Cardiovascular Risk Factors

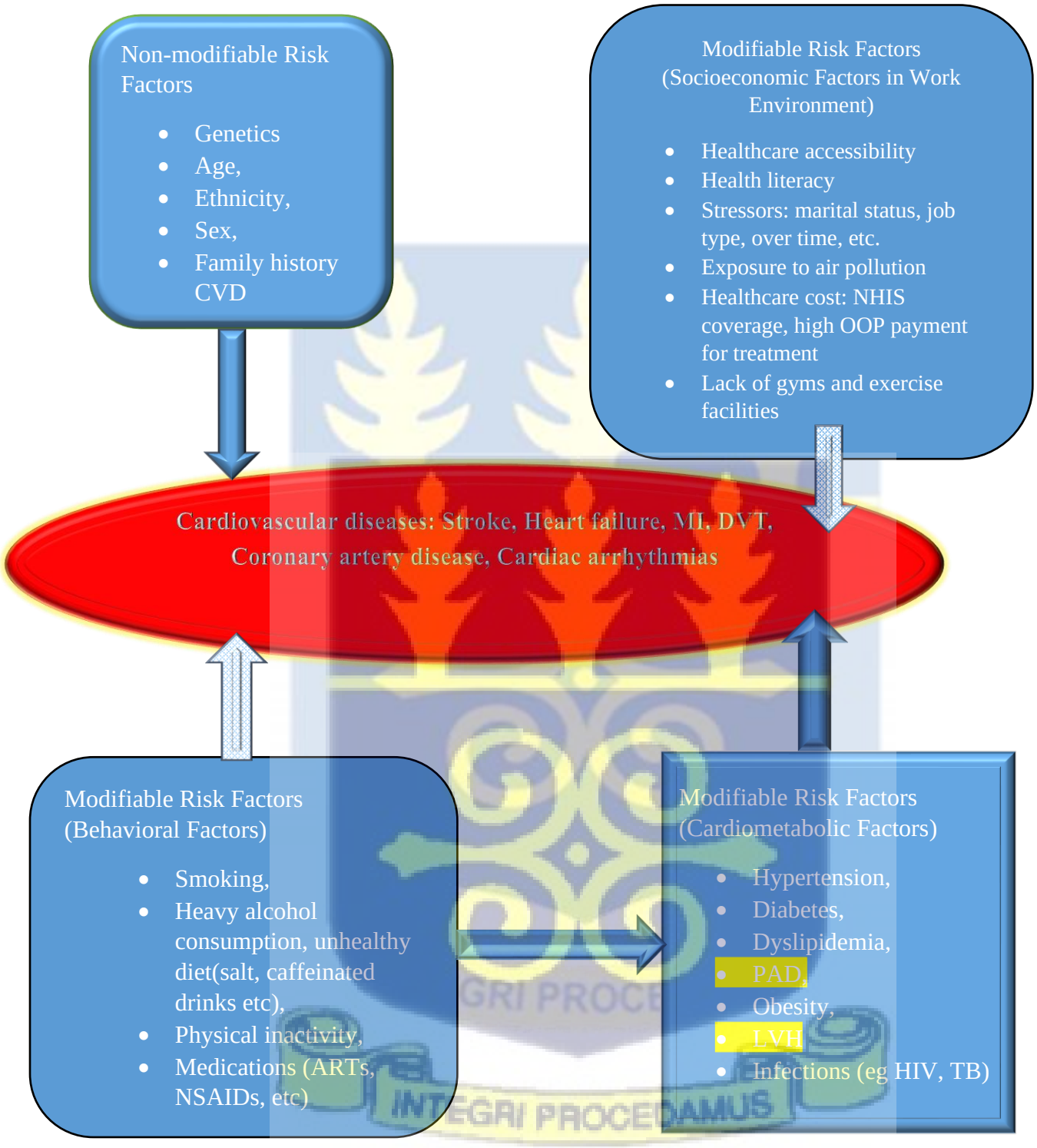

Fig 1.1 Conceptual Framework of the Cardiovascular Disease Risk Factors among Study Participants.

Acronyms

ART: Antiretroviral therapy; CAD: Coronary Artery Diseases; CVD: Cardiovascular diseases; DVT: Deep Vein Thrombosis; MI: Myocardial Infarction; NSAIDs: Non-steroidal anti-inflammatory Drugs; National Health Insurance Scheme; OOP: Out of Pocket payment; PAD: Peripheral Artery Disease; LVH; Left Ventricular Hypertrophy.

Narrative

The conceptual framework (***figure 1***) above was adapted from several sources of literature. The goal was to identify risk factors that directly or indirectly affect CVDs. Studies that quantified the association between identified risk factors and CVD were included while those that do not support the hypothesized association were excluded. Cardiovascular diseases include stroke, heart failure, myocardial infarction (MI), deep vein thrombosis (DVT), coronary artery disease (CAD), cardiac arrhythmias, and artrial fibrillations. Findings from studies are represented below. CVD causes are generally non-modifiable and modifiable factors (Maculewicz et al., 2022).

1.4.1 Non-modifiable factors

Genetics, age, ethnicity, sex, and family history of CVD are non-modifiable factors that cannot be controlled or changed. However, they can have a direct influence on cardiometabolic factors and CVD outcomes, as depicted in Figure ***1*** above.

Genetic mutations can influence the risk of heart disease. A family history of cardiovascular disease controls the potential risk of CVD depending on the figure and age of affected first-degree relatives (Kolber & Scrimshaw, 2014). Though the Framingham study demonstrated cardiac disease risk can be doubled or tripled due to unfortunate genes, ageing can increase the risk of morbidity or mortality due to hypertension, heart failure, atrial fibrillation and stroke (Lee et al., 2020). In both male and female sexes, the risk of CVD increases with age, and this may link to a

complete decrease in sex hormones, primarily estrogen and testosterone as Rodgers et al. (2019) reported. Moreover,Y.-K. Wong et al. (2018), reported age as a biomarker-clinical risk for the prediction of cardiovascular events in patients with coronary artery disease, a complication of cardio-metabolic conditions such as hypertension, dyslipidaemia, obesity and diabetes.

1.4.2 Modifiable Risk Factors

The environmental or modifiable factors are factors that can be controlled. This is categorized into two: behavioral risk factors and cardio-metabolic risk factors. Genes do not act alone Genes - a sedentary lifestyle and physical inactivity control CVD risk (Hajar, 2020). The major behavioral factors are physical inactivity, heavy alcohol consumption, an unhealthy diet, and cigarette smoking. Work environment factors directly affect behavioral and cardio-metabolic risk factors and indirectly affect CVD outcomes. These work environment factors include stressors: marital status, long working hours or overtime, heavy workload, type of work (office or fieldwork), and shift night work, and , low literacy level, healthcare service inaccessibility, high cost of care, low NHIS coverage, and hazards such as , toxic air pollution exposure etc., influence directly on cardiometabolic risk factors and indirectly on CVD outcome.

The modifiable cardio-metabolic factors are hypertension, diabetes, dyslipidemia, Obesity, and peripheral artery disease. Güneş et al. (2019), reported that high systolic blood pressure, low high-density lipoprotein cholesterol, obesity, poor nutritional status, cigarette smoking, family history, age, male gender and high total cholesterol are all standard CVD risk factors. Moreover, a national survey conducted in Ghana reported hypertension (55.4%), dyslipidemia (37.5%), and obesity (21.5%) as predominant risk factors for CVD (Li et al., 2020). According to a recent WHF report, high blood pressure, obesity, poor diet, diabetes, high cholesterol, air pollution and tobacco use

are major risk factors for CVD (WHF, 2023). These factors can directly affect CVD outcomes that have major effects on staff and the institution as illustrated ***figure. 1*** above.

1.5.0 Research Questions

1. What are the non-modifiable risk factors of cardiovascular diseases among Koforidua Technical University staff?
2. What is the prevalence of hypertension, diabetes, and obesity as cardiovascular risk factors among Koforidua Technical University staff?
3. What socioeconomic factors are associated with cardiovascular disease among Koforidua Technical University staff?

1.5 Objectives of the study

1.5.1 General Objectives

To assess cardiovascular risk factors among staff of Koforidua Technical University.

1.5.2 Specific Objectives

1. To identify non-modifiable risk factors of cardiovascular diseases among Koforidua Technical University staff
2. To determine the prevalence of hypertension, diabetes, and obesity as cardiovascular risk factors among Koforidua Technical University staff
3. To determine socioeconomic factors associated with risk factors for cardiovascular disease.

CHAPTER TWO

LITERATURE REVIEW

2.1 Burden of Cardiovascular Risk Factors

Cardiovascular diseases are common, with poor prognosis and remain the main global cause of death and disability (WHO, 2020). The burden of disease risk factor study is the primary systematic and complete attempt to identify, and map out emerging threats to a population significance to point out preventive strategies.

According to Roth et al. (2020), the global prevalent cases of total cardiovascular disease (CVD) nearly doubled from 271 million in 1990 to 523 million in 2019. In 2019 alone, CVD caused 6.2 million deaths, occurred between the ages of 30 and 70 years, this is nearly at par with a recent global viral pandemic.

Despite being preventable, CVD is the primary cause of early death in Sub-Saharan Africa (SSA), mainly due to uncontrolled hypertension (Keates et al., 2017). Earlier the regional prevalence of CVD in SSA was 5.5% in a systematic analysis conducted and the pattern has continued to rise over decades (Mensah et al., 2015). By 2030, the burden of CVD is expected to double in SSA (Amegah, 2018) if implementable preventative policies are not put in place to stop these threats, the continent will face a triple burden of diseases due to cardiovascular diseases, existing and re-emerging infectious diseases. In Ghana, Doku et al. (2024), revealed in a systematic review and meta-analysis that the national CVD prevalence was 10.34% twice the prevalence of 5.5% in Sub-Saharan Africa (Mensah et al., 2015). A study conducted in a peri-urban district in the eastern region of Ghana reported that CVDs were the primary cause of mortality in 2014 after diarrheal

illness (Ofori-Asenso & Garcia, 2016). According to Doku et al. (2024), the prevalence of CVD is high in Ghana and male sex, old age, unemployment, diabetes, and hypertension are identifiable associated risk factors as evidenced in existing literature. Other risk factors include family history, physical inactivity, smoking, high blood cholesterol, overweight or obesity, and family history of heart disease (WHF, 2023).

Identification of these risk factors is essential in promoting specific health intervention programs. Many studies on the epidemiology of CVD categorize them into non-modifiable and modifiable risk factors.

2.2 Non-modifiable risk factors of cardiovascular disease

It is well-established that age, sex, genetics, and family history of CVD are known non-modifiable risk factors associated with CVDs (Doku et al., 2024; Onyango et al., 2017; Regassa et al., 2021). However, recent studies indicate that occupation and marital status are linked to CVD risk occurrence. Mekonene et al. (2023) conducted a hospital-based cross-sectional study in Addis Ababa using the 10-year CVD risk Framingham Risk Score. It was revealed that a significant proportion (28.2%) of hypertensive patients had a high predicted 10-year risk of CVD. This risk was found to be associated with age, gender, unemployment, and high systolic blood pressure. Notably, unemployed participants were 3.24 times more likely to have a higher risk of CVD compared to employed participants, and those aged 64-74 years were 4.21 times more likely to have a higher risk than those aged 40-47 years. These findings highlight the urgent need for targeted interventions to reduce the burden of CVD in older adults. A 2018 meta-analysis by C. W. Wong et al. (2018) found that unmarried individuals had a 42% increased risk of developing CVD compared to those married from 34 studies, These findings assert the importance of marital status as a risk factor for CVD. According to the World Heart Federation (WHF, 2023), people

with a first-degree relative who had a heart attack before the age of 55 (for men) or 65 (for women) are at higher risk of developing cardiovascular disease due to hereditary factors or family history. This information buttress Agyekum and Akumiah (2023) studies that identified age, sex, family history, occupation status, and marital status as predictors of CVD.

2.3 Modifiable Cardiovascular Risk Factors

Cardiovascular disease burden is mainly due to modifiable risk factors according to Roth et al. (2020). This is categorized into cardio-metabolic factors, environmental and occupational factors, behavioral factors, and socio-economic factors (WHF, 2023). The established cardio-metabolic factors include hypertension, diabetes, dyslipidemia, overweight and obesity (Sharma et al., 2023) and tobacco smoking (Braffett et al., 2022).

2.3.1 Hypertension

Hypertension is a key risk factor for cardiovascular disease. The global burden of hypertension is projected to increase, affecting one-third of the world's population by 2025 (Oliveros et al., 2020). According to a study using electronic health records, individuals with hypertension were five years more likely to develop CVD in their lifetime than those with normal blood pressure (Rapsomaniki et al., 2014).

Studies have shown that the incidence of hypertension increases with age. Age-related pathological changes in the heart and blood vessels can raise a person's risk of CVD. Evidence from Regassa et al. (2021) study revealed that individuals aged 60 years and above are more than three times more likely to develop CVD than those who are younger than 40 years like Doku et al. (2023), in a meta-analysis reported in Ghana. According to Kurtul et al. (2020), cross-sectional studies carried out among a university hospital staff, one in six people aged 40-49 and one in three

individuals aged 50-59 have hypertension and advised that individuals aged 40 years and above routinely be screened. The World Health Organization, 2023, reported that 34% of adults aged 30-79 years in Ghana have hypertension, but only 50% of the total population is diagnosed. To bridge this wide gap, it is crucial to increase hypertension screening programs such as wellness clinics nationwide and prioritize hypertension periodic screening for individuals aged 40 years and above.

2.3.2 Diabetes

According to the Ghana Offensive against Diabetes Report by the WHO in 2023, approximately 2.4 million people are living with diabetes in Ghana. Patients with diabetes are likely to develop cardiovascular disorders, which are major sources of morbidity and mortality. Diabetes frequently manifests as insulin resistance, which can raise blood glucose levels. A recent meta-analysis by Doku et al. (2024) found that individuals with diabetes are more likely to develop CVD than those without diabetes. Earlier, in Ethiopia, a cross-sectional study found that 17.9% of workers had metabolic syndrome and 3.4% of workers had diabetes (Gidey et al., 2023). These are well-established cardio-metabolic risk factors for CVD.

Studies indicate that diabetes is linked to some risk factors such as hypertension, central obesity and dyslipidemia. Zhou et al. (2015) asserted that the severity of diabetes largely depends on the presence of vascular risk factors and there was a high prevalence of atherosclerosis in older individuals with advanced diabetes.

A study conducted by Regassa et al. (2021) reported that the prevalence of cardiovascular diseases was high at 42.5% among patients with type 2 diabetes in Ethiopia. This was linked to factors such as advanced age, physical inactivity, alcohol consumption, high body mass index, hypertension, and microvascular complications. Therefore, public health interventions should consider age, sex, physical activity, diet and socio-demographic disparities to promote cardiovascular health.

2.3.3 Obesity

Obesity is defined as having a body mass index (BMI) ≥30 or having central obesity (BMI ≥28 with waist circumference ≥90 cm in men or ≥80 cm in women) according to the WHO's 2005 guidelines. In Ghana, a study conducted by Ofori-Asenso and Garcia (2016) found that estimates for the national prevalence of overweight and obesity were 25.4% and 17.1% respectively. The prevalence of obesity is higher in urban areas among women of reproductive age, as reported by Amugsi et al. (2017) analysis. In the same year, Boakye et al. (2017) emphasized that women employed in public institutions with a high education were more likely to be overweight or obese than those without a formal education. An increase in BMI is due to unhealthy lifestyles, work intensity, work stress, irregular eating habits and lack of exercise as reported by Kurtul et al. (2020).

In Regassa et al. (2021) study among diabetes patients, CVD was highly prevalent and associated with advanced age, physical inactivity, overweight and obesity, and hypertension, These risk factors tend to co-occur within the same individuals, and the cluster of diabetes, hypertension, and obesity have been associated with a higher risk of cardiovascular diseases (Olufayo et al., 2023).

Intensive lifestyle intervention together with rational use of drug treatment for obesity may reduce the cardiovascular risk factors and prevent poor CVD outcomes as revealed in a systematic and clinical review (Yanovski & Yanovski, 2014).

2.3.4 Behavioral risk factors

Lifestyle behavioral risk factors are reported in the Ghana Heart Study as being alcohol use, smoking tobacco, being physically inactive, and having inadequate fruit and vegetable intake (Li et al., 2020). Moreover, other studies confirm psychological stress in addition to the above factors as behavior risk factors of CVD (WHO, 2005; WHF, 2021).

Agyekum et al. (2024) reported that Ghanaians have a high prevalence of lifestyle behavioral risk factors for atherosclerotic cardiovascular disease. The study asserted that males are more likely to use tobacco and alcohol than females. And those married are more likely to have two or more risk factors than the unmarried. Almost 92% of participants had multiple risky behavioral factors in their findings.

According to research, individuals who work in blue-collar or service jobs may face a higher risk of diseases. This is likely because they are often paid lower wages, experience high levels of stress and job insecurity, and are more likely to work long hours or shift work, which can lead to a sedentary lifestyle as confirmed by Sherry, et al., 2016. This, in turn, can affect cardiovascular health. A recent study by Saberinia et al., 2020 found that there is a significant correlation between high work-related stress and glucose levels, but no apparent relationship with other cardiovascular disease risk factors was found.

Workers and employers need to take steps to mitigate these risks. Improving access to healthcare is also crucial in managing other chronic disease risk factors (Boakye, et al., 2017), especially at the workplace. This will prevent CVD and improve the health and overall well-being of individuals affected by occupational stress.

2.3.5 Socio-economic factors

Socioeconomic status (SES) has a significant effect on health. This is because education, income and employment are closely associated with dietary and physical activity patterns, making them important predictors of cardiovascular disease outcome (Psaltopoulou et al., 2017). Unfortunately, individuals with low SES are more likely to experience increased cardiovascular event rates and poorer outcomes (Schultz et al., 2018). This supports previous multi-cohort and meta-analysis studies, which found an independent association between SES and mortality due to traditional

major CVD risk factors(Stringhini et al., 2017). This evidence is crucial, and we must address socioeconomic factors through effective behavioral interventions that consider social determinants of health at both individual and community levels.

Research has shown that women employed in the public sector are almost 5 times more likely to be overweight or obese (OR: 4.94, 95% CI) than the self-employed or those in the private sector and recommended inexpensive targeted intervention programs to reduce overweight and obesity (Boakye et al., 2017), particularly among Ghanaian women employed in the public sector.

As evidenced in randomized double-blind, placebo-control, 2-by-2 factorial trial, cocoa extract supplements among older adults reduced CVD mortality by 27% Cocoa (Sesso et al., 2022). Other evidenced-based nutritional modifications such as consuming more fruits, vegetables, seeds, plant proteins, legumes, nuts and fatty fish (Belardo et al., 2022; Eichelmann et al., 2022) and social determinants of health are important in the prevention of CVD.

Therefore, multifactorial effective management of hypertension, diabetes, dyslipidaemia, and obesity through both therapeutic, behavioural and socioeconomic interventions are needed more at the primary healthcare level to reduce CVD burden.

CHAPTER THREE

METHODS

3.1 Study design

A cross-sectional descriptive institutional-based study was carried out among Koforidua Technical University staff within a three-month period, from August to October 2024. Participants were randomly enrolled from clinic outpatient visits and offices. Data collected included a family history of cardiovascular disease and current use of antihypertensive, antidiabetic, and cholesterol-lowering drugs. Measurements for anthropometric and blood pressure were performed using WHO guidelines. Logistic regression analysis in STATA 17 software was used to identify risk factors.

3.2 Study area

The study was conducted at the University Clinic of Koforidua Technical University (KTU), Koforidua, situated in the New Juaben South Municipality, Eastern region of Ghana. The 2021 census report showed that New Juaben South Municipality had a population of 125,256 residents, with 48.4% males and 51.6% females, covering an area of 43 sq km (PHC, 2021). Koforidua is the Eastern region's capital. The town is bounded by bustling urban municipalities, north-east with East Akim Municipality, to the south-east with Akwapim North Municipality, to the west Yilo Krobo Municipality, and to the east with Suhum Municipality. The New Juaben South Municipality lies between longitudes 1030° West and 0030° East, and latitudes 60° South and 70° North, in Koforidua, as depicted in *figure 2* below. Though the study area falls within a semi-deciduous rainforest, temperature is generally high ranging between 20 and 32 degrees Celsius. A previous study conducted by Ofori-Asenso and Garcia (2016) found that cardiovascular disease is the main cause of death in a peri-urban district. In 2020, the municipality reported an increase in cases of hypertension and diabetes from 6,594 to 13,776 and 1, 433 to 4573 respectively. The

regional prevalence of HIV was 3.4% above the national average of 1.7 in 2019 (New Juaben South Constituency Profile, 2021) and is a public concern. The Koforidua Technical University clinic, located on the main campus, is used by approximately 1,000 individuals seeking healthcare. The clinic operates as a primary healthcare provider for twelve hours each day. It has five departments, including OPD, laboratory, pharmacy, stores, and eye department, as well as two mini wards, three consultation rooms, and a total of twenty-two staff. The clinic provides high-quality healthcare services, including wellness and medical services to students, staff, and their dependents. Its focus is on providing holistic healthcare services that cater to the needs of its patients. The university clinic records attendance for more than 900 OPD individuals monthly and offers referral services to the Eastern Regional Hospital and St. Joseph's Orthopedic Hospital, both located in Koforidua. As part of KTU's strategic plan for 2023-2027, the university aims to enhance staff welfare, establish a fitness and wellness recreational centre, complete the new clinic building and extend healthcare services to the surrounding communities.

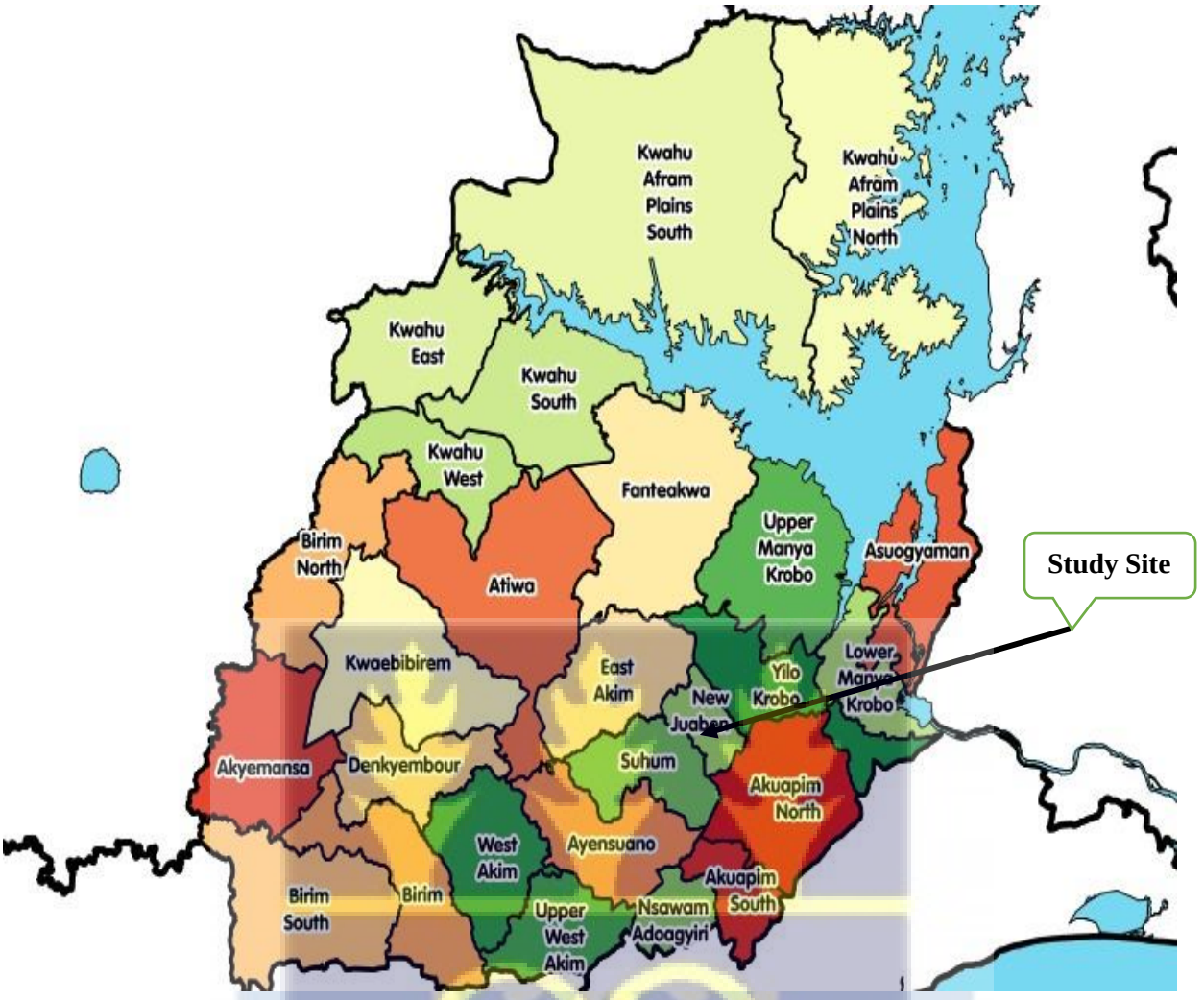

Fig. 3.1 Map of the Eastern region showing New Juaben Municipality, one of the twenty-six districts.

Map adopted from the local government service website. http.lgs.gov.gh/eastern.

3.3 Study population and participants

The study population consists of 651 university staff, 411 (63.13%) faculty, and non-teaching staff 240 (36.87%). Of this population, 476 (73.12%) are male and 175 (26.88%) females, with an age range between 25 and 65 years. Most of these staff reside off-campus and have additional personal jobs besides their university's job responsibilities. Most staff work in offices, while few others

work in the field. Approximately 90% of the staff are literates, with diverse academic standings, marital status, and cultural backgrounds. Most are subscribers of the national health insurance scheme while few are in the private health insurance scheme.

3.4 Sample size estimation

The study's sample size was determined based on the pooled prevalence of cardiovascular disease and its related risk factors in recent studies conducted in Ghana. The prevalence was found to be 10.34%, which is about twice the prevalence of 5.5% in Sub-Saharan Africa (Mensah et al., 2013). Therefore, the expected sample size of 142 was determined using the formula N = Z*2p (1-p)/d*2 for a single population proportion. Here, "N" represents the sample size, "p" is the expected prevalence or proportion in the population based on previous studies (10.34%), "d" is the margin of error or precision (0.05) and "Z" is the z statistic for a 95% level of confidence.

However, using the Yamane formula, $n = N/(1+Ne*^2)$,

where n = minimum sample size required

"N" is the known population size = 651

"e" is the 95% confidence interval margin of error = 0.05

$n = N / (1+ Ne^2) = 651 / (1+ 651 \times (0.05)^2) = 247.76.$

The minimum sample size (n) 248 was estimated. Hence, a sample size of approximately 252 participants was used for the study.

3.5 Sampling Technique

This study recruited participants by a stratified random sampling technique. Participants were categorized into two strata: teaching stratum and non-teaching stratum. The teaching stratum comprised academic staff members, including lecturers, instructors and professors, while the non-teaching stratum included administrative, technical and support staff. A sampling frame was prepared, with each member in each stratum assigned a unique identification number. To ensure a balanced sample, the study employed a computer-generated random number method, which facilitated the independent selection of 126 individuals from the teaching stratum and another 126 individuals from the non-teaching stratum. This process resulted in a total sample size of 252 participants, providing a baseline for the study's analysis.

3.6 Inclusion criteria

All permanent employees of KTU between the ages of 25 and 59 who were active in service and visited the university clinic were eligible to participate in the study. Employees who voluntarily submitted their signed consent forms were included in the study.

3.7 Exclusion criteria

This study excluded pregnant women and staff diagnosed with chronic health-related conditions such as disabilities, CVDs, and AIDS. This was done to minimise potential confounding variables and enhance the validity and reliability of the research findings.

3.8 Data collection tool

A modified WHO STEPS questionnaire was uploaded to Kobo Collect toolbox for data collection. Data were collected on demographics, socioeconomic factors, drug use history for hypertension, diabetes and high cholesterol treatment. Two trained research physician assistants collected blood

pressure, anthropometrics and other relevant study variables. Height was measured to the nearest 0.1cm using a stadiometer, and weight was measured to the closest 0.1kg using the weight and height RGZ-160 mechanical personal scale with a maximum height capacity of 70 – 90cm. Body mass indices were calculated from the physical measurements. Blood pressure was measured using the Andon KD-595 Automatic BP monitor. Participants were asked to sit in an armchair and rest quietly for 15 minutes. Without participants crossing their legs, three readings were obtained with participants resting for three minutes between each reading. The average of two systolic and diastolic blood pressure readings was recorded according to the WHO recommendations (WHO, 2024).

3.9 Study Variables

3.9.1. Definition of cardiovascular disease risk factors

The diagnosis of cardiovascular disease was based on guidelines set forth by the World Health Organization standard STEPS instrument core questions on the drug history of cardio-metabolic conditions and physical measurements (WHO, 2024). The cardiovascular risk factors definition includes self-reported hypertension, diabetes, elevated cholesterol, high body mass index, smoking, physical inactivity, and alcohol intake which have been confirmed by relevant studies (Olanrewaju et al., 2023).

3.9.2 Dependent Variable or Outcome of Interest

The cardiovascular risk factor was the main outcome of interest in this study. This dependent variable plays a crucial role in understanding the underlying factors and outcomes associated with CVD. Details are summarized in **Table 3.1** below.

Table 3.1 WHO Definition of cardiometabolic risk factors for cardiovascular disease

CVD Risk Factors	Definition
Hypertension	Having an average systolic BP (SBP) ≥140 mmHg or average diastolic BP (DBP) ≥ 90mmHg or having self-reported current antihypertensive treatment
Dyslipidaemia	Having self-reported current cholesterol-lowering treatment
Diabetes	Having self-reported current diabetes treatment
Obesity	Having BMI ≥30Kg/m^2

Individuals were deemed to have distinct clusters of their respective CVD risk factors if they had at least two out of four (≥ 2/4) cardiometabolic risk factors.

In this study, ideal cardiovascular health was defined as the absence of all cardiometabolic risk factors (not on antihypertensive or BP <120/80mmHg or untreated blood pressure <120/80 mmHg; not on antidiabetic drug for diabetes treatment; no statin drug history for high cholesterol treatment and ideal BMI <25 kg/m^2 without any clinical CVD (CHD, stroke, heart failure, etc.) similar to national studies (Li et al., 2020; Lloyd-Jones et al., 2010) definition.

3.9.3 Independent Variable(s) / Predictor(s)

The independent variables or predictors of cardiovascular risk among participants were age, sex, family history of CVD (stroke, heart failure, heart attack, and deep vein thrombosis) marital status, educational level, job description and history of access to healthcare.

3.10 Quality Control

Two research physician assistants were recruited for the study. They were trained on all aspects of the study including how to conduct interviews and complete the questionnaire electronically using the Kobo toolbox collect software. The questionnaire was reviewed and validated by physicians and researchers in the field of cardiovascular diseases for relevance variables of each construct measured before and after pretesting.

3.11 Data analysis

The electronic data were downloaded into a single master (Microsoft 365 Excel spreadsheet) for cleaning and imported into STATA software version 17 for analysis and processing. Data were again checked for duplicates and consistency before analysis. Normal distribution data was analyzed and presented as mean and standard deviation. Analysis was tailored to cardiovascular risk factors as outcome variables and socioeconomic factors as independent variables or predictors for two statistical methods - descriptive and inferential statistics analyses. Cross tabulations were performed to summarize the prevalence of cardiometabolic factors by predictors and presented in tables. Participants' mean age and standard deviation values were also computed and presented.

A univariate analysis was performed to determine the association between cardiometabolic risk factors and socioeconomic-demographic factors. A more robust analysis was performed using multivariate logistic regression to determine the factors associated with cardiometabolic risk factors. All other predictors were adjusted for potential confounders in the multivariate logistic regression analysis. Odds ratios, confidence intervals at 95% and p-values less than 0.05 were used for all statistical significance. Finally, a dichotomized variable was created for participants with no or single or multiple risk factors for CVD outcome. This was tabulated and frequencies of having either 0, 1, 2, or all 3 cardiometabolic risk factors for CVD were analyzed and presented in a chart.

3.12 Ethical consideration

This study was approved by the Ghana Health Service Ethical Review Committee (No. GHS-ERC: 065/05/2024) and the KTU Ethical Review Board (KTU/DRI/ERB/GAI/03). The study adhered to the protective guidelines established by the Common Rule, and the ethical guidelines set forth by the Ghana Health Service Ethical Review Committee and the Declaration of Helsinki

(Association, 2013). Potential participants received detailed information about the research and voluntarily consented to participate after understanding the consent statement. The rights and privacy of research participants were respected and safeguarded. Participants detected either with hypertensive urgency or with other medical conditions were counselled and referred to the university clinic for further evaluation and treatment. All information collected through this research was treated as highly confidential.

CHAPTER FOUR

RESULT

4.1 Background Characteristics of Study Participants

A total of 252 staff aged 25-59 years (mean: 44, SD: ±8.08) participated in the study. A few staff 11 (4.4%) were aged <29 years. Most of the staff were males 180 (71.4%). More than half (225, 89.3%; 204, 81.0%) of the participants had tertiary education and were married respectively. Almost half (116, 46.0%) of them were teaching staff. One hundred and twenty-two (48.4%) of them had a family history of cardiovascular disease and 235 (93.3%) of them had visited a clinic before (**Table 4.1**).

Table 4.1 Background Characteristics

Variable	Category	Frequency (N = 252)	Per cent (100%)
Age group(years)			
	<29	11	4.37
	30-39	59	23.41
	40-49	112	44.44
	≥50+	70	27.78
Sex			
	Male	180	71.43
	Female	72	28.57
Education level			
	Primary	4	1.59
	Secondary	23	9.13
	Tertiary	225	89.29
Marital status			
	Single	34	13.49
	Married/cohabiting	204	80.95

	Separated/divorced	6	2.38
	Widowed	8	3.17
Job description			
	Non-teaching staff	136	53.97
	Teaching staff	116	46.03
Family history of CVD		122	48.41
Ever accessed clinic		235	93.25

Mean age= 44.27; standard deviation= 8.08; 95%CI = 43.26- 45.27; min=25, max = 59.

4.2 Distribution of Cardiovascular Risk Factors Stratified by Independent factors

The proportion of participants on antihypertensive drugs was 31.0% (78/252). Out of this number, more than half (37, 52.9%) were aged ≥ 50 years, males were 24 (33.3%) and participants with a family history of CVD were 63 (51.6%). Three (8.8%) of the participants were single, 68 (30.2%) had a tertiary level of education, 43 (31.6%) of them were non-teaching staff, 77 (32.8%) visited the clinic and 52 (34.7%) of them had high blood pressure.

A total of 14 (5.5%) participants were taking antidiabetic drugs. Eight (7.1%) were aged 40-49 years, 10 (5.6%) were females, 14 (11.5%) had a family history of CVD.

Twenty-eight (11.1%) participants were on statins (cholesterol drugs). Out of this number, 26 (30.2%) were aged 40 years and above, 10 (5.6%) were females, 27 (13.2%) were married, 68 (30.2%) had a tertiary level of education, and 43 (31.6%) were non-teaching staff. Users of cholesterol-lowering drugs who had visited the clinic were 26 (11.1%) and 13 (1.3%) of them had high blood pressure.

Eighty-five (33.7%) participants were obese (had a BMI≥ 30 kg/m^2). Participants aged 30–39 were obese (25, 42.4%). Out of the 85 obese participants, 50 (41.0%) of them reported a family

history of CVD and 66 (32.4%) obese individuals were married. Most (82, 34.9%) of the participants had accessed a clinic before, 76 (33.7%) had tertiary education, teaching staff were 45 (33.1%), 82 (34.9%) of them and 39 (38.2%) had high blood pressure.

High blood pressure was prevalent (40, 57.1%) among the ≥50+ age group, females were 30 (41.7%), participants with a family history of CVD were 67 (54.9%) and 9 (26.5%) of them had never married. Participants with primary education had zero (0%) prevalence of high blood pressure, teaching staff were 54 (46.6%), and 93 (39.6%) clinic visitors had high blood pressure (**Table 3**). The prevalence of high blood pressure among all study participants was 102 (40.5%) as shown in **Figure 4.1.**

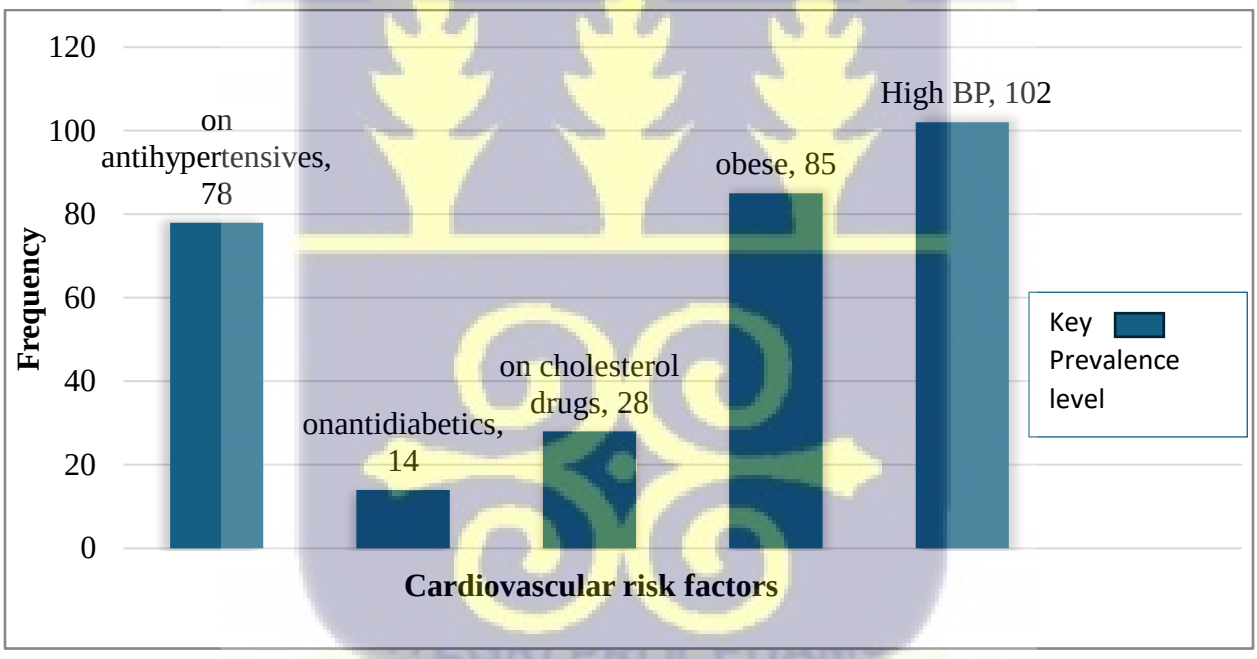

Fig. 4.1 Frequency of individual cardiovascular risk factors.

Table 4.2 Distribution of Cardiovascular Risk Factors by Independent Factors

			Cardiovascular risk factors				
Variable	**Category**	**Total** N (%) 252 (100.00)	**Currently on antihypertensive** N (%) 78 (30.95)	**Currently on antidiabetics** N (%) 14 (5.50)	**Currently on cholesterol drug** N (%) 28 (11.11)	**Obesity (BMI ≥30(Kg/m^2))** N (%) 85 (33.73)	**High BP (≥140/≥90 mmHg)** N (%) 102 (40.48)
Age group (years)	<29	11 (4.37)	1 (9.09)	0 (0)	0 (0)	2 (18.18)	0 (0)
	30-39	59 (23.41)	7 (11.86)	1 (1.69)	2 (3.39)	25 (42.37)	15 (25.42)
	40-49	112 (44.44)	33 (29.46)	8 (7.14)	13 (11.61)	41 (36.61)	47 (41.96)
	≥50+	70 (27.78)	37 (52.86)	5 (7.14)	13 (18.57)	17 (24.29)	40 (57.14)
Sex	Female	72(28.57)	54 (30.00)	10 (5.56)	17 (9.44)	31 (43.06)	30 (41.67)
	Male	180 (71.43)	24 (33.33)	4 (5.56)	11 (15.28)	54 (30.00)	72 (40.00)
Family history CVD	Yes	122 (48.41)	63 (51.64)	14 (11.48)	27 (22.13)	50 (40.98)	67 (54.92)
Marital Status	Single	34(13.49)	3 (8.82)	0 (0)	0 (0)	14 (41.18)	9 (26.47)
	Married/coha.	204(80.95)	70 (34.31)	12 (5.88)	27 (13.24)	66 (32.35)	86 (42.16)
	Separated/divo.	6 (2.38)	2 (33.33)	1 (16.67)	1 (16.67)	3 (50.00)	4 (66.67)
	Widowed	8 (3.17)	3 (37.75)	1 (12.50)	0 (0)	2 (25.00)	3 (37.75)
Educational level	Primary	4 (1.56)	3 (75)	0(0)	1(25)	2(50)	0(0.0)
	Secondary	23 (9.13)	7 (30.43)	0(0)	2(8.70)	7(30.43)	8(34.78)
	Tertiary	225 (89.29)	68(30.22)	14(6.22)	25(11.11)	76(33.78)	69(30.67)
Job description	Non-teaching staff	136 (53.97)	43 (31.62)	6 (4.41)	12 (8.82)	45 (33.09)	48 (35.29)
	Teaching staff	116 (46.03)	35 (30.17)	8 (6.89)	16 (13.79)	40 (34.48)	54 (46.55)
Ever accessed clinic	Yes	235 (93.25)	77 (32.77)	14 (5.96)	26 (11.06)	82 (34.89)	93 (39.57)
High BP	Yes	102 (40.48)	52 (34.67)	9 (8.82)	13 (12.75)	39 (38.24)	102 (40.48)
	No	150 (59.52)	26 (25.49)	5 (3.33)	15 (10.0)	46 (30.67)	0 (0)

N: Number of participants; %: percentage; HxCVD - History of cardiovascular disease. BMI: Body Mass Index; BP: Blood pressure

4.3 Participants with multiple Cardiovascular Risk Factors for Cardiovascular Disease.

Most participants had multiple risk factors (**Figure 4.2)**. Users of antidiabetic drugs, obese participants and those with high blood pressure readings were among those with these risk factors.

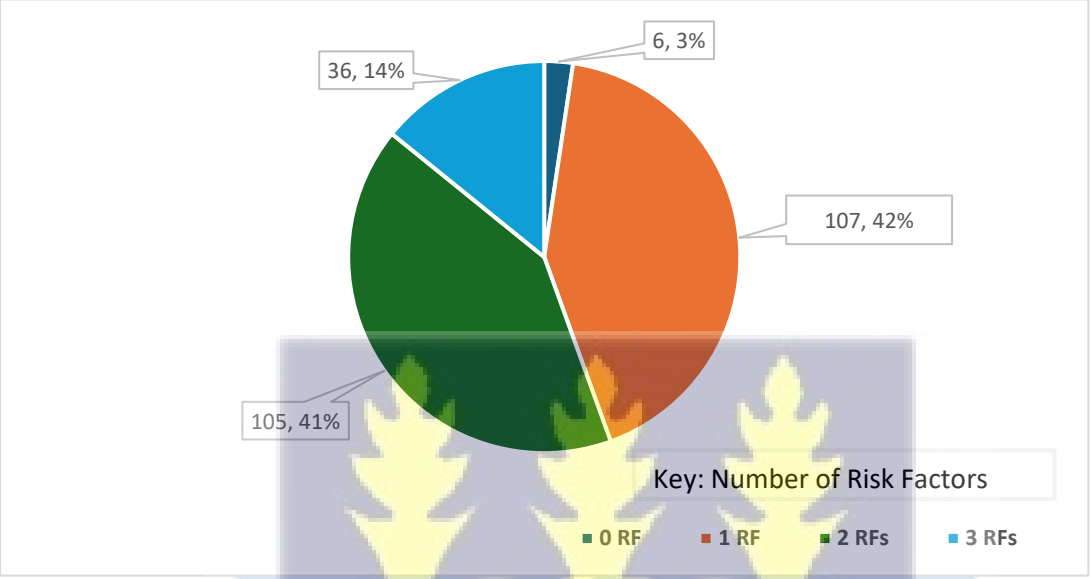

Fig.4.2 Frequency of having 0, 1, 2, or 3 cardiovascular risk factors for CVD.
Participants in Category 0 had no risk factors, Category 1 had one risk factor, Category 2 had two risk factors, and Category 3 had three risk factors.

A few 6 (3%) participants in category 0, had no risk factor. Category 1 participants recorded the highest risk factor frequency 107 (42%). In total, 141 (55%) participants in categories 2 and 3 had two or more risk factors, increasing the likelihood of developing cardiovascular disease.

4.4 Association Between High Blood Pressure and Diabetes

Out of the total participants, nine (8.2%) individuals who recorded high blood pressure readings were taking antidiabetic drugs, compared to five (3.3%) participants without high blood pressure who were on such medications. Results from the logistic regression analysis showed

that participants with high blood pressure had 60% lower odds of using antidiabetic drugs compared to those without high blood pressure (AOR = 0.40, 95% CI: 0.13–1.24, p > 0.05). This implies that the likelihood of being on antidiabetic drug was lower among hypertensive participants after adjusting for potential confounding factors such as age, sex, and marital status. Although, this difference was not statistically significant.

In terms of sex distribution, males were found to have 18% lower odds of using antidiabetic drug compared to females after adjusting for possible confounders (AOR = 0.82, 95% CI: 0.23–2.94, p > 0.05); however, this difference was also not statistically significant (**Table 4.3).** All other variables did not show any statistically significant association with antidiabetic drug use.

Table 4.3. Factors Associated with the Current Use of Antidiabetic Drugs among Study Participants

Variable	Category	Currently on an antidiabetic drug N (%)		Crude OR (95%CI)	p-value	Adjusted OR (95% CI)	p-value
		Yes	No				
Age(years)	≥30	14(5.8)	226(94.2)	empty (omitted)		empty (omitted)	
	<30	0(0)	12(100.0)				
Sex	Male	10(5.6)	170(94.4)	1(0.30-3.29)	1.00	0.82(0.23-2.94)	0.763
	Female	4(5.6)	68(94.4)				
Marital status	Separated/div	1(16.7)	5(83.3)	0.31(0.03-2.89)	0.31	0.35(0.04-3.55)	0.373
	Married	12(5.9)	192(94.1)				
	Single	0(0)	34(100.0)				
	Widowed	1(12.5)	7(87.5)				
High BP	Yes	9(8.8)	93(91.2)	2.81(0.92-8.64)	0.072	0.40(0.13-1.24)	0.111
	No	5(3.3)	145(96.7)				

**Significant risk; N: number of participants; %: percentage; OR: Odds ratio; CI: Confidence interval; p-value<0.05; BP: Blood pressure; omitted: due to collinearity*

4.5. Factors Associated with the Current Use of Antihypertensive Drugs among Study Participants

A total of 78 (31.7%) participants were currently using antihypertensive drug at the time of the study. Out of these, 77 (32.1%) were aged ≥30 years, while only 1 (8.3%) participant was below 30 years. Although the proportion of antihypertensive drug use was higher among participants aged ≥30 years, this association was not statistically significant after adjustment for potential confounders (AOR = 0.69, 95% CI: 0.05–9.79, p = 0.787).

Participants who reported having a family history of CVD had 8.8 times higher odds of being on antihypertensive drug compared to those without such a history, this was statistically significant (AOR = 8.80, 95% CI: 4.46–17.36, p < 0.05). Three (8.8%) single participants were taking antihypertensive drug compared to 70 (34.3%) married participants. Single participants had 87% lower odds of taking antihypertensive drugs compared to married participants, this was statistically significant (AOR = 0.13, 95% CI: 0.28–0.63, p < 0.05). These significant associations suggest that family history of CVD and marital status were independent predictors of antihypertensive drug use.

Participants with high blood pressure had 3.6 times higher odds of taking an antihypertensive drug than their normotensive counterparts (AOR = 3.60, 95% CI: 1.87–6.94, p = 0.001). In terms of health service utilization, participants who had ever accessed a clinic had 3.5 times higher odds of using an antihypertensive drug than those who had never visited a clinic. However, this association was not statistically significant in the adjusted model (AOR = 3.46, 95% CI: 0.39–31.04, p = 0.268). All other factors did not show any statistically significant association with antihypertensive drug use after adjusting for confounders by multiple logistic regression analysis at a 95% confidence interval and p-value >0.05 (**Table 4.4**).

Table 4.4 Factors Associated with Current Use of Antihypertensive Drugs among Study Participants

Variable	Category	Currently on antihypertensives N (%)		Crude OR (95%CI)	p-value	Adjusted OR (95% CI)	p-value
		Yes	No				
Age(years)	≥30	77(32.1)	163(67.9)	5.2(0.66-	0.118	0.69(0.04	0.787
	<30	1(8.3)	11(91.7)	40.97)		9-9.79)	
Sex	Male	54(30.0)	126(70.0)	0.86(0.48-	0.605	1.13(0.56	0.738
	Female	24 (33.3)	48(66.7)	1.54)		1-2.29)	
Family	Yes	63(51.6)	59(48.4)	8.19(4.30	0.0001*	8.80(4.46	0.0001*
HxCVD	No	15(11.5)	115(88.5)	–15.60)		- 17.36)	
Marital	Single	3 (8.8)	31(91.2)	0.18(0.55-	0.007*	0.13(0.28	0.011*
status	Married	70(34.3)	134(65.7)	0.63)		-0.63)	
	Separa/divo	2(33.3)	4(66.7)				
	Widowed	3(37.5)	5(62.5)				
Educ.level	Tertiary	68(30.2)	157(69.8)	0.14(0.15-	0.096	0.17(0.01	0.177
	Secondary	7(30.4)	16(69.6)	1.41)		2-2.25)	
	Primary	3(75.0)	1(25.0)				
Job	Teach. Staff	35(30.2)	81(69.8)	0.93(0.55-	0.805	0.70(0.33	0.378
descript.	Non-teach. staff	43(31.6)	93(68.4)	1.60)		-1.53)	
Ever	Yes	77(32.8)	158(67.2)	7.80(1.02-	0.048*	3.46(0.39	0.268
accessed	No	1(5.9)	16(94.1)	59.88)		-31.04)	
clinic							
High BP	Yes	52(51.0)	50(49.0)	4.96(2.79-	0.0001*	3.60(1.87	0.001*
	No	26(17.33)	124(82.67)	8.81)		-6.94)	

**Significant risk factor; N: number of participants; %: percentage; OR: Odds ratio; CI: Confidence interval; p-value<0.05; BP: Blood pressure; HxCVD: History of cardiovascular disease*

4.6 Factors associated with the Use of High Cholesterol-lowering Drugs

From the findings, study participants with a positive family history of CVD had 2.5 times higher odds of using cholesterol-lowering drugs than those without a family history of CVD, this was statistically significant (AOR: 2.53, 95%CI: 1.04-6.21, $p<0.05$).

With respect to sex, 17 (9.4%) of male participants and 11 (15.3%) of female participants were using cholesterol-lowering drugs. After adjusting for potential confounding factors, the odds of male participants using these drugs were 43% lower compared to their female counterparts. While the data suggests that the use of cholesterol-lowering drugs was fairly more prevalent among females, this association did not reach statistical significance (AOR = 0.57, 95% CI: 0.24–1.34, p = 0.197). Similarly, blood pressure status did not reveal a statistically significant association with the use of cholesterol-lowering drugs. Among participants, thirteen (12.6%) with high blood pressure and fifteen (10.0%) without high blood pressure were using these drugs. The adjusted analysis indicated that participants with high blood pressure had 12% lower odds of being on a cholesterol-lowering drug compared to those without high blood pressure (AOR = 0.88, 95% CI: 0.37–2.08, p = 0.771). All other variables were not statistically significant after adjusting for potential confounders by logistic regression analysis at 95% CI and p-value *>0.05*. This suggests that a family history of CVD was the only independent predictor of the use of cholesterol-lowering drugs (**Table 4.5)**.

Table 4.5. Factors Associated with the Use of Cholesterol-lowering Drugs among Study Participants

Variable	Category	Currently on cholesterol drug N (%)		Crude OR (95%CI)	p-value	Adjusted OR (95% CI)	p-value
		Yes	No				
Age(yrs)	≥30	28(32.9)	57(67.1)	empty		empty	
	<30	0(0)	12(100.0)	(omitted)		(omitted)	
Sex	Male	17(9.4)	163(90.6)	1.73(0.77-3.90)	0.187	0.57(0.24-1.34)	0.197
	Female	11(15.3)	61(84.7)				
Family HxCVD	Yes	19(15.6)	103(84.4)	0.40(0.17-0.93)	0.033*	2.53(1.04-6.21)	0.042*
	No	9(6.9)	121(93.1)				
Marital status	Separated/div.	1 (16.7)	5(83.3)	1.31(0.15-11.65)	0.808	1.32(0.13-12.97)	0.814
	Widowed	0(0)	8(100.0)				
	Single	0(0)	34(100)				
	Married	27(13.2)	177(86.7)				
Educational level	Tertiary	25(11.1)	200(88.9)	0.38(0.04-3.74)	0.403	0.29(0.025-3.46)	0.332
	Secondary	2(8.7)	21(91.3)				
	Primary	1(25.0)	3(75.0)				
High BP	Yes	13(12.8)	89(87.3)	1.31(0.60-2.89)	0.497	0.88(0.37-2.08)	0.771
	No	15(10.0)	135(90.0)				

**Significant risk factor; N: number of participants; %: percentage; OR: Odds ratio; CI: Confidence interval; p-value<0.05; BP: Blood pressure; HxCVD: History of cardiovascular disease; omitted: due to collinearity*

4.7 Factors Associated with Obesity among Study Participants

Out of the total study population, 54 (30.0%) of male participants and 31 (43.1%) of female participants were obese. Male participants had 47% lower odds of being obese compared to their female counterparts. This showed a significant difference between the sexes (OR = 0.57, 95% CI: 0.32–1.00, p = 0.049) and remained significant after adjustment for confounding variables, as male participants had 48% lower odds of being obese compared to female participants (AOR = 0.52, 95% CI: 0.28–0.96,

p = 0.038). Single participants had 3.1 times higher odds of being obese compared to married participants (AOR = 3.14, 95% CI: 1.15–8.61, p = 0.026). Participants with a family history of CVD initially showed 46% lower odds of being obese compared to those without such a history in the crude analysis (OR = 0.54, 95% CI: 0.31–0.93, p = 0.019). However, after adjusting for potential confounding factors, this association lost statistical significance, with those having a family history of CVD showing 1.5 times higher odds of obesity (AOR = 1.46, 95% CI: 0.81–2.64, p = 0.210). Among participants aged 30 years and above, 82 (34.2%) were obese, compared to only 3 (25.0%) participants under 30 years. Although obesity appeared slightly higher among older participants, logistic regression analysis revealed that age was not statistically associated with obesity (AOR = 1.32, 95% CI: 0.24–7.38, p = 0.749). Based on clinic accessibility, results revealed that participants who had ever visited a clinic had 2.7 times higher odds of being obese compared to those who had never accessed a clinic (AOR = 2.70, 95% CI: 0.70–10.41, p = 0.148). This difference was not statistically significant in the adjusted model. Similarly, participants with high blood pressure had 1.2 times higher odds of being obese compared to those without high blood pressure. Again, this association was not statistically significant in the adjustment model (AOR = 1.16, 95% CI: 0.64–2.11, p = 0.617).

This indicates that sex, marital status and family history of CVD were independent predictors of obesity among the study participants (**Table 4.6)**.

Table 4.6 Factors Associated with Obesity among Study Participants

Variable	Category	Obesity (BMI ≥30Kg/m^2) N (%)		Crude OR (95%CI)	p-value	Adjusted OR (95% CI)	p-value
		Obese	Not obese				
Age(yrs)	≥30	82(34.2)	158(65.8)	1.56(0.41-5.91)	0.515	1.32 (0.24-7.38)	0.749
	<30	3(25.0)	9(75.0)				
Sex	Male	54(30.0)	126(70.0)	0.57(0.322-0.997)	0.049*	0.52 (0.28-0.96)	0.038*
	Female	31(43.1)	41(56.9)				
Family HxCVD	Yes	50(41.0)	72(59.0)	0.54 (0.31-0.32)	0.019*	1.46 (0.81-2.64)	0.210
	No	35(26.9)	95(73.1)				
Marital status	Single	14(41.2)	20(58.8)	1.46(0.70-3.08)	0.315	3.14(1.15-8.61)	0.026*
	Sep./div.	3(37.5)	5(62.5)				
	Widowed	2(25.0)	6(75.0)				
	Married	66(32.4)	138(67.6)				
Educ. level	Tertiary	76(33.8)	149(66.2)	0.51(0.07-3.69)	0.505	0.68(0.09-5.20)	0.712
	Secondary	7(30.4)	16(69.6)				
	Primary	2(50.0)	2(50.0)				
Ever accessed clinic	Yes	82(34.9)	153(65.1)	2.50(0.70-8.95)	0.159	2.70(0.70-10.41)	0.148
	No	3(17.7)	14(82.3)				
High BP	Yes	39(38.2)	63(61.7)	1.4(0.82-2.38)	0.213	1.16(0.64-2.11)	0.617
	No	46(30.7)	104(69.3)				

**Significant risk factor; N: number of participants; %: percentage; OR: Odds ratio; CI: Confidence interval; p-value<0.05; BP: Blood pressure; HxCVD: History of cardiovascular disease; BMI: Body Mass Index*

4.8 Factors Associated with High Blood Pressure among Study Participants

Out of the total study population, 102 participants (40.5%) had high blood pressure (≥140/≥90 mmHg), while 150 (59.5%) had normal blood pressure readings.

The adjusted logistic regression analysis showed that participants aged ≥30 years had 7.7 times higher odds having high blood pressure than those under age 30 (AOR = 7.72, 95% CI: 1.18–79.85, p = 0.034). This association was statistically significant. Similarly, participants with a family history of CVD had over four times higher odds of having high blood pressure compared to those without such a history (AOR = 4.22, 95% CI: 2.35–7.58, p < 0.001). A statistically significant association was also found between clinic attendance and high blood pressure. Participants who had ever accessed clinic services had 78% lower odds of having high blood pressure compared to those who had never accessed clinic services (AOR = 0.22, 95% CI: 0.07–0.71, p = 0.011).

After adjusting for potential confounders, males were found to have 1.4 times higher odds of having high blood pressure compared to females (AOR = 1.40, 95% CI: 0.73–2.69, p = 0.313). This difference, however, was not statistically significant. All other variables were not statistically significant after adjusting for potential confounders by logistic regression analysis at 95% CI and p-value *>0.05*. The findings indicate that age, a family history of CVD, and clinic accessibility are independent predictors of high blood pressure among the study participants **(Table 4.7).**

Table 4.7 Factors Associated with High Blood Pressure among Study Participants

Variable	Category	High BP ≥140/≥90 mmHg N (%)		Crude OR (95%CI)	p-value	Adjusted OR (95% CI)	p-value
		Yes	No				
Age(yrs)	≥30	101 (42.1)	139 (57.9)	7.99(1.02-	0.048*	7.72(1.18	0.034*
	<30	1(8.3)	11 (91.7)	62.91)		-79.85)	
Sex	Male	72 (36.4)	126(63.6)	0.93(0.54-	0.81	1.40(0.73	0.313
	Female	30 (42.3)	41(57.8)	1.63)		-2.69)	
Family	Yes	67(48.2)	72(51.8)	2.53(1.52-	0.0004*	4.22(2.35	0.0001*
HxCVD	No	35(26.9)	95(73.1)	4.21)		-7.58)	
Marital	Single	9 (31.0)	20(69.0)	0.49(0.22-	0.09	0.80(0.30	0.663
status	Single	4 (44.4)	5(55.6)	1.11)		-2.17)	
	Widowed	3 (33.3)	6(66.7)				
	Married	86 (38.4)	138(61.6)				
Educ.	Tertiary	92 (40.9)	133(59.1)	2.08(0.21-	0.530	3.18(0.30	0.336
level	Secondary	9 (39.1)	14(60.9)	20.26)		33.62)	
	Primary	1(25.0)	3(75.0)				
Job	Teaching	54 (41.5)	76(58.5)	1.07(0.65-	0.787	0.76 (2.39	0.374
descript.	staff			1.78)		1.39)	
	Non-teaching staff	48(34.5)	91(65.5)				
Ever	Yes	93 (39.6)	142(60.4)	0.58 (0.22-	0.283	0.22(0.07	0.011*
accessed	No	9 (52.9)	8(47.1)	1.56)		0-0.71)	
clinic							

**Significant risk factor; N: number of participants; %: percentage; OR: Odds ratio; CI: Confidence interval; p-value<0.05; BP: Blood pressure; HxCVD: History of cardiovascular disease.*

In summary, the mean age of the 252 study participants was 44 years (range: 25 to 59). Most were males (71.4%), and 81.0% married. Key findings showed that 48.4% had a family history of CVD. According to the results, 40.5% (4 in 10) participants had high blood pressure, the topmost cardiometabolic risk factor for cardiovascular disease. This was followed by obesity (33.7%), and diabetes (5.5%), the lowest. No statistically significant association was identified between hypertension and diabetes.

Obesity was significantly more prevalent among females than males, with over half of all study participants having multiple risk factors. Additionally, marital status and family history of CVD emerged as predictors of obesity. Participants with a single risk factor had lower odds of developing CVD than those clustered with two or more risk factors.

The study findings indicated that a family history of cardiovascular disease, marital status, and high blood pressure were independent predictors of antihypertensive drug use. The family history of CVD was the only independent predictor of the use of cholesterol-lowering drugs among participants. Furthermore, the independent predictors of high blood pressure identified within the study included age, family history of CVD, and accessibility to clinic services.

The non-modifiable risk factors for CVD identified were age, sex, a family history of cardiovascular disease. The socioeconomic factors associated with cardiovascular risk were mainly marital status and accessibility to clinic services.

CHAPTER FIVE
DISCUSSION

An analytical cross-sectional study was carried out to determine the cardiometabolic risk factors among Koforidua Technical University staff. The study identified various individual-level factors associated with cardiovascular risk.

5.1 Prevalence of Cardiovascular Risk Factors

The study revealed a high prevalence of hypertension and obesity as cardiometabolic risk factors for cardiovascular diseases among participants influenced by age, sex, marital status, family history, education level, job description and access to healthcare. This confirms that CVD remains a global threat even in the academic and health community in the era of non-communicable disease epidemics.

5.1.1 Non-modifiable risk factors of cardiovascular disease

The study identified age, sex, and family history as non-modifiable CVD risk factors, consistent with other studies conducted in Ghana and elsewhere (Regassa, et al., 2021; Doku, et al., 2024). A significant proportion of older participants (aged ≥30 years) had 7.7 times higher odds of having high blood pressure than those aged below 30 years, after controlling for potential confounders (AOR: 7.72(1.18-79.85); $p<0.05$). This indicates that increasing age was a strong predictor of hypertension among the study participants and validates the evidence that age is a major determinant of arterial stiffness, which is a marker of hypertension (Boutouyrie et al., 2021), stroke (Akpalu et al., 2022), myocardial infarction (Oliveros et al., 2020) and other CVD outcomes. As reported in other studies, this raises the risk of cardiovascular diseases (Doku et al., 2024).

There were no statistically significant associations between age and antidiabetic drug use and between age and cholesterol-lowering drug use. Neither age independently influenced the likelihood of taking cholesterol-lowering drugs nor antidiabetic drugs in the study population.

Of all antidiabetic drug users, 14 (5.8%) were aged ≥30 years. The same age group recorded 28 (11.7%) among cholesterol-lowering drug users. This may be because individuals under age 30 either do not have a history of diabetes and dyslipidaemia or have never been screened and diagnosed with diabetes and dyslipidaemia conditions. Screening for diabetes and high cholesterol is recommended in the older age group (Anto et al., 2019). However, it has been recommended that for individuals with a family history of hypercholesterolemia or early CVD, screening and treatment should be carried out for young adults (Bucholz et al., 2018).

It is evident that obesity prevalence increases with ageing (Jura & Kozak, 2016). In our study, individuals in the older age group were 32% more likely to be obese than those under the age of 30 years. Though this difference was insignificant, statistical power could explain the reason. Yet, study results support the evidence that cardiovascular risk burden is more prevalent among the elderly than the young.

According to the results (**Table 4),** the prevalence of sex-based current antihypertensive use was nearly the same among females (24, 33.3%) and males (54, 3%). The slight gender disparities in clinic accessibility could be the reason. The adjusted logistic regression revealed that males had 13% higher odds of taking antihypertensive drugs than females, but this association was not significant (AOR: 1.13 (95%CI: 0.561-2.29); p>0.05). Though in our study, drug efficacy and adherence were not assessed, our findings may contradict the assertion that hypertensive females are more likely to take antihypertensive drugs than males (Ullah et al., 2023). Moreover, a cross-sectional survey conducted in Bangladesh reported that non-working women are less likely to use antihypertensive drugs than working women (Rahman et al., 2017). Regarding marital status, it was shown that marital status was an independent predictor of antihypertensive drug use. Single participants had 87% lower odds of using antihypertensive drug compared to married participants (AOR = 0.13, 95% CI: 0.28–0.63, p < 0.05). Mental and financial stress commonly found among married couples may be influencing

antihypertensive drug uptake. According to Colafella and Denton (2018), obese and type 2 diabetes mellitus women lose cardio-protection due to the loss of oestrogen and testosterone's functions in controlling vasodilator and vasoconstrictor pathways with the renin-angiotensin-aldosterone system inclusive. And that lean women are more prone to develop early CVD than obese women. In our findings, males had 48% lower odds of being obese than females in adjusted logistic regression (AOR:0.52 (95%CI:0.28-0.96), *p<0.05)*, indicating that obesity was significantly more prevalent among females than males. This statistically significant association supports existing literature that females are more obese than males (Addo et al., 2015; Assasie, 2019). The influence of sex hormones and genetic factors may offer deeper insights into this phenomenon. A concerted effort to control CVD risk factors in women (Braffett et al., 2022) should be prioritized especially at the primary healthcare level. Promotion of weight loss, increased use of statins and antihypertensive drugs, and physical activities like regular exercising could all help reduce the burden of CVDs (Rentsch et al., 2023).

Family history of cardiovascular disease history

In a recent study (Bappah et al., 2022), it was reported that undiagnosed hypertension was mainly associated with non-modifiable risk factors, especially positive family history. In our findings, participants with a family history of CVD were statistically significantly associated with antihypertensive drug use. Participants with such a history had 8.8 times higher odds of being on antihypertensive drug compared to those without a CVD family history (AOR = 8.80, 95% CI: 4.46–17.36, $p < 0.05$). This association remained significant after adjustment for other sociodemographic and clinical variables, underscoring the influence of familial cardiovascular risk on antihypertensive drug uptake. Similarly, participants with positive CVD family history were 4.2 times higher odds of developing high blood pressure than those without such a history. This association was statistically significant, showing that hereditary or familial factors play a key role in the likelihood of developing hypertension among the study population.

Additionally, participants with CVD family history were 2.5 times higher odds of using cholesterol-lowering drug than those without such history (AOR = 2.53, 95% CI: 1.04–6.21, p < 0.05). This finding implies that individuals with familial predispositions to cardiovascular conditions were more likely to be placed on lipid therapy. Individuals who may be fully aware of a positive family history of CVD may engage in lifestyle changes such as physical activities, avoiding smoking and excessive alcohol intake, and dietary with antioxidants therapy to prevent future uptake of antihypertensives and cholesterol-lowering drugs. Participants with a positive CVD family history had 46% lower odds of obesity than those without such history. This was statistically significance at the crude analysis level (OR= 0.54, 95%CI: 0.31–0.93, p=0.019), but after adjustment for potential confounders, this relationship lost statistical significance (AOR= 1.46, 95% CI: 0.81–2.64, p=0.210). This suggests that while family history of CVD appeared related to obesity at the unadjusted level, other factors may account for the observed difference. Obese participants with a positive family history of CVD may be fully aware and adhere more to lifestyle modifications aimed at reducing cardiovascular risk than their counterparts without a family history of CVD. In a prospective randomised controlled trial, 541 eligible first-degree relatives of 144 patients with premature ischaemic heart disease were recruited for CVD assessment, it was revealed that 34 % of these individuals had moderate to very high 5-year absolute risk for CVD (Stocks et al., 2015). In Ghana, it has been reported that individuals with a positive family history of CVD are at higher risk for non-stroke CVD such as myocardial infarction than those without a positive CVD family history (Doku et al., 2024; Valerio et al., 2016). This suggests that individuals who have a family history of CVD should be targeted for early intervention of modifiable risk factors of CVD. Promoting preventative behaviours, such as keeping a healthy weight and controlling high blood pressure through health education based on family history can successfully encourage cardiovascular health.

5.1.2 Modifiable risk factors

The national age-standardized prevalence of hypertension among Ghanaian adults aged 30-79 years was 33.9% (WHO, 2024). Since hypertension is so common, it is known to be the cause of most CVD cases (Valerio et al., 2016). A retrospective trend analysis conducted on CVD admissions and cardiac outcomes in Ghana reported that hypertension is the leading cause of heart failure and other CVDs (Appiah et al., 2017). Moreover, in a comparative cross-sectional study to determine the prevalence of obesity and cardiometabolic risk factors in rural and urban populations in the Ashanti region, hypertension was more prevalent among urban settlers compared to rural folks (Obirikorang et al., 2015). In this present study, high blood pressure was more prevalent (40.5%), followed by obesity (33.7%), antihypertensive drug use (31.0%), cholesterol drug users (11.1%) and antidiabetic drug use (5.5%). Similarly, hypertension and dyslipidaemia were also reported as the most prevalent risk factors in a baseline study conducted by Kosiborod et al. (2023). Our current study revealed that four in ten individuals aged 30 years and above had 7.7 times higher odds of having high blood pressure than those under 30 years. The study population's workforce falls under this age group. This confirms (Kurtul et al., 2020), which reported that one in six people aged 40-49 and one in three individuals aged 50-59 have hypertension. Frequent absenteeism of workers due mainly to ill health caused by cardiometabolic risk factors for CVD in this age group can affect productivity in this population. This result aligns with the natural progression of blood pressure with age, as arterial stiffness and vessel elasticity often decrease, contributing to hypertension in middle-aged individuals.

Though males and females had nearly similar high blood pressure prevalence levels of 40% and 41.7% respectively above the national prevalence of 36.1% and 31.4% from 1990 to 2019 (WHO, 2024), no statistically significant association was observed in both logistic analyses.

After adjusting for potential confounders, males were found to have 1.4 times higher odds of having high blood pressure compared to females (AOR = 1.40, 95% CI: 0.73–2.69, p = 0.313). This indicates that sex, independent of other factors did not significantly influence hypertension prevalence in this study. This is in contrast with an earlier study (Sawitri et al., 2023), which reported a higher prevalence of high blood pressure among male workers and attributed it to the fact that male workers have high stress levels in daily life, tend to have more job or organizational commitment and long working hours than female workers. Though stress levels were not assessed in our study, further investigations are warranted as sex differences in behavioural lifestyle factors or underlying medical conditions could play a role. Findings from the study revealed participants with high blood pressure had 3.6 times higher odds of taking antihypertensive drug than their normotensive counterparts (AOR = 3.60, 95% CI: 1.87–6.94, p = 0.001), indicating that the presence of high blood pressure strongly influenced the use of antihypertensive drug. Non-adherence or defaulting to prescribed antihypertensive medications among individuals with high blood pressure may lead to uncontrolled hypertension that may warrant admission.

It has been documented that hypertension is the main cause of admissions accounting for 67% of all mortality in a tertiary hospital (Abban et al., 2021). Recent reports indicated a 34% of adults aged 30-79 years in Ghana have hypertension, but only 50% of the total population was diagnosed (WHO,2023). Periodic hypertension screening for individuals aged 30 and above is recommended especially at the community setting, where most of the cases are recorded since the primary healthcare level is the first point of call for healthcare.

The prevalence of diabetes was 5.5% lower than the national estimated prevalence of 7.5% in Ghana (WHO, 2023), but 5.5% higher than the 3.5% reported in a cross-sectional study among Ethiopian employees by Gidey et al. (2023). According to Glovaci et al. (2019), regardless of sex or ethnicity, diabetics carry a higher mortality risk from cardiovascular disease than non-

diabetics. Despite the high prevalence, many individuals may be living with diabetes undiagnosed and may present with CVD complications at a later stage. A recent study reported a higher prevalence of CVDs among individuals with diabetes than those without diabetes (Doku et al., 2023; Regassa et al., 2021). Diabetic patients may suffer from multiple disease complications in the heart, blood vessels, kidneys, eyes, and brain if blood glucose levels are not detected and well controlled. Early detection of diabetes risk factors such as high blood pressure, obesity and high blood cholesterol through routine medical screening and regular exercise may help to prevent diabetes and its complications. Since it is documented that the severity of diabetes depends on the presence of vascular risk factors (Zhou et al., 2015). Therefore, effective diabetes control with antidiabetic agents and lifestyle modification is essential for good cardiovascular health outcomes.

Obesity, defined by elevated BMI (30 kg/m^2), has reached epidemic levels worldwide (Roth et al., 2020) and university employees are not exempted. The overall prevalence of obesity in this study population was 33.7% higher than 17.8% of employees of financial institutions in Accra (Addo et al., 2015). Behavioural factors such as less physical activity, long office sitting hours, and high intake of calories could explain the high prevalence of obesity. Alcohol consumption increases appetite for food intake. Addo et al. (2015) reported that individuals who consume alcohol had three times increased risk of obesity or overweight compared to non-alcohol consumers. However, the age, anatomic size, gender difference and physical activity level of an individual determine the amount of calories needed to maintain a healthy body weight. The main predictors of obesity were sex and marital status in the study findings. Single participants had about 3.1 times higher odds of being obese compared to married participants. This association was statistically significant, indicating that marital status played a role in obesity among the study population. Factors such as social isolation, greater reliance on fast

food or convenience meals than home-cooked meals, and unhealthy eating patterns may explain why singles had higher odds of being obese than married individuals.

Obesity most often worsens CVD risk factors such as hypertension, dyslipidaemia and diabetes. It is established that uncontrolled hypertension is associated with obesity (Lavie et al., 2018). Participants with high blood pressure had 1.2 times higher odds of being obese compared to those without high blood pressure after controlling potential confounders, yet the difference could not be confirmed statistically.

Therefore, targeted strategies must be implemented early to prevent obesity and its complications at younger ages. The current target weight loss for obese people is known to be 5% in the existing literature. This target may be achieved through stringent behavioural modification therapy, pharmacological therapy and bariatric surgery. A recent medication for obesity review conducted by Gudzune & Kushner (2024) revealed that antiobesity medications are effective adjunctive therapy to lifestyle changes to improve weight loss and health outcomes. Health systems and policymakers may need to focus on some of these approaches that can reverse these trends. These may include improving access to healthcare at the workplace, policies on diet, recreational centres, and physical activity programs. The government's implementation of policies on diets and drugs needs improvement, especially the reduction in simple sugars, total calories and complex carbohydrates importation.

5.2 Association between hypertension, diabetes and obesity

The study findings showed clustered risk factors among participants. Users of antidiabetic drugs, obese participants and those who have high blood pressure were among those with these risk factors. Individuals with two or more risk factors accounted for 55% of the total study population. This significant proportion of multiple risk factors among participants increases the likelihood of developing cardiovascular disease.

However, findings revealed association between high blood pressure and antidiabetic drug use among study participants was not statistically significant (AOR: 0.40 (0.13-1.24); *p=0.111*). This implies participants with high blood pressure had 60% lower odds of using antidiabetic drugs compared to those without high blood pressure contrast to other studies that indicate diabetes is moderately associated with high blood pressure. Zhou et al. (2015), asserted that the severity of the disease largely depends on the presence of vascular risk factors and there is a high prevalence of atherosclerosis in older individuals with advanced diabetes. In diabetics, hyperglycemia stimulates renal cells. If left uncontrolled can lead to chronic activation of the renin-angiotensin system (RAAS) which can result in kidney damage and hypertension, an increased risk of CVD (Wolf, G., et al.,1997). According to Murray *et al.*, (2020), half of the global burden of disease is contributed by the following five major risk factors for CVD. These are hypertension, obesity, diabetes, tobacco smoking, and air pollution.

It is evidenced that exposure to multiple cardiovascular risk factors for CVD is associated with age (Kim, 2021), our results confirm this evidence. Obese individuals are prone to hypertension, diabetes and dyslipedeamia. Weight management and lifestyle modifications as evidenced in existing literature are major primary prevention methods to prevent these complications.

5.3 Association between socioeconomic factors and risk of CVD

Married or cohabiting participants were more at risk for CVD as a significant proportion used antihypertensives (34.31%), antidiabetics (5.9%), and high cholesterol-lowering drugs (13.2%). Additionally, 32.4% were obese and 42.2% of them had high blood pressure. According to C. W. Wong et al. (2018) being unmarried (single, never married, divorced or widowed) influences CVD and prognosis after CVD. In a review of 34 studies, it was reported that singles had 42% higher odds of developing CVD and with myocardial infarction had

higher odds of mortality. A significant association was identified in this study, indicating that single individuals exhibited 87% reduced odds of antihypertensive drug use compared to their married counterparts. This suggests that single individuals were less at risk of hypertension than married couples. Hence, preventive cardiovascular health education targeting unmarried individuals could serve as an effective strategy for preventing cardiovascular diseases.

Most (222, 89.9%) of the study participants had tertiary education. The extra representation of individuals with tertiary education may introduce bias. This may potentially affect the inference of socioeconomic factors and cardiometabolic risk factor outcomes. Our results indicated that university employees with primary education had 83% lower odds of taking antihypertensive drugs than those who had tertiary education. However, this association was not statistically significant. Individuals with primary education had 32% lower odds of being obese than those with tertiary education. Our findings contrast with the work by Woodward et al. (2015), which reported an individual with a tertiary education is inversely related to an increased risk of CVD. Education is a significant determinant of several health outcomes (Schultz et al., 2018). Findings suggest that individuals with secondary education may have better health literacy and access to cardio-metabolic preventive measures, contributing to lower obesity and blood pressure rates than those with primary or no formal education.

Individuals with poor health literacy are more likely not to adhere to prescribed medications for the management of these diseases. To reduce the prevalence of CVD, health literacy with dietary choices, physical activities, healthy lifestyle and healthcare accessibility must be encouraged.

More than half 235 (93.3%) of the participants visited the clinic. These individuals accessing the clinic had about 3.5 times higher odds of using antihypertensive, though association was not significant. This may be due to a preventive benefit of regular healthcare access. Moreover,

participants who accessed clinic services had 78% lower odds of having high blood pressure compared to those who had never visited a clinic before (AOR = 0.22, 95% CI: 0.07–0.71, p = 0.011). This recommends that routine clinic visits may contribute to better blood pressure management among individuals. Routine clinic visits provide opportunities for early risk detection and management, allowing individuals to adopt lifestyle modifications that mitigate the need for medications. Therefore, addressing social determinants of CVD is essential in promoting health equity for cardiovascular health outcomes (Powell-Wiley et al., 2022).

Although statistically there was no association between job description and cardiovascular risk in our study, examining job-specific stress and health behaviours among teaching versus non-teaching staff could provide further insight into potential occupational health interventions. It is evidenced in the existing literature that occupational sitting time is a contributor to the obesity epidemic and therefore efforts are needed to mitigate health-related hazards resulting from long sitting hours in the office (Addo et al., 2015).

CVD not only burdens the health system with direct costs but can also cause productivity loss through job burnout and absenteeism among workers (Gordois et al., 2016). Strategic preventive measures are needed to reduce this burden.

5.4 Summary

This current study assessed the prevalence of risk factors for cardiovascular diseases among Koforidua Technical University staff. The mean age of the 252 study participants was 44 years (range: 25 to 59). Most of the participants were males (71.4%), and 81.0% were identified as married. The non-modifiable risk factors for CVD identified were age, sex, a family history of cardiovascular disease. Key findings showed that 48.4% had a family history of CVD. Hypertension was found to be the most prevalent modifiable risk factor at 40.5%, followed by obesity at 33.7%. In contrast, the prevalence of diabetes was lower, at only 5.5%. A unit

increase in age (≥30 years) increased the odds of developing high blood pressure by 72%, while each additional outpatient clinic visit reduced the odds by 78%. Obesity was significantly more prevalent among females than males, with over half of all participants having multiple risk factors. Participants with a single risk factor had lower odds of developing CVD than those clustered with two or more risk factors. Among those individuals, age, sex, marital status, and family history of CVD were primary predictors of the clustered risk variable. Independently, sex, marital status, and family history of CVD emerged as predictors of obesity. Moreover, a family history of CVD was the only predictor of the use of cholesterol-lowering drugs among the participants. The independent predictors of high blood pressure identified within the study included age, family history of CVD, and accessibility to clinic services.

The socioeconomic factors associated with cardiovascular risk were mainly marital status and accessibility to clinic services. The study highlights an increased prevalence of cardiovascular risk factors mostly clustered among workers, leading to high demands for healthcare access and CVD case management, though accessibility and capacity to handle cardiovascular diseases are very limited in a resource-constrained community. This calls for preventative measures to address this health threat in the public institutions.

5.5 Study Strengths and Limitations

To our knowledge, this study seems to be the first to assess CVD risk factors among university staff in the Eastern region of Ghana. The study used modified STEPwise-based questionnaires to gather representative data from the population. The study findings will benefit policymakers such as MoH, the university management, the Ghana Heart Initiative, and the Stroke Association Support Network (SASNET) for cardiovascular health decision-making to prevent and manage cardiovascular risk factors. Again, self-reported physician diagnoses and participants past drug history for CVD risk were used to reduce biases. Studies have shown that self-reported tools are good predictors of cardiovascular events (Olanrewaju, et al., 2023).

The study had some limitations. Physiological and anthropometric measurements, like blood pressure and weight, were taken in a single visit during data collection. However, these values may not accurately reflect "real" values due to fluctuations from circadian rhythms or prior drug use. Such fluctuations were checked with strong quality control procedures employed by well-trained physician research assistants. Multiple logistic regression analyses were performed to manage the confounding variables and heteroskedasticity. This cross-sectional study's findings should be interpreted cautiously, as causal inference and temporality cannot be established. Due to time and budget constraints, some data were missed, including tests for glycated hemoglobin and lipid profiles, which introduced clinical equipoise in the assessment of diabetes and dyslipidemia. However, repeated community cross-sectional surveys can be conducted periodically to monitor the prevalence of variables of interest. Our findings do not represent the general population of university staff in Ghana. Nevertheless, these limitations do not invalidate our findings.

CHAPTER SIX

CONCLUSION AND RECOMMENDATION

6.1 Conclusion

The findings of this study buttress other studies that report cardiovascular risk factors are prevalent in the academic setting. Significant predictors that emerged as non-modifiable risk factors were age, sex, and family history of CVD. Hypertension was the topmost cardiovascular risk factor, followed by obesity and diabetes. Socioeconomic factors identified were marital status and clinic services accessibility. This calls for the clinical implementation of secondary prevention of CVD by government policymakers to improve access to healthcare in institutional community settings.

This calls for the clinical implementation of secondary prevention of CVD by policymakers to improve access to healthcare and support programs for early diagnosis and management of cardiovascular risk factors, especially in community settings.

6.2 Recommendation

The policies and strategies developed to address cardiovascular disease are poorly implemented in primary healthcare settings. Based on the findings and the conclusion hitherto presented, the following recommendations are made:

1. Implement an office-based BP monitoring program at the workplace, as part of the wellness program, to control hypertension, as the most prevalent CVD risk factor.
2. The managers of tertiary institutions should establish a healthcare facility and provide equipment for the management of hypertension, diabetes, obesity and CVD condition management in tertiary institutions.

3. The university's media and health directorate should provide regular health education programs on non-modifiable risk factors such as age and family history of CVD and CVD medication adherence to reduce CVD risk factors.
4. Routine clinic visits may contribute to better blood pressure and other CVD risk factors management among staff. Therefore, healthcare services should be expanded and made available to all universities and colleges by the Health Ministry in partnership with policymakers and stakeholders.
5. Public and private health institutions should conduct annual medical assessments for their employees to identify CVD risk factors for proper management to enhance a healthy workforce.
6. The Ministry of Health, in collaboration with the universities, should address the gap in cardiovascular research in each member country in Africa.
7. The university's media and health directorate should provide regular health education programs on modifiable and non-modifiable risk factors of CVD and CVD medication adherence to reduce CVD risk factors.
8. The management of tertiary institutions together with private partners should establish a fitness and wellness recreational gym centre, as a community hub to improve physical activities, and help to reduce CVD modifiable risk factors occurrence.
9. It is essential for all stakeholders to implement clinical and public health interventions to effectively manage and reverse the adverse pattern of CVD risk factors nationwide.

6.3 Future Research

Further research should investigate whether healthcare accessibility and drug adherence literacy could influence cardiovascular risk factors in academic settings. Investigations should also be done on the efficacy and side effects of drugs for managing CVD and determine whether

healthcare engagement alone is sufficient in preventing cardiovascular risk factors among employees. Future studies focusing on the clinical implementation of secondary prevention of cardiovascular disease in primary healthcare settings using the WHF Roadmap are critical.

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Appendix A Participant's Information Sheet

PARTICIPANT GENERAL INFORMATION SHEET

Research Title:

Cardiovascular diseases risk factors among Koforidua Technical University Staff: A Cross-Sectional Institutional-Based Study.

Identity of Sponsor(s) or funder(s): N/A

Name(s) and affiliation(s) of researcher(s)

The investigator for this study is Joseph Dakudzi, a Clinical Trial student of the Department of Epidemiology and Disease Control, University of Ghana, and Principal Health Superintendent at the Koforidua Technical University. He is under the supervision of Professor Francis Anto, the Supervisor, and the Head of the Department of Epidemiology and Disease Control at the University of Ghana.

Invitation

We invite you to partake in this study which forms part of the clinical investigators' dissertation. Please you are to understand that this is research work and not service delivery.

Before you decide whether you want to partake, you need to know why the research is being done, and how and what your participation will involve. Please take time to read the following information carefully and discuss it with others if you wish and seek further clarification from us if in doubt.

Brief background

Cardiovascular disease (CVD) is a disease of the heart and blood vessels such as heart failure, heart attacks, stroke, etc. Currently, it is the leading cause of death globally. It affects individuals across diverse demographics and has no respect for persons. The burden of CVD is driven by several factors: hypertension, diabetes, high cholesterol, overweight and obesity, unhealthy lifestyle behaviors, and stress among others.

Purpose of research

The purpose of this study is to analyze and understand the various factors contributing to cardiovascular disease among Koforidua Technical University staff and to suggest preventive measures to help curtail the problem.

Selection or Recruitment Method

The study targets 25-year-old and above staff of KTU who are active in service. We anticipate about 248 staff to participate in the study. Your selection into the study is by chance like lottery and not by any form of coercion or undue influence to ensure fairness. The study will cover 5 weeks duration but your participation is for only one day.

Procedure

You will be given a consent form to sign if you agree to participate in the study. Afterward, you will be asked to complete a set of questionnaires about your demographic information, lifestyle behavior, and medical history on CVDs which will take you about 15 – 20 minutes. Your weight, height, and blood pressure will also be taken.

Risk-Benefits analysis

You may face some negligible foreseeable risks if you take part in the study. This may include spending time to take part in this study, which may be inconvenient to you because of your busy schedule. Yet be assured that all efforts will be made not to waste your time unnecessarily during this study.

However, you may benefit from cardiovascular health tips throughout the study but with no compensation for participation. Your results from the medical screening will be shared with you in person or via your stated contact(s). However, we cannot guarantee that you will personally benefit from the research findings, but prospective patients with cardiovascular disease and caregivers will benefit in the future when the research findings are incorporated into good clinical practice.

Privacy and Confidentiality

We will ensure your rights and privacy are respected and protected. All information that will be gathered through this research will be treated as highly confidential. Only the research team will have access to your information with your identity hidden and replaced with code. The completed questionnaires and screening results will be kept securely on a computer with a

password. However, as part of our responsibility to conduct this research properly, we may allow officials from the ethics committees to have access to your records.

Voluntariness

Your participation in this research is voluntary. Although you may consult family members or friends, you will not be enrolled in the research unless you freely agree.

You may choose to withdraw from the research at any time. Your refusal to participate in the study or decision to withdraw from the study will never interfere with the patient-doctor relationship or service delivery at the clinic. There will be no consequence, loss of benefit, or care to you if you choose to withdraw from the study.

Compensation

There will be no compensation to be paid to you, however, much appreciation will be given for any inconvenience caused.

Declaration of Conflict of Interest

There is no conflict of interest on the part of the researchers.

Contacts:

Please do not hesitate to contact the Principal Investigator, for any study-related inquiries via jdakudzi@st.ug.edu.gh or +233240065017.

Further, if you have any concerns about the conduct of this study, your welfare, or your rights as a research participant, you may contact:

The GHS ERC Administrator, email ethics.research@ghs.gov.gh, **only** on ethical issues.

APPENDIX B

CONSENT FORM

Statement of the individual acquiring informed consent:

I have explained this research to _____ and provided enough information about the study's procedure, risks, and benefits for an informed decision.

Date: _____ Signature: _____

Name: _____

Statement of the individual giving consent:

I have read the research information or have had it translated into a language I understand. I am satisfied with the details discussed with the interviewer.

I acknowledge that my participation is voluntary. I am informed about the purpose, methods, risks, and benefits of the research, allowing me to make an informed decision to participate. I understand that I can freely withdraw from the research at any time, without any consequences. I have received a copy of this consent form with an information sheet for my records.

Date: _____ Signature/Thumbprint: _____

Name (If applicable): _____

Witness' Signature (if applicable): _____

Witness' Name (if applicable):

APPENDIX C

A Modified WHO Steps Instrument
Cardiovascular Disease Risk Factors: Analytical Cross-Sectional Study Among KTU Staff

<Koforidua>

Survey Information

Location and Date	Response	Code
Centre name	KTU	I1
Interviewer ID	……..	I2
Date of completion of the questionnaire	⌊_⌋⌊_⌋ ⌊_⌋⌊_⌋ ⌊_⌋⌊_⌋⌊_⌋⌊_⌋ dd mm year	I3

Consent and contact (optional)	Response	Code
Consent has been read and obtained *Select relevant response.* Initials	Yes 1 No 2 **If NO, END** ……	I4
Optional Contact phone number or		I5

Step 1 Demographic Information – Non modifiable factors

	CORE: Demographic Information		
No	**Question**	**Response**	**Code**
1	a. How old are you? b. What is your date of birth?	⌊_⌋⌊_⌋ ⌊_⌋⌊_⌋ dd /mm / year	DI1
2	Sex *Select Male / Female as observed.*	Male 1 Female 2	DI2
3	What is the **highest level of education** you have completed?	Basic school 1 Secondary school 2 HND / 1st Degree 3 2nd Degree / PhD 4 Postdoctoral 5	DI3
4	What is your **marital status**?	Single 1 Married / 2 Separated / 3 Widowed 4	DI4
5	Job description	Teaching staff 1 Non -Teaching 2	DI5
6	Do you have a family history of any of these diseases; hypertension, heart disease, obesity, or diabetes, or stroke?	Yes 1 No 2	DI6

Step 2 Modifiable factors

	b. Socioeconomic factors & Physical activities		
7	Do you have access to the university healthcare facility?	Yes No	**DI7**
8	Is the university clinic fully resourced and accessible to you without seeking any ancillary service elsewhere?	Yes No	**DI8**
9	Are you a member of NHIS?	Yes No	DI9
10	Do you often make out-of-pocket payments for the cost of your medications?	Yes No	D10
11	Does your work involve less than 75 minutes of vigorous-intensity physical activity per week that causes large increases in breathing or heart rate like *[carrying or lifting heavy loads, or construction work]*?	Yes No	D11
12	**Do you work over working hours?**	Yes No	D12

	CORE: History of Raised Blood Pressure		
13	Have you ever been told by a doctor or other health worker that you have raised blood pressure or hypertension?	Yes 1 No 2	HBP13
14	In the past two weeks, have you taken any drugs (medication) for raised blood pressure prescribed by a doctor or other health worker?	Yes 1 No 2	HBP14
	CORE: History of Diabetes		
15	Have you ever been told by a doctor or other health worker that you have raised blood sugar or diabetes?	Yes 1	HDM15
16	Are you currently taking any anti-diabetic drugs eg. Metformin, or insulin for diabetes prescribed by a doctor or other health worker?	No 2	HDM16

	CORE: History of Chronic Infections		
17	Have you ever been told by a doctor or other health worker that you have any long-term infections eg TB, or HIV?	No 2 No 2	HCI17

18	Are you currently taking any long-term drugs eg. HIV or TB, drug, painkillers, or contraceptives, hormone drug, prescribed by a doctor or other health worker?	Yes 1 No 2	HCI18
	CORE: History of Raised Total Cholesterol (Dyslipidemia)		
19	Have you ever been told by a doctor or other health worker that you have raised cholesterol?	Yes 1	HD19
20	Are you currently taking cholesterol drug (eg Atorvastatin or any other statin) regularly to prevent or treat heart disease?	Yes 1 No 2	HD20
	CORE: History of Cardiovascular Diseases		
21	Have you ever had a heart attack or chest pain from heart disease (angina) or a stroke (cerebrovascular accident or incident)?	Yes 1 No 2	HD21
22	Are you currently taking any drug eg. aspirin regularly to prevent or treat heart disease?	Yes 1 No 2	HD22

Step 3 Physical & Physiological Measurements			
	CORE: Height and Weight		
24	Weight	in Kilograms (kg) ⌊⌋⌋⌋.⌊⌋	W23
25	Height	in Centimetres (cm) ⌊⌋⌋⌋.⌊⌋	H24
26	Body Mass Index	Kg/m^2 ⌊⌋⌋⌋.⌊⌋	BMI25
	CORE: Blood Pressure		
27	a. Reading 1 (Record the first measurement after the participant has rested for 15 minutes. Wait 3 minutes before taking the second measurement).	Systolic (mmHg) ⌊⌋⌋⌋ Diastolic (mmHg) ⌊⌋⌋⌋	BP26
	b. Reading 2 Ask the participant to rest for another 3 minutes before taking the 1st measurement.	Systolic (mmHg) Diastolic (mmHg)	
	Average	Systolic (mmHg) ⌊⌋⌋⌋ Diastolic (mmHg) ⌊⌋⌋⌋	

Thank you for participating

APPENDIX D ETHICAL APPROVAL

GHANA HEALTH SERVICE ETHICS REVIEW COMMITTEE

In case of reply the number and date of this Letter should be quoted.

Research & Development Division
Ghana Health Service
P. O. Box MB 190
Accra
Digital Address: GA-050-3303
Mob: +233-50-3539896
Tel: +233-302-960628
Email: ethics.research@ghs.gov.gh
17th July 2024

My Ref. GHS/RDD/ERC/Admin/App 241368
Your Ref. No.

Joseph Dakudzi
University of Ghana
Department of Epidemiology and Disease Control
P. O. Box LG 13
Legon, Ghana

The Ghana Health Service Ethics Review Committee has reviewed and given approval for the implementation of your Study Protocol.

GHS-ERC Number	**GHS-ERC: 065/05/24**
Study Title	Cardiovascular Disease Risk Factors: An Analytical Cross-Sectional Study among Koforidua Technical University Staff
Approval Date	17th July 2024
Expiry Date	16th July 2025
GHS-ERC Decision	**Approved**

This approval requires the following from the Principal Investigator

- Submission of a yearly progress report of the study to the Ethics Review Committee (ERC)
- Renewal of ethical approval if the study lasts for more than 12 months,
- Reporting of all serious adverse events related to this study to the ERC within three days verbally and seven days in writing.
- Submission of a final report after completion of the study
- Informing ERC if study cannot be implemented or is discontinued and reasons why.
- Informing the ERC and your sponsor (where applicable) before any publication of the research findings.

You are kindly advised to adhere to the national guidelines or protocols on the prevention of COVID -19

Please note that any modification of the study without ERC approval of the amendment is invalid.

The ERC may observe or cause to be observed procedures and records of the study during and after implementation.

Kindly quote the protocol identification number in all future correspondence in relation to this approved protocol

SIGNED.....
Mr. Kofi Wellington
(GHS ERC Chairperson)

Cc: The Director, Research & Development Division, Ghana Health Service, Accra

KOFORIDUA TECHNICAL UNIVERSITY

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Ghana, West Africa

Tel: (+233) 3420 24466 (+233) 3420 22890 (+233) 3420 24993) **Tel/Fax:** (+233) 3420 24179 **Website:** www.ktu.edu.gh

Our Ref: KTU/DRI.ERB/30/05 *Your Ref:* ..... *Date:* 5/08/2024

Mr. Joseph Dakudzi
University of Ghana
Department of Epidemiology and Disease Control
P. O. Box LG 13
Legon-Accra

Dear Applicant,

ETHICAL APPROVAL TO CONDUCT RESEARCH

The University Ethical Review Board has considered your application for clearance to conduct research titled "*Cardiovascular Disease Risk Factors Among Koforidua Technical University Staff: An Analytical Cross-Sectional Study*".

All the documents submitted in accordance with the checklist were reviewed and has granted approval for the conduct of the research.

Kindly ensure strict adherence to high ethical standards to ensure that participants to this research are not harmed in the process.

Kindly ensure that you quote this Reference No. **KTU/DRI/ERB/GAI/03** in any communication related to this application.

Yours faithfully,

Prof. Samuel Kwofie
Chairman, Ethical Review Board

Cc:
Dean, FHAS.