SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA

DETERMINANTS OF CARDIOVASCULAR DISEASE RISK AMONG CLINICAL HEALTH WORKERS IN A TERTIARY HEALTH FACILITY, ACCRA-GHANA.

BY

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(10938000)

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DECLARATION

I, David Darkwah, declare that except for other works which have been duly acknowledged, this work is the result of my own original research, and that as far as I am aware, this dissertation, either in whole or in part, has not been presented elsewhere for another degree.

17th April, 2023

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Dr. Adolphina Addo Lartey DATE

(ACADEMIC SUPERVISOR)

DEDICATION

This dissertation is dedicated to God Almighty for His provision and grace. Glory be to God on High! This is also dedicated to my lovely parents, siblings, and friends who have been of immense support though every step of this journey.

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I first of all want to acknowledge Almighty God for His grace and guidance throughout the program and for the successful completion of this study.

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Finally, I would also like to appreciate my family, for their endless support, prayers and encouragement throughout my program of study.

ABSTRACT

Background: Cardiovascular disease (CVD) is a leading cause of morbidity and mortality, contributing significantly to poor health status and socioeconomic decline, especially in sub-Saharan Africa. It affects all social classes and occupations including health workers, who in addition to other factors, are constantly stressed by overwhelming workloads, high-risk environments, and often poor working conditions. The prevalence of cardiovascular disease risk factors such as hypertension, diabetes, and obesity in Ghana has been well established, and while other countries report that health workers have lower CVD risk compared to their population, little data exists to establish the same claims for health workers in Ghana. The study made use of risk assessment tools (WHO-CVD and SPARS-CVD models) to assess the 10-year risk of cardiovascular disease development and sought to identify risk factors that significantly contributed to increased risk of cardiovascular events among clinical health workers in Korle Bu Teaching Hospital (KBTH), Accra.

Methodology: The research employed a quantitative cross-sectional design. An estimated 420 participants (including doctors, nurses, pharmacists, and allied health staff) were selected from four departments, to form a representative sample. Data on sociodemographic determinants and other potential risk factors for cardiovascular disease were collected through a structured questionnaire. Physical measurements were also taken, and data was organized and analyzed using Microsoft excel 16 and Stata-BE version 17 software. The level of significance (α), was set at $p < 0.05$.

Outcome: The proportion of clinical staff with moderate-to-high 10-year risk of CVD was less than 1% and 1.43% using the WHO-CVD and SPARS-CVD models respectively. Being overweight/obese was the most prevalent metabolic risk factor for both WHO and SPARS models (33% and 28.8% respectively), and a significant number of respondents (40.24%) had unhealthy diet choices. Increasing age ($p<0.001$), male sex ($p<0.001$), being single ($p<0.001$), obesity/overweight ($p<0.001$), and increasing blood pressure ($p<0.001$) were related to an increased risk of CVD. Key recommendations were for organization of routine pre-hypertension and overweight/obesity screening, and implementation of innovative ways to promote healthy lifestyle in the hospital.

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Abbreviations

CVD - Cardiovascular disease

COVID-19 - Coronavirus disease (SARS-Cov-2)

KBTH – Korle Bu teaching hospital

NCD - Non-communicable diseases

SLIQ - Simple lifestyle indicator questionnaire

SARS - Severe acute respiratory disease

SPARS - Simplified Persian atherosclerotic (CVD) risk stratification

WHO - World Health Organization

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Cardiovascular diseases (diseases of the heart or blood vessels) are the leading cause of mortality and morbidity and were estimated to amount to 32% of all global deaths in 2019 (World Health Organization [WHO], 2021). Sub-Saharan Africa is significantly affected by this problem, in addition to the challenges it is still facing with communicable diseases and other non-communicable diseases such as diabetes, chronic respiratory diseases, and cancer (Agyei-Mensah and de-Graft Aikins, 2010; Peters et al., 2019). Cardiovascular disease (CVD) alone accounts for 37% of all deaths from non-communicable diseases (Yuyin et al., 2020), and in Ghana, stroke and coronary heart disease are considered the two leading causes of death from all causes, with corresponding death rates of 124 per 100,000 and 119.9 per 100,000 respectively (WHO, 2022).

Various interrelated genetic, sociodemographic, lifestyle, and metabolic factors contribute to the development of CVD, with the main factors being increasing age, male gender, and hypertension (Loscalzo, 2016). Hypertension has been found as the CVD risk factor with the highest prevalence in Ghana, being as high as 54.6% in urban communities (Addo et al., 2022). Also of note is that, about 60% of CVDs have been linked to modifiable lifestyle factors such as unhealthy diet, physical inactivity, tobacco, smoking, alcohol misuse, and stress (Mozaffarian et al., 2008; van Dame et al., 2008). Following the Omni Cohort of the Framingham heart study in 1994, many models and algorithms have been designed to assess cardiovascular risk, and these have been useful tools in CVD prediction and prevention (Hasabullah et al., 2020; Dawber et al., 1951).

Cardiovascular disease prevalence has also been seen to increase in recent years among health care professionals (Ulguim et al., 2019), and CVD has been found to contribute significantly to causes of death among physicians and nurses (Leong and Chia, 2008, Carpenter et al., 1997). A recent study in Uganda also found cardiovascular disease to be one of the main causes of death among doctors

(Amandua et al., 2022). Although the actual death rates are lower than the general population, CVD contributes to health workers often calling in sick, short staffing, and loss of veteran health workers (Frank and Burnett, 2000). With the growing demand on health care, health workers also tend to meet their professional duties at the expense of their personal health responsibilities (Guillard, 2017). There is also an increased recognition that physicians are likely to experience fatigue, stress, and burnout, further increasing their risk of developing cardiovascular diseases (Dyrbye, & Shanafelt, 2011).

In Ghana, there is only a handful of research work concerning cardiovascular disease among health workers, compared to the general population (Osei-Yeboah et al., 2018). The research, therefore, sought to assess cardiovascular risk among clinical health workers in a tertiary health facility in Accra-Ghana, as a crucial first step in bridging these research gaps, promoting health among essential workers, and adding to knowledge that will inform public health policies.

1.2 Problem statement

There is an anticipated global deficit of 15 million health workers by the year 2030, primarily in low and lower-middle-income countries (WHO, 2016). As at 2017, the density of essential health workers (e.g. doctors, nurses, and midwives) in Ghana stood at 2.65 per 1,000 inhabitants, requiring a further 105,440 health workers to meet its minimum staffing requirements in May 2018 (Asamani et al., 2021). Rapid urbanization rates demand more human resources in health care settings (Tay, & Ocansey, 2022). With an estimated population of 2,605,000, the Accra metropolis has a little over 65 Hospitals, 11 of which are government facilities that deliver over 80% of the total health care in the zone (Accra Metropolitan Assembly, 2022). Korle Bu teaching hospital also currently operates with a daily outpatient attendance of 1500, with about 250 in-patient admissions (Korle Bu Teaching Hospital [KBTH], 2022). Not only does it serve the Korle Bu community, but being a tertiary facility, it receives referrals from other hospitals in the Accra metropolis, Greater Accra region, other regions, and beyond the country’s borders (Sasu, 2022).

The advent of COVID-19 has further increased the demand for health workers in Ghana (Bonenberger et al., 2014). All these coupled with the stress of night shifts, long working hours, and high-risk environments, puts health workers in certain vulnerable states which have been linked to CVD development, either directly or through adaptation of lifestyles that promote the development of CVD (Owusu et al., 2021). According to Clarke, (2003), death accounted for 6.1% of the causes of high attrition among health workers in Ghana, and studies elsewhere have shown that cardiovascular disease is the leading cause of death among health workers (Leong and Chia, 2012; Carpenter et al., 1997). There is currently not enough research information to support cardiovascular health among health care workers in Accra, or how moderate-to-high CVD risk differs from that of the general population, estimated to be between 33.8 and 37.9% (Boateng et al., 2018). A few studies have been done in rural and peri-urban districts, but these seem to be limited in generalizability and diversity of health professionals (Kasu et al., 2015; Duodu, 2015).

The study hypothesized that the prevalence of moderate-to-high CVD risk among health workers in Korle Bu teaching hospital is different from those of the general population (37.9%).

1.3 Justification

CVDs are mostly preventable, especially with lifestyle modification and early detection of increased cardiovascular risk (WHO, 2015). CVDs also affect economically productive persons, including health workers who are considered essential workers (Carter, et al., 2019). Undetected CVD risk among health workers could lead to lack of prompt preventive interventions, resulting in CVD development with its accompanying morbidity and mortality. From this, more health workers may call in sick to be absent from work, and without an adequate number of health workers, there is a risk of poor health service delivery because of higher patient-to-health worker ratios (Evans et al., 2015). Figure 1.1 gives a framework for the determinants of CVD and the potential effects on health workers and the health. The knowledge obtained from this research will inform public and institutional health policies, as well as inspire innovative programs targeted at secondary CVD prevention and improvement of cardiovascular health among health workers. Future implementation of the principles of this work in major health programs will go a long way to reduce the cost of health, improve the inadequate worker-to-patient ratio, strengthen the health workforce, and improve confidence in the services rendered by the health sector. Finally, the research will contribute to existing knowledge on cardiovascular disease in Ghana.

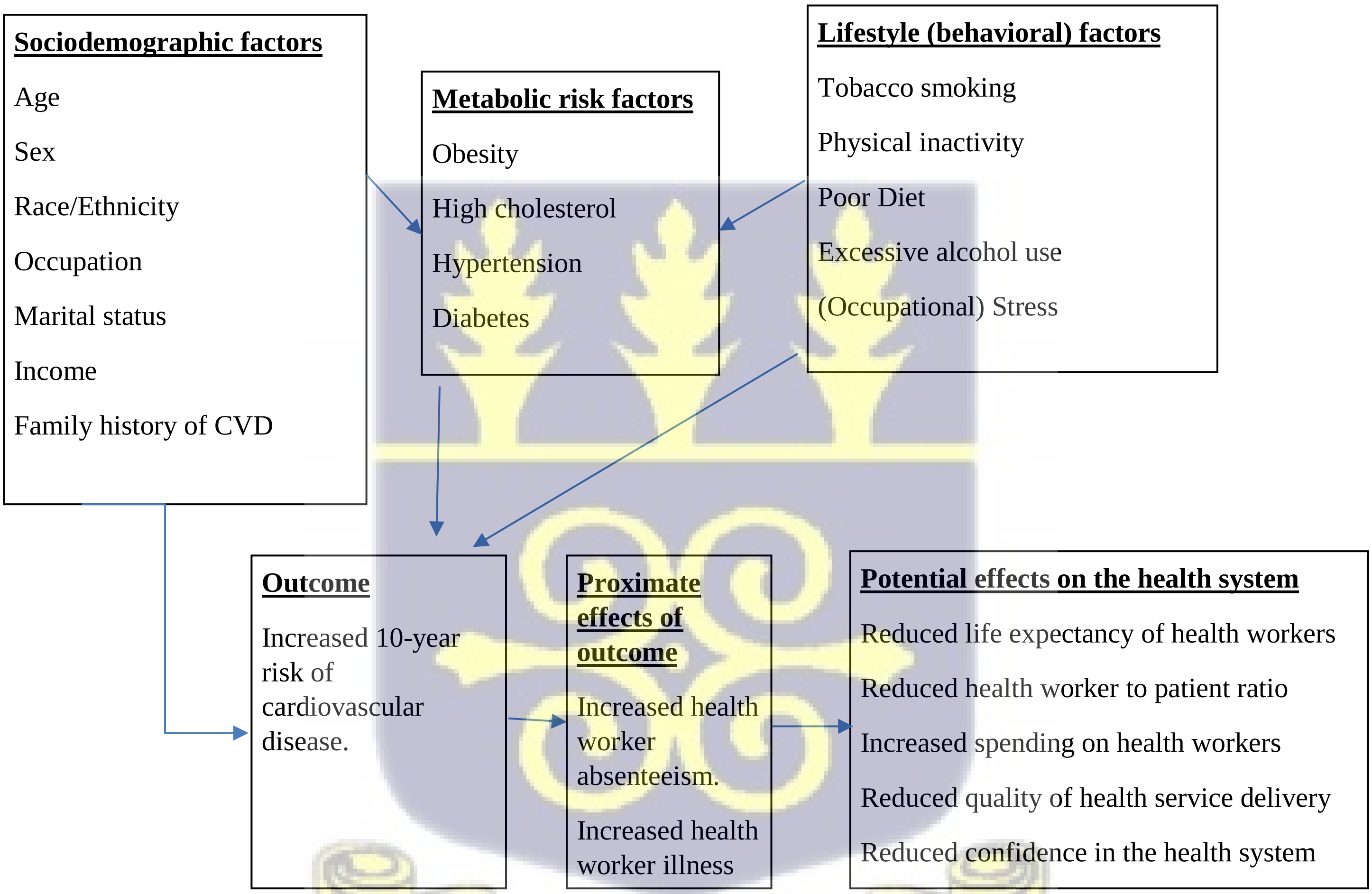

Fig 1.1: *The conceptual framework for the determinants of cardiovascular disease risk and the potential effects on the health system*

1.4 Research Questions

1. What is the proportion of clinical health workers with a moderate to high risk of cardiovascular disease in Korle Bu teaching hospital?
2. What specific factors are associated with cardiovascular disease risk among the clinical staff in Korle Bu teaching hospital?
3. Is there a significant association between healthy lifestyle and cardiovascular disease risk among the clinical health workers in Korle Bu teaching hospital?

1.5 General objective

The main objective of this research was to assess the determinants of cardiovascular risk among clinical health care workers in Korle Bu teaching hospital.

1.5.1 Specific objectives

The specific objectives of the study among clinical health care workers in Korle Bu teaching hospital were;

1. To determine the proportion of clinical staff with a moderate-to-high risk of cardiovascular disease.
2. To examine the sociodemographic, lifestyle, and metabolic factors that are associated with cardiovascular disease risk among clinical health workers.
3. To assess the relationship between lifestyle and cardiovascular risk among the clinical staff.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Cardiovascular disease (CVD) burden

Globally, about 17.9 million lives are lost each year from CVDs (WHO, 2021). Sub-Saharan Africa records most of these deaths (Yuyun et al., 2020; Mensah et al., 2015). In Ghana, stroke and coronary heart disease account for about 16.73% of all deaths. With the steadily growing percentage of individuals over the age of 65, global deaths from NCDs are expected to reach 75.26% by 2030 (Wang and Wang, 2020). CVD risk is generally higher in urban communities (Kodaman et al., 2016; Agyei-Mensah and deGraft Aikins, 2010). A 5-year review of autopsy cases at Korle Bu teaching hospital from 2006 – 2010 showed that CVD was responsible for 22% of deaths from all causes (Sanuade et al., 2014).

The prevalence of CVD among health workers has seen a gradual increase in the last few years owing to increased work demand, poor lifestyle choices despite sufficient knowledge of the disease, poor working conditions, and unhealthy weight among other factors (Ulguim et al., 2019). CVD mortality has also been found to be generally lower among health professionals compared to the general population (Leong and Chia, 2012; Carpenter et al., 1997). There are however significant risk factors being picked up in recent studies that could potentially increase morbidity and mortality of CVD among health workers (Hassan et al., 2023). No studies have been found that assess CVD-related death among health professionals in Ghana.

2.2 Risk factors affecting cardiovascular disease

CVD results from a combination of modifiable and non-modifiable risk factors (WHO, 2015). According to a comparative analysis of CVD risk prediction in sub-Saharan African populations, the moderate-to-high 10-year risk for CVD in Ghana was found to be between 33.8 and 37.9% (Boateng et al., 2018). In Sefwi-Wiawso Municipal Hospital, about 50% of the staff had at least one metabolic risk factor. (Osei-Yeboah et al., 2018). A study in Nigeria found CVD risk to be generally lower among health workers compared to the public (Olubiyi et al., 2022). Research in a tertiary hospital in Kuala Lumpur also estimated that majority of health workers had relatively lower CVD risk, with a recorded prevalence of high, moderate and low 10-year CVD risk of 12.8%, 20.0%, and 67.2% respectively (Ahmad et al., 2020).

2.2.1 Prevalence of cardiovascular risk factors

About 60% of CVDs result from lifestyle factors such as unhealthy diet, physical inactivity, tobacco, smoking, alcohol misuse, and stress (Mozaffarian et al., 2008; van Dame et al., 2008). In a tertiary hospital in the Sarawak state of Malaysia, a study was conducted to assess the lifestyle of health workers as regards cardiovascular health, the majority of which included allied health staff. About 38.6% of participants were considered to have healthy lifestyle habits, while 58% and 3.4% engaged in intermediate and unhealthy lifestyles respectively (Kuan et al., 2020). Lifestyle factors translate into intermediary metabolic factors like hypertension, diabetes, obesity, and dyslipidemia, leading to cardiovascular disease (Mitchell et al., 2010; Loscalzo, 2016). Globally, CVD-related deaths attributable to hypertension, diabetes, physical inactivity, and overweight/obesity were estimated to be 13%, 9%, 6% and 5% respectively (Ofori-Asenso, & Garcia, 2016).

According Unger et al. (2020), threshold blood pressures to diagnose hypertension are a systolic pressure ≥140 mm Hg or a diastolic pressure ≥ 90 mm Hg. WHO (2015), estimated the prevalence of hypertension in Ghana to be 36.4%. A systematic review also identified the prevalence of hypertension in Ghana to range from 19.3% in rural to 54.6% in urban areas (Addo et al., 2013). Osei-Yeboah et al. (2018) reported the prevalence of hypertension and pre-hypertension among health workers in Sefwi Wiawso Hospital to be 16.07% and 52.68%, highlighting that, addressing pre-hypertension may offer a window of opportunity to prevent the establishment of hypertension.

The prevalence of diabetes in Ghana in 2004 was estimated to be about 6% (450,000 cases), and the most recent prevalence is expected to be higher (Danquah et al., 2012). In a random cluster sample of Ghanaians aged ≥25 years from the Greater Accra area of Ghana, diabetes, impaired fasting glucose (IFG) and impaired glucose tolerance (IGT), as defined by criteria of the American Diabetes Association and WHO, were found to have an age-adjusted prevalence of 6.4%, 6.0% and 10.7%, respectively with higher numbers seen for increasing age (Amoah et al., 2002). Osei-Yeboah et al. (2018) reported the prevalence of diabetes among health workers in Sefwi Wiawso to be 4.46%. Elsewhere, the prevalence of diabetes among doctors and nurses was found to be 25.4% and 18% respectively (Hedge et al., 2015; Huang et al., 2016). Although rates are lower compared to the general population, the studies highlighted a significant reduction in the quality of life of health care workers who had diabetes (Alamri et al., 2021).

The prevalence of unhealthy blood cholesterol in Ghana is between 17% and 23% (de-Graft Aikins et al., 2012). Osei-Yeboah et al. (2018) also reported the prevalence of atherogenic dyslipidemia among health workers to be 18.07%, which is very close to the national prevalence reported. Obesity results from the accumulation of excess fat in adipose tissue of the body. This results from a positive energy balance over a long time, with the usual causes being an unhealthy diet and lack of physical activity (WHO, 2021). The overall prevalence of obesity and overweight in Ghana seems to have increased from 25.5% in 2003 to 30.5% in 2008 (Ofori-Asenso et al., 2016). A systematic review of overweight and obesity among health care workers in Ghana found the prevalence of overweight and obesity to be as high as 38.39% and 28.9% respectively (Abubakar et al., 2021). Among nurses and midwives in Kajebi, Kanu et al. (2015) the prevalence of obesity was estimated to be 12.7%. Socio-cultural associations such as weight gain (perceived as a sign of wellbeing), westernization, and long sitting hours at work were found to contribute to the problem. About 60% of 45 employees of a philanthropic health institution in Sawarak in Malaysia, were also found to have sedentary lifestyles (Albawardi et al., 2017). Similarly, Ulguim et al. (2019), also reported that about 60% of health workers in a major hospital in Brazil had sedentary lifestyles.

The European Society of Cardiology and the American Heart Association recommends a daily intake of multiple servings of fruits and vegetables as a way of reducing the risk of CVD (Dauchet et al., 2009). Sadly, unhealthy eating patterns are becoming common in Ghana and in other sub-Saharan communities. In the World Health Survey 2002-2003, fruit and vegetable consumption in Ghana was ranked lowest among 52 low- and middle-income countries including 19 African nations (Dake et al., 2011).

In Ghana, recent estimates indicate a smoking prevalence of around 10%, with higher rates in men compared to women (14% and 7% respectively) (Ofori-Asenso et al., 2016). The global estimated prevalence of tobacco use among health care workers is also about 21%, with higher numbers in high-income groups (Nilan et al., 2019). Although little representative data exists for Ghanaian health workers, an overall ever-smoked prevalence of 39.6% was recorded in Kano, Nigeria among health professionals. Most of the respondents (87.5%) were indifferent in their disposition toward smoking (Abubakar et al., 2011).

2.3 Measuring cardiovascular risk

Many tools have been adopted over time to predict CVD risk using algorithms based on established associations between risk factors and disease development (Loscalzo, 2016). The models are specific to different geographic and cultural locations. According to a survey of over 10,000 individuals aged between 40-60 years in sub-Saharan Africa, different patterns of CVD risk distributions were noted when different risk stratification tools were used among different groups (Ramsay et al., 2016), highlighting the need for validating tests and for further context-specific algorithms to be developed, to ensure more accurate predictions. The WHO-CVD risk assessment charts, the Simplified Persian Atherosclerotic CVD Risk Stratification charts (SPARS), and the Framingham cardiovascular risk calculator have been widely used by many countries, with the main predictor variables being sex, age, race, cholesterol level, smoking status, systolic hypertension, and diabetes.

Earlier versions of the models required capital-intense laboratory testing, which did not allow for self-funded large-scale studies to be carried out in low-resource settings like Ghana (Chanmnan and Aekplakorn, 2017). In 2019, WHO developed more specified charts for various regions that did not require laboratory testing; the new charts replace cholesterol with body mass index and divide sub-Saharan Africa into different regions with region-specific parameters (WHO, 2020). Similarly, there is a non-laboratory version of the Framingham and SPARS models, which replace cholesterol with body mass index and waist-to-hip ratio respectively (Pandya et al., 2011; Hassannejad et al., 2021). Studies done to compare the consistency in laboratory-based versus non-laboratory-based assessments have shown similar predictive results with the Framingham non-laboratory assessment being the most reliable (WHO, 2020).

The Simple lifestyle Indicator Questionnaire (SLIQ) is also a useful model that assesses lifestyles related to CVDs and NCDs in general. Standardized assessments based on diet, physical activity, alcohol consumption, stress, and smoking are carried out based on internationally accepted guidelines. The individual categories are scored from 0(unhealthy) to 2(healthy) based on internationally accepted criteria, and the overall is scored from 1 to 10, with categories from 0-4, 5-7, and 8-10 considered as healthy, intermediate, and unhealthy lifestyles respectively (Godwin et al., 2008).

CHAPTER THREE

3.0 METHODS

3.1 Study design

The study employed a cross-sectional observational design.

3.2 Study area

Korle Bu teaching hospital was established in 1923 and is currently a leading teaching hospital and tertiary referral center in Ghana and West Africa. Located in the Accra metropolis, it has a bed capacity of over 2000, with a combination of clinical, administrative, research, and support staff, that offer health services to about 1500 out-patients and carry out about 250 in-patient admissions per day (KBTH, 2022). It also offers education and training to undergraduate and post-graduate students, with about 21 clinical and diagnostic departments, making it an ideal site to study diverse groups of clinical staff. Administratively, clinical staff are categorized into 4 main groups; doctors and allied health professionals under the medical directorate, nurses under the nursing directorate, and pharmacists under the pharmacy directorate. To ensure equal representation, clinical staff from four departments (Internal Medicine, General Surgery, Child Health, and Obstetrics and Gynecology) were enrolled in the study. These were the earliest departments to be established, and together have majority of clinical staff with a relatively diverse representation of the various groups of clinical workers (KBTH, 2022).

The department of Internal Medicine is the physician specialist department of the Hospital with a 277-bed capacity (KBTH, 2022). It has a 4-storey in-patient medical block as well as other units such as the chest clinic, medical out-patient clinic, stroke unit, renal dialysis unit, fevers unit, and national diabetes center. The department of Surgery occupies a 6-storey block with affiliate facilities, offering various forms of general and specialized surgical services such as urology, orthopedics, plastics and reconstructive surgery, etc. (KBTH, 2022). The department of Child health provides medical and surgical health services to children under the age of 13 years, with 3 general pediatric wards, a pediatric surgical theatre, a babies' unit (NICU – located on the 3rd floor of the maternity building), a pediatric intensive care unit, an emergency room, a child care protection unit, and a specialist OPD (KBTH, 2022). The obstetrics and gynecology department has 3 gynecological wards, a gynecological OPD, a gynecology theatre, a 6-storey maternity building, an obstetrics OPD and emergency, a family planning unit, a dedicated blood bank, two labor wards, and an obstetric theatre. It attends to all women of child bearing age (KBTH, 2022). The pharmacy department has approximately 100 registered pharmacists and 80 pharmacy assistants and technicians (KBTH, 2022). Allied health professionals include a diverse group of health professionals such as physiotherapists, dieticians, medical laboratory and pathology laboratory technicians, occupational health officers, radiographers, etc. (Ministry of Health, 2021).

Data obtained from the secretariat units of the Medical, Nursing, and Pharmacy directorates of the Korle Bu teaching hospital, estimated a total of 2847 clinical health professionals in the study population with a distribution of 631 doctors, 1655 nurses, 526 allied health professionals, and 35 pharmacists in the four departments used for the study.

3.3 Inclusion criteria

Participants to be selected from the study population met the following inclusion criteria;

i. All participants were between the ages of 18 – 60yrs.

ii. Participants were certified clinical health workers.

Operational definition of certified clinical health worker: Medical doctors, nurses, mid-wives, allied health professionals, or pharmacists, who are recognized as members and are licensed to practice, by their respective regulatory bodies in Ghana (Medical and Dental Council, Nursing and midwifery council, Pharmacy council, and Allied Health professional council).

iii. Participants were recognized as staff of any of the 4 departments (Internal Medicine, General surgery, Child health, Obstetrics and Gynecology).

iv. All recruited staff must have had at least 3 months of working experience in the facility, as it has been proposed that, at least 3-6 months is the time needed for an employee to be established and used to their new job (Shoebridge, 2021).

3.4 Exclusion Criteria

Clinical staff with existing cardiovascular disease were excluded from the study.

3.5 Sampling

3.5.1 Sample size calculation

According to the literature review, the prevalence of moderate-to-high risk of CVD in Ghana is estimated to be as high as 37.9% (Boateng et al., 2018). The required sample size for the study was obtained by using the Cochrane sample size estimation formula for a dynamic population (Cochran, 1977) as illustrated below;

With a confidence level of 95%, a corresponding 'z' of 1.96, and a margin of error of 5%, the sample size (n) will be calculated as follows;

$n = \frac{z^2 P(1-P)}{\varepsilon^2}$, $n = \frac{1.96^2 x 0.379(1-0.379)}{0.05^2} \approx$ **362 participants**

This value was cross-checked using an online Cochrane sample size calculator for a dynamic population (https://www.Calculator.net/sample-size-calculator.html).

To account for an assumed 10% non-response rate;

$\frac{100}{90} x 362 \approx$ **402 participants**

A total of 402 participants were to be enrolled in the study.

3.5.2 *Selection of Participants*

A multi-level probability sampling method was used to select the 402 participants from a sampling frame of 2847.

First, a proportionate stratified sampling was used to select total participants from a cross-tabulation between the four strata of clinical health workers (doctors, nurses, allied health workers, pharmacists) and the four strata of departments (medicine, surgery, allied health, pharmacy). The data on the distribution of number of health workers was obtained from the respective directorates.

The sampling fraction 'k' was calculated as follows;

$$\frac{n}{N} \quad where \ n = sample \ size, and \ N \ = \ sampling \ frame$$

$$k = \frac{402}{2847} = 0.1412$$

The sampling fraction was then applied to the estimated total number of health workers among the various groups as shown in Table 3.1 below;

Table 3.1: *Distribution of study population versus proportionate distribution (in brackets) of clinical staff by department and type of health worker using a sampling fraction of 0.1412.*

		Department				Total
		Internal medicine	General surgery	Child Health	Obstetrics and Gynecology	
Type of Health worker	Doctors	176 **(25)**	163 **(23)**	150 **(21)**	142 **(20)**	631 **(89)**
	Nurses	339 **(48)**	313 **(44)**	330 **(47)**	673 **(95)**	1655 **(234)**
	Allied Health	193**(27)**	142**(20)**	85**(12)**	106**(15)**	526 **(74)**
	Pharmacists	9 **(1)**	8 **(1)**	8 **(1)**	10 **(2)**	35 **(5)**
					Total	2847 **(402)**

Values in the cells represent the distribution of the 2847 staff, each of which has been multiplied by the sampling fraction to obtain the number to be selected (boldened values in brackets).

The second stage in the selection employed a simple random sampling method. A numbered alphabetical list of all clinical staff in each department was made and grouped into various occupations. Based on the required numbers from Table 3.1, an online random generator (https://www.random.org) was used to select "x" random numbers from each of the specific groups (e.g. for doctors in internal medicine, 25 distinct whole numbers were randomly selected from 1 to 176, ensuring that a number could be selected once). The name of the participant with that assigned number on the alphabetical list was selected for the study.

The random sampling was repeated from the remaining names to make up for the required numbers, as some initially selected participants who were not available, did not meet the selection inclusion/exclusion criteria, or were unwilling to participate. This was continued until all the required numbers of participants across departments and occupations were obtained.

3.6 Study variables

3.6.1 Dependent variable

The dependent variable in the study was the 10-year cardiovascular risk score expressed as a percentage. (e.g. a score of 5% meant that the risk of having a cardiovascular event in ten years for an individual of a particular age and sex is 5%). Two assessment tools were used; the revised 2019 WHO non-laboratory-based cardiovascular risk assessment chart for western sub-Saharan Africa, as well as the Simplified Persian Atherosclerotic Risk Stratification charts. The scores for both tools were categorized into low risk (<5%), moderate risk (5-10%), and high risk (>10%).

3.6.2 Independent variable

The independent variables evaluated in the study were;

- Sociodemographic variables such as age (in completed years), sex, marital status, department, and occupation.
- Cardiovascular lifestyle indicators such as diet, smoking, physical activity, alcohol intake, and stress.
- Clinical measurements such as Systolic blood pressure, weight, height, body mass index (BMI), waist-to-hip ratio (WHR).
- Diabetes status and history of dyslipidemia.

A summary of the variables are shown in Table 3.2 below;

Table 3.2: *Table showing details of variables and Source of data*

Type of variable	Variable	Operational definition	Scale of measurement	Source of data
Dependent variable	10-yr CVD risk score	Non-laboratory WHO charts scores for CVD risk in Western sub-Saharan Africa	Continuous	Derived variable
Independent variables	**Sociodemographic factors**			
	Age	Completed age of the participant in years	Continuous	Questionnaire
	Sex	Sex of participant	Binary	Questionnaire
	Religious affiliation	Religion of participants	Nominal	Questionnaire
	Occupation	Occupation of participants	Nominal	Questionnaire
	Educational level	Highest level of education attained by the participant	Ordinal	Questionnaire
	Cardiovascular lifestyle			
	Lifestyle factor	The score for diet, smoking, physical activity, stress, alcohol	Continuous	Questionnaire
	Lifestyle score	The total CVD lifestyle score Lifestyle score categorization	Continuous Ordinal	Derived

	Metabolic profile			
	SBP	Mean systolic blood pressure (mmHg)	Continuous	Measured
	Height	Height in meters	Continuous	Measured
	Weight	Weight in Kilograms	Continuous	Measured
	BMI	Body mass index (in kilograms per meter squared)	Continuous	Derived variable
	WHR	Waist-to-hip ratio	Continuous	Measured
	Diabetic status	Previous diagnosis of diabetes	Nominal	Questionnaire
	Dyslipidemia	Previous diagnosis of dyslipidemia	Nominal	Questionnaire

3.7 Data collection and tools

A standardized questionnaire as seen in appendix 1 was used to assess the cardiovascular risk. Each respondent was interviewed by the principal investigator, ably assisted by two field workers. A standardized questionnaire that was specific to the study was designed to obtain data on the participants' sociodemographic, lifestyle, and metabolic risk factors in sections A, B, and C respectively. Section C also involved clinical assessment i.e. anthropometric measurements (weight, height, waist and hip circumference) as well as blood pressure measurements. Height and weight were measured by a standardized stadiometer and standard weighing scale. The waist circumference was also measured using a standard tape measure. Finally, the blood pressure was measured by an automated OMRON blood pressure device.

3.8 Data analysis

Data were entered into Microsoft excel 2016, cleaned and organized. It was then transferred to STATA version 17. The participants' information was kept secure in a password-protected folder. Categorical variables were presented as proportions and continuous variables (most of which were normally distributed) were presented as means with standard deviations. Descriptive statistics were summarized into tables.

Pearson's correlation was used to test for an association between participant's age and raw WHO CVD score, while Fisher's exact test was used to test the association between other sociodemographic variables and WHO CVD categorical stratification. Kruskal-Wallis test and one-way ANOVA test were used to assess significant differences in the median WHO CVD risk and mean SPARS CVD risk scores among SLIQ categories respectively. The one-way ANOVA was further used to test for associations of diet, physical activity, and stress with CVD risk scores. A two-sample t-test was used to test for mean differences in CVD risk between non-smokers and respondents with a smoking history. Two-sample t-test was also used to test for mean differences in scores between groups of those who reported a history of diabetes/dyslipidemia and those who reported no disease.

Multivariate analysis was also done using linear regression models with CVD risk score as the outcome variable. Of the factors that were significantly associated with the outcome, the derived models were compared with the standard WHO CVD and SPARS CVD models using the Akaike Information Criterion and Bayesian Information Criterion. The level of significance was set at a p-value of 0.05 with a 95% confidence interval.

3.9 Quality control

3.9.1 Training of field workers and research assistants

The fieldwork involved a seven-member team, which includes the principal investigator, two research assistants (one male doctor and one female medical doctor), and four registered nurses (one from each department) who were trained to take anthropometric measurements. Meetings were held to brief the entire team on the details of the research work and data collection plan, following which every team member received training on their specific roles before the fieldwork. The training included a briefing on the selection of participants, obtaining informed consent, documentation/recording of data, and other relevant ethical considerations. The research assistants were fluent in English, Twi and Ga.

The work of the principal investigator and the two research assistants was to guide participants fill the questionnaire. They also checked for completeness and errors in the data obtained with the questionnaire as well as anthropometric measurements. For any error identified attempts were made to obtain the correct data by re-interviewing the participant if necessary.

3.9.2 Pretesting Questionnaires

Questionnaires were pretested at the Greater Accra regional hospital. 40 participants (including doctors, nurses, allied health workers and pharmacists) were selected for the pretest. The participants were observed whilst responding to the questionnaire to assess areas where they hesitated. Mistakes realized were highlighted and further evaluated. After the questionnaires were administered, feedback was obtained from the participants about ease of understanding, wording, and length of the questionnaire.

3.10 Ethical consideration

This research proposal was submitted to the Ethical and Protocol Review committee, at Korle Bu teaching hospital. The purpose and objectives of the study were clearly explained to participants, who signed an informed consent form (ICF) before taking the survey. It was ensured that participants read the consent form, and clearly understood its contents, to allow them to ask any questions, and address all their concerns as much as possible. Respondents were informed that participating in the study was entirely voluntary and that they could withdraw from the study at any point without it affecting them in any way.

The participants were given enough time to ask questions and also contact the principal investigator for further clarification and communication throughout the study period. The participant was asked to sign the consent form either by thumbprint or signature. Furthermore, no name was used in the recording or any publications from this work, thereby ensuring anonymity. Following the questionnaire, participants' blood pressures and anthropometric measurements were taken by the researcher or research assistants based on the gender preference of participants. The assessment was done confidentially, and the participants were not shown their anthropometric measurements unless they wished to know. All data was secured with a password.

CHAPTER FOUR

4.0 RESULTS

4.1 Sociodemographic characteristics

The mean age for respondents was 31.65 years (95%CI: 31.07 - 32.23), and about 69.05% were female. Two-thirds of the study participants were Christians. Also, about 52.86% of respondents were single, and 45.71% were married. A greater proportion of the study participants lived in urban communities (96.9%) while a few stayed in peri-urban communities (3.1%). There was a fair distribution of participants across departments, with Obstetrics and Gynecology being the largest department (30.71%). Furthermore, majority of the staff were nurses/midwives (55.71%) and pharmacists had the least numbers (3.81%). The above details are summarized in Table 4.1.

***Table 4.1**: Sociodemographic characteristics of selected KBTH staff (N=420)*

	N	%
Sex		
Male	130	30.95
Female	290	69.05
Religion		
Christian	384	91.43
Moslem	36	8.57
Marital status		
Single	222	52.86
Married	192	45.71
Divorced/widowed	6	1.43
Place of residence		
Urban	407	96.90
Peri-urban	13	3.10
Occupation		
Medical doctor	93	22.14
Nurse/midwife	234	55.71
Pharmacist	16	3.81
Allied Health Professional	77	18.33
Department		
Medicine	112	26.67
Surgery	94	22.38
Child health	85	20.24
Obstetrics and Gynecology	129	30.71
Total Participants	**420**	**100**

4.2 Overall 10-year CVD risk

The average 10-year risk of CVD from the WHO CVD risk assessment tool was 1.49%. While most respondents had a low 10-year risk of CVD, six individuals representing 1.43% of the respondents had a moderate 10-year risk for CVD and no respondent had a high risk.

Similarly, the average 10-year risk of CVD based on the Simplified Persian Atherosclerotic CVD Risk Stratification model was 1.8%, with Less than 1% of the participants having a moderate risk of CVD and no respondent was at high risk of CVD. Table 4.2 summarizes these results.

Table 4.2 – Overall 10-year risk of cardiovascular disease among selected KBTH clinical staff (N=420)

	N	%
WHO 10-year CVD risk stratification		
<5%	414	98.57
5 – 10%	6	1.43
≥10%	0	0
Simplified Persian Atherosclerotic CVD Risk Stratification (SPARS)		
<5%	417	99.29
5 – 10%	3	0.71
≥10%	0	0
Total Participants	**420**	**100**

4.3 Healthy lifestyle assessment of clinical staff of Korle Bu teaching hospital

Of the 420 respondents, 47.38% ate green vegetables less than once a week or once a week, while those who took fruits and fiber up to once a week were 34.29% and 16.67% respectively. A total of about 40.24% had a poor diet SLIQ score. Majority of participants also engaged in light-intensity and moderate-intensity exercise (74.76% and 74.76% respectively) at least 2-3 times per week, while 31.9% of participants engaged in significant vigorous activity (2-3 per week). In all, about a fifth of the respondents had a poor physical activity. Most of the participants did not consume alcoholic wine (94.29%), beer (96.43%), or spirit (98.33%). Also, only 1 participant admitted to smoking currently and 2.14% of participants had a past smoking history. Lastly, about 38.1% of participants reported having severe levels of stress, while 14% had a good SLIQ stress score. Table 4.3 summarizes the above results.

Table 4.3 – Healthy lifestyle assessment of selected KBTH clinical staff (N=420)

	N	%
Diet		
Unhealthy	169	40.24
Satisfactory	219	52.14
Healthy	32	7.62
Physical activity		
Unhealthy	82	19.52
Satisfactory	204	48.57
Healthy	134	31.9
Alcohol		
Unhealthy	0	0
Satisfactory	1	0.24
Healthy	419	99.76
Smoking		
Unhealthy	0	0
Satisfactory	8	1.9
Healthy	412	98.1
Stress		
Unhealthy	160	38.1
Satisfactory	201	47.86
Healthy	59	14.05
SLIQ score category		
Unhealthy	12	2.86
Satisfactory	312	74.29
Healthy	96	22.86
Total Participants	**420**	**100**

4.4 Physical and metabolic assessment of clinical staff of Korle Bu teaching hospital

The mean systolic blood pressure was 115.71(±0.12) mmHg. About 66.2% of the respondents did not have hypertension or pre-hypertension, while 27.6% and 6.19% were found to have pre-hypertension and hypertension respectively. The mean body mass index (BMI) was 27.43(±0.19) kg/m^2, with 33.3% and 28.1% of the respondents being overweight and obese respectively. Less than 1% of the respondents were underweight. Of the 420 participants, 65.48% had a normal waist-to-hip ratio

(WHR; <0.90 for males, and <0.85 for females), while 34.52% were in the at-risk WHR category for CVD. Less than 1% of the respondents also reported having diabetes mellitus while 93.3% reported never having diabetes. About 5.95% of the respondents had never checked their diabetic status. Table 4.4 summarizes the physical and metabolic factors associated with CVD.

Table 4.4 – Physical and metabolic assessment of clinical staff of Korle Bu teaching hospital (N=420)

	N	%
Blood pressure		
Normal blood pressure	278	66.19
Pre-hypertension	116	27. 62
Hypertension	26	6.19
Body mass index (BMI)		
Underweight	4	0.95
Normal weight	155	36.90
Overweight	140	33.33
Obese	121	28.81
Waist-to-hip ratio (WHR)		
Normal	275	65.48
At risk	145	34.52
Ever diagnosed with diabetes		
Yes	3	0.71
No	392	93.33
Never checked	25	5.95
Total Participants	**420**	**100**

4.5 Association between sociodemographic characteristics and overall 10-year CVD risk

From the WHO CVD risk assessment scores/categorization, age had a moderate positive correlation with increasing cardiovascular risk scores (rho = 0.46; $p < 0.001$). There was also a significant association between the department and cardiovascular risk ($p = 0.003$). No significant associations were seen with other sociodemographic factors such as sex, religion, marital status, and occupation. Similar results were seen using the SPARS CVD assessment scores/categorization. Comparing scores of the WHO CVD and SPARS CVD risk assessments, there was a strong positive correlation between the two (rho = 0.72; $p<0.001$). The above findings are summarized in Table 4.5.1 and 4.5.2 below.

Table 4.5.1 – Association between sociodemographic characteristics and WHO overall 10-year risk of cardiovascular disease among selected KBTH clinical staff (N=420)

Characteristic	N	WHO Score/Category		Statistic	P-value
Age	420			0.4575	<0.001*
		Low risk	Moderate risk		
Sex					
Male	130	126	4		0.077
Female	290	288	2		
Religion					
Christian	384	378	6		0.582
Moslem	36	36	0		
Marital status					
Single	222	220	2		0.470
Married	192	188	4		
Widowed/Divorced	6	6	0		
Department					
Medicine	112	112	0		0.003*
Surgery	89	89	5		
Child Health	84	84	1		
Obstetrics/Gynecology	129	129	0		
Occupation					
Doctor	93	93	0		0.118
Nurse/Midwife	234	229	5		
Pharmacist	16	15	1		
Allied Health Professional	77	77	0		
Total Participants	**420**				

Table 4.5.2 – Association between sociodemographic characteristics and SPARS overall 10-year risk of cardiovascular disease among selected KBTH clinical staff (N=420)

Characteristic	N	SPARS Score/Category		Statistic	P-value
Age	420			0.4548	<0.001*
		Low risk	Moderate risk		
Sex					
Male	130	128	2		0.228
Female	290	289	1		
Religion					
Christian	384	382	2		0.236
Moslem	36	35	1		
Marital status					
Single	222	221	1		0.616
Married	192	190	2		
Widowed/Divorced	6	6	0		
Department					
Medicine	112	109	3		0.038*
Surgery	89	94	0		
Child Health	84	85	0		
Obstetrics/Gynecology	129	129	0		
Occupation					
Doctor	93	93	0		0.232
Nurse/Midwife	234	233	1		
Pharmacist	16	16	0		
Allied Health Professional	77	75	2		
Total participants	**420**				

4.6 Association between healthy lifestyle characteristics and overall 10-year CVD risk

There was a significant difference in the mean CVD risk scores between participants with intermediate smoking scores and those with healthy smoking scores for both WHO and SPARS models. There was also a very weak positive correlation between total SLIQ score and SPARS CVD risk scores; as well as significant differences in the mean SPARS CVD risk scores among SLIQ categories. Lastly, there were no significant associations between physical activity/stress and CVD risk. These are illustrated in Table 4.6 below.

Table 4.6 – Association between healthy lifestyle characteristics and overall 10-year risk of cardiovascular disease among selected KBTH clinical staff (N=420)

Characteristic	**WHO Score**		**SPARS Score**	
	Statistic	P-value	Statistic	P-value
Diet	2.27	0.10	0.44	0.64
Physical activity	2.05	0.13	2.05	0.13
Alcohol	N/A	N/A	N/A	N/A
Smoking	2.57	<0.05*	2.57	<0.05*
Stress	0.13	0.88	1.41	0.24
Overall SLIQ score	- 0.01	0.88	0.096	<0.05*
SLIQ category	4.02	0.13	3.06	<0.05*

4.7 Correlation between physical and metabolic characteristics and Overall 10-year CVD risk

Mean systolic blood pressure showed a strongly positive correlation with WHO CVD risk assessment scores (rho = 0.615, p<0.001), while body mass index and waist-to-hip ratio showed a weakly positive association (rho = 0.292, p<0.001 & rho 0.253, p<0.001 respectively). There were also significant differences in the mean 10-year WHO CVD risk between respondents who reported a history of dyslipidemia and those who did not. Similarly, the mean systolic blood pressure showed a strongly positive correlation with the SPARS CVD risk assessment scores (rho = 0.731, p<0.001), while the waist-to-hip ratio showed a weakly positive correlation (rho = 0.324, p<0.001). Body mass index showed a very weakly positive correlation (rho 0.096, p = 0.05 respectively). There were significant differences in the mean 10-year SPARS CVD risk scores between those who reported a history of diabetes/dyslipidemia and those who did not. The results are summarized in Table 4.7.

Table 4.7 – Correlation between physical and metabolic characteristics and overall 10-year risk of cardiovascular disease among selected KBTH clinical staff (N=420)

Characteristic	**WHO Score**		**SPARS Score**	
	Statistic	P-value	Statistic	P-value
Mean systolic blood pressure	0.62	<0.001*	0.73	<0.001*
Body mass index	0.29	<0.001*	0.09	0.05
Diabetic history (reported)	1.79	0.07	25.30	<0.001*
Dyslipidemia history (reported)	3.73	<0.01*	5.68	<0.001*
Waist-to-hip ratio	0.25	<0.001*	0.32	<0.001*

4.8 Univariate and multivariate linear regression analysis of the factors associated with CVD risk among participants using the WHO CVD model.

Tables 4.8.1 and 4.8.2 summarize the univariate and multivariate linear regression analysis of the association between sociodemographic, lifestyle, and physical/metabolic factors associated with CVD risk scores using the WHO CVD model. Significant differences were noticed with age (p<0.001), sex(p=0.002), marital status(p=0.004), and smoking lifestyle(p<0.001). There were also significant differences in CVD risk scores with increasing BMI(p<0.001), systolic blood pressure(p<0.001), and history of dyslipidemia(p<0.001).

Table 4.8.1 – Unadjusted linear regression of the association between risk factors for cardiovascular disease and WHO CVD risk score among clinical staff at KBTH (N=420)

Characteristic	Coefficient	95% Confidence Interval		P-value
		Lower	Upper	
Age	0.04	0.03	0.05	<0.01*
Sex				
Male	Ref.			
Female	-0.26	-0.42	-0.11	<0.01*
Religion				
Christian	Ref.			
Moslem	-0.05	-0.25	0.15	0.611
Marital status				
Single	Ref.			
Married	-0.22	-0.35	-0.09	<0.01*
Widowed/Divorced	-0.48	-0.97	0.01	0.06
Department				
Medicine	Ref.			
Surgery	0.02	-0.13	0.18	0.76
Child Health	-0.01	-0.18	0.16	0.94
Obstetrics/Gynecology	0.01	-0.14	0.16	0.91
Occupation				
Doctor	Ref.			
Nurse/Midwife	0.14	-0.02	0.29	0.08
Pharmacist	0.18	-0.14	0.50	0.27
Allied Health Professional	0.06	-0.12	0.23	0.54
Diet				
Healthy	Ref.			
Intermediate	-0.12	-0.24	-0.01	<0.05*
Unhealthy	-0.05	-0.16	0.26	0.64
Physical activity				
Healthy	Ref.			
Intermediate	-0.05	-0.20	0.10	0.54
Unhealthy	-0.05	-0.21	0.11	0.54
Alcohol				
Healthy	Ref.			
Intermediate	0.60	-0.44	1.64	0.26
Smoking				
Healthy	Ref.			
Intermediate	-1.10	-1.53	-0.67	<0.001*
Stress				
Healthy	Ref.			
Intermediate	0.04	-0.12	0.13	0.95
Unhealthy	-0.0002	-0.18	0.18	0.10
Mean systolic blood pressure	0.03	0.02	0.03	<0.001*
Body mass index	0.02	0.01	0.03	<0.01*
Diabetic history (reported)				
No	Ref.			
Yes	0.48	-0.14	1.10	0.13
Dyslipidemia history (reported)				
Yes	Ref.			
No	0.39	0.17	0.60	<0.001*

Waist-to-hip ratio	-0.06	-1.27	1.15	0.93

Table 4.8.2 – Adjusted linear regression of the association between risk factors for cardiovascular disease and WHO CVD risk score among clinical staff at KBTH (N=420)

Characteristic	Coefficient	95% Confidence Interval		P-value
		Lower	**Upper**	
Age	0.04	0.03	0.05	<0.001*
Sex				
Male	Ref.			
Female	-0.20	-0.33	-0.07	<0.01*
Marital status				
Single	Ref.			
Married	-0.19	-0.31	-0.06	<0.01*
Widowed/Divorced	-0.42	-0.91	0.05	0.08
Diet				
Unhealthy	Ref.			
Intermediate	-0.11	-0.22	0.01	0.07
Healthy	-0.07	-0.13	0.28	0.50
Smoking				
Healthy	Ref.			
Intermediate	-0.88	-1.28	-0.49	<0.001*
Mean systolic blood pressure	0.03	0.02	0.03	<0.001*
Body mass index	0.02	0.01	0.03	<0.001*
Dyslipidemia history (reported)				
Yes	Ref.			
No	0.39	0.19	0.60	<0.001*

Only independent variables that were significant at $p<0.05$ were used to run the adjusted model

4.9 Univariate and multivariate linear regression analysis of the factors associated with CVD risk among participants using the SPARS CVD model.

Tables 4.9.1 and 4.9.2 summarize the univariate and multivariate linear regression analysis of the association between sociodemographic, lifestyle, and physical/metabolic factors associated with CVD risk using the SPARS CVD model. Significant differences in CVD risk were noted with increasing age(p<0.001), as well as across sex(p<0.001), marital status(p=0.003), occupation(p=0.023), systolic blood pressure(p<0.001), and history of diabetes(p=0.025).

Table 4.9.1 – Unadjusted linear regression of the association between risk factors for cardiovascular disease and SPARS CVD risk score among clinical staff at KBTH (N=420)

Characteristic	Coefficient	95% Confidence Interval		P-value
		Lower	Upper	
Age	0.04	0.03	0.05	<0.001*
Sex				
Male	Ref.			
Female	-0.82	-0.97	-0.68	<0.001*
Religion				
Christian	Ref.			
Moslem	-0.08	-0.10	0.25	0.39
Marital status				
Single	Ref.			
Married	-0.17	-0.29	-0.06	<0.05*
Widowed/Divorced	-0.16	-0.60	0.28	0.48
Department				
Medicine	Ref.			
Surgery	0.04	-0.10	0.18	0.56
Child Health	-0.14	-0.30	0.16	0.08
Obstetrics/Gynecology	0.05	-0.09	0.18	0.50
Occupation				
Doctor	Ref.			
Nurse/Midwife	0.12	-0.01	0.26	0.08
Pharmacist	0.08	-0.20	0.36	0.58
Allied Health Professional	0.19	-0.03	0.35	<0.05*
Diet				
Healthy	Ref.			
Intermediate	0.03	-0.07	0.14	0.50
Unhealthy	-0.11	-0.30	0.08	0.24
Physical activity				
Healthy	Ref.			
Intermediate	-0.01	-0.13	0.14	0.94
Unhealthy	-0.07	-0.07	0.21	0.32
Alcohol				
Healthy	Ref.			
Intermediate	0.56	-0.37	1.49	0.23
Smoking				
Healthy	Ref.			
Intermediate	-0.02	-0.40	0.47	<0.93
Stress				
Healthy	Ref.			
Intermediate	0.06	-0.05	0.17	0.32
Unhealthy	-0.03	-0.13	0.19	0.74
Mean systolic blood pressure	0.033	0.03	0.04	<0.001*
Body mass index	-0.004	-0.01	0.01	0.50
Diabetic history (reported)				

No	Ref.			
Yes	0.64	0.10	1.19	<0.05*
Dyslipidemia history (reported)				
Yes	Ref.			
No	0.18	-0.01	0.37	0.06
Waist-to-hip ratio	1..20	0.12	2.28	<0.05*

Table 4.9.2 – Adjusted linear regression of the association between risk factors for cardiovascular disease and SPARS CVD risk score among clinical staff at KBTH (N=420)

Characteristic	Coefficient	95% Confidence Interval		P-value
		Lower	Upper	
Age	0.04	0.03	0.05	<0.001*
Sex				
Male	Ref.			
Female	-0.90	-1.02	-0.78	<0.001*
Marital status				
Single	Ref.			
Married	-0.16	-0.26	-0.05	<0.05*
Widowed/Divorced	-0.13	-0.50	0.25	0.51
Occupation				
Doctor	Ref.			
Nurse/Midwife	0.12	-0.001	0.25	0.05
Pharmacist	0.14	-0.11	0.39	0.27
Allied Health Professional	0.16	-0.02	0.30	<0.05*
Mean systolic blood pressure	0.033	0.029	0.035	<0.001*
Diabetic history (reported)	Ref.			
No	-0.60	-1.1	-0.07	<0.05*
Yes				
Waist-to-hip ratio	0..75	-0.16	1.66	0.107

Only independent variables that were significant at $p<0.05$ were used to run the adjusted model

4.10 Comparing the different outcome-generated models to the risk assessment models

The standard WHO-CVD risk assessment charts were developed based on age, sex, diabetic status, smoking status, and body mass index, while the regression model in table 4.8.2 showed that age, sex, smoking lifestyle, BMI, systolic blood pressure, and history of dyslipidemia were significantly contributory to CVD risk. Using the Akaike information criterion and Bayesian information criterion, it was observed that the second model was a slightly better predictor of the WHO 10-year risk for this study.

Similarly, the standard SPARS-CVD risk assessment charts were based on age, sex, diabetic status, smoking status, and waist-to-hip ratio, while the regression model in table 4.9.2 showed the age, sex, marital status, occupation, systolic blood pressure, and history of diabetes were significantly contributory to CVD risk. The comparison showed a slightly better predictability of the outcome using the second model. Table 4.10 below summarizes the comparison.

Table 4.10 – Comparing the risk assessment chart models with outcome-based models

Model	**Akaike information criterion**	**Bayesian information criterion**
WHO CVD chart model	654.24	682.087
WHO CVD outcome model	563.18	590.35
SPARS CVD chart model	499.36	527.22
SPARS CVD outcome model	494.30	534.09

Only independent variables that were significant at $p<0.05$ were used to run the adjusted model

CHAPTER FIVE

5.0 DISCUSSION

The main objective of this research was to assess the determinants of cardiovascular risk among clinical healthcare workers in a tertiary facility in Accra-Ghana, specifically, Korle Bu teaching hospital. The literature review provided information on existing work concerning health workers and cardiovascular disease, as well as cardiovascular risk factors and how to assess them especially in low resource settings. This guided the development of the dissertation and provided an opportunity to compare results from this study with existing research. This study could be one of the first to measure cardiovascular risk among different specialties of clinical health workers in the country. Previous studies in Ghana on cardiovascular risk assessment have focused largely on the general population and patients rather than healthcare workers. However, healthcare workers are equally as important to focus on since they are a bedrock of the health system and are to be examples of the very thing they preach and stand for.

5.1 Cardiovascular risk outcomes

Two assessment tools were used in determining the 10-year cardiovascular risk of CVD among the clinical staff of KBTH; the WHO-CVD risk charts and the SPARS-CVD risk charts. The prevalence of moderate-to-severe risk of CVD was less than 1% in the WHO model and 1.43% in the SPARS model. This was significantly lower than that of the general population ($p<0.001$) and agrees with similar studies in the UK, Nigeria, and Kuala Lumpur (Ahmad et al., 2020; Frank and Burnette, 2000; Olubiyi et al., 2022). Although it could suggest that health workers may be living healthier lifestyles, the difference may be because majority of the participants are young, given increasing age is a significant non-modifiable risk factor. Also, the very low prevalence of moderate-high CVD meant that assumptions for estimating sample size (using a prevalence of 37.9%) may have been flawed and therefore the findings need to be interpreted with caution.

5.2 Factors associated with cardiovascular disease risk

Increasing age and male sex were significant predictors of higher CVD risk scores in both WHO and SPARS models. This is similar to what was found by Loscalzo (2016) on significant non-modifiable CVD risk factors. Also, in this study, married and divorced/widowed individuals had lower cardiovascular outcomes than those who were single. This was not found in other studies and may be worth looking into in our setting.

The most frequent unhealthy lifestyle was diet with about 40.24% of respondents having unhealthy diet assessment scores. This could be attributed to the stressful and time-demanding nature of the work coupled with possible lack of assess to healthy food options at the workplace, all of which may limit health workers to settle for “junk” foods and already processed foods. The least common unhealthy lifestyle risk factor was the consumption of alcohol, with about 99.7% of participants reporting no or healthy alcohol intake limits. This could result from the fact that alcohol misuse apart from being bad for health, is unethical in healthcare practice, and thus individuals may be inclined to refrain from excessive alcohol in order to avoid making ethical mistakes. Also, this assumption could have resulted in under-reporting the number of drinks individuals took in a week. Although there was no significant association between physical activity and CVD risk from the 2 models, the proportion of health workers who exercised adequately was 31%. This is similar to the study in Sarawak-Malaysia, where 60% of employees were found to have sedentary lifestyles (Albawardi et al., 2017).

The most prevalent metabolic risk factor was unhealthy weight. This study found the proportion of individuals considered overweight and obese to be 33.33% and 28.81% respectively. These are similar to national estimates reported by Ofori-Asenso et al. (2016) and Abubakar (2021). Out of the 234 nurses enrolled in the study, 37.62% were overweight and 22.48% were considered obese. This is also higher compared to the study that employed nurses and midwives in Kajebi, where Kanu et al reported an obesity prevalence of 12.7% (Kasu et al, 2015). This further increase could be due the additional influence of urbanization on healthy lifestyle habits e.g. unhealthy diet and lack of exercise.

A lot of the clinical staff in KBTH also have night shifts and some may probably have an extra meal during the night.

The least common metabolic risk factor was (reported) diabetic status, with less than 1% of respondents reporting that they have ever been diagnosed of diabetes. A more objective assessment such as fasting blood sugar would have given a more reliable result and eliminated recall bias and misclassification. Also increasing systolic blood pressure significantly correlated with increasing cardiovascular risk in both WHO CVD and SPARS risk scores. Although the prevalence of hypertension in the study was low, it is worth emphasizing that the proportion of health workers with pre-hypertension was about 27.1%, highlighting the need for screening to pick this early enough, so as to institute changes that will prevent individuals from advancing to a hypertensive status.

5.3 Study Limitations

The study used non-laboratory methods of assessment on account of a lack of funds to carry out biochemical tests and other tests of genetic predisposition, which could have allowed for broader and accurate comparisons with other studies. Also, the Framingham non-laboratory assessment model was found to be the most reliable but was not included in the models used on account of delays in obtaining patents for its use. Other tertiary facilities are not included in the study owing to the lack of time and resources. It may therefore be difficult to generalize the results to the rest of the population. Lastly, the study was a cross-sectional study and therefore did not allow for participants to be followed over the 10 years to measure the outcome and ascertain how best the risk assessment tools were able to accurately predict the occurrence of disease.

CHAPTER SIX

6.0 CONCLUSION AND RECOMMENDATIONS

6.1 Summary

This study was conducted to assess the risk of cardiovascular disease among clinical staff in a tertiary facility in Accra. It sought to determine the proportion of clinical health workers (doctors, nurses, allied health professional, and pharmacists) in Korle Bu teaching hospital with a moderate-to-high risk of CVD, and assess the factors that significantly contribute to cardiovascular disease risk.

Overall most participants had a low 10-year risk of cardiovascular disease. Notwithstanding, increasing age, male sex, and being single, were the most significant sociodemographic factors associated with increased CVD risk. Poor diet was the most concerning lifestyle habit as it was significantly associated with increased CVD disease risk, and only a third of respondents engaged in healthy physical activity. Another finding of significance was the fact that more than half of the respondents were overweight/obese, and although the proportion of individuals with hypertension was low, it was concerning that about a third of the respondents were considered to have pre-hypertension. Both increase systolic blood pressure and body mass index were associated with higher CVD risk scores.

6.2 Recommendations

The recommendations based on the study are as follows;

- It is recommended that health workers in Korle Bu teaching hospital be counselled on the need to take care of their health despite the challenges of the health system and the workload they face. They need to recognize themselves as health representatives, whose lifestyle and image become an example for their patients to follow.

- Based on the significant proportion of health workers in Korle Bu teaching hospital being overweight/obese and about a third of them being sedentary, it would be helpful to put in interventions such as the establishment of a gym dedicated to health workers and situating car parks further from the wards and offices to encourage walking. Snack stands offering healthier food options can also be set up at vantage points to improve access to fruits, salads and other healthy snacks, rather than processed and unhealthy food options.

- Further research can be conducted among health workers in Korle Bu teaching hospital with established cardiovascular diseases or early stage cardiovascular outcomes. Lifestyle intervention strategies (e.g. behavior modification techniques and stress management interventions) can be implemented with the latter group to see how improved lifestyle can reduce CVD risk and the rate of disease progression.

REFERENCES

Abubakar, M.B., Uthman, U.A., & Ibrahim, K. G. (2021). Prevalence of Overweight and Obesity among Health-Care Workers in Ghana; A Systematic Review. *Nigerian Journal of Experimental and Clinical Biosciences*, 9(1) 47-53. https://doi:10.4103/njecp.njecp_39_20

Abubakar S., Abubakar, I.S., Gajida, A.U., & Mbachu, O.B. (2011). Prevalence and Attitude Towards Tobacco Smoking Among Health Care Workers in Kano State. *Ebonyi Medical Journal*, 9(2):106–11. https://doi.org/10.4314/ebomed.v9i2.71690

Accra Metropolital Assembly [AMA]. (2022). Ghana Metro Area Population 1950-2022. *MacroTrends*. Retrieved on 28th August 2022 from: https://www.macrotrends.net/cities/21107/accra/population

Addo, J., Agyemang, C., Smeeth, L., de-Graft Aikins, A., Edusei, A. K., & Ogedegbe, O. (2012). A review of population-based studies on hypertension in Ghana. *Ghana Medical Journal*, 46(2 Suppl), 4–11.49.

Agyei-Mensah, S., de-Graft Aikins, A. (2010). Epidemiological transition and the double burden of disease in Accra, Ghana. *Journal of Urban Health*; bulletin of the New York Academy of Medicine, 87(5):879–97. https://doi.org/10/1007/s11524-010-9492-y

Ahmad, N., Panduragan, S.L., Soon, C.H., Gemini, K., Khor, Y.S., Bahrin, N.A., Azhar, N.J., Ibrahim, M.Z., Othman, N.S., & Nawawi, K. (2020). Ten-year Cardiovascular Disease Risk Amongst Workers in a Tertiary Healthcare Institution in Kuala Lumpur. *Borneo Epidemiology Journal*, 1(1):35–45. https://doi.org/10.51200/bej.v1i1.2435

Alamri, W., Alhofaian, A., & Mersal, N. (2021). Quality of Life (QoL) among Health Care Workers with Diabetes Mellitus: A Literature Review. *Clinics and Practice*, 11(4), 801–826. https://doi.org/10.3390/clinpract1104009654.

Albawardi, N. M., Jradi, H., Almalki, A. A., & Al-Hazzaa, H. M. (2017). Level of Sedentary Behavior and Its Associated Factors among Saudi Women Working in Office-Based Jobs in Saudi Arabia. *International Journal of Environmental Research and Public Health*, 14(6), 659. https://doi.org/10.3390/ijerph1406065958.

Amandua, J., Masembe, V., Amone, J., Mukasa-Kivunike, P., Makanga, L., Orem, J., Tumwesigye, N. M., Kalungi, S., Ariaka, H., Mungherera, M., Nyankori, F., Munkunya, D., & Katumba, F. S., (2002). The profile and causes of death among medical doctors and dental surgeons in Uganda: 1986-2016. *African Health Sciences*, 22(3), 656-665. https://doi.org/10.4314/ahs,v22i3.70

Amoah, A. G., Owusu, S. K., & Adjei, S. (2002). Diabetes in Ghana: A community-based prevalence study in Greater Accra. *Diabetes Research and Clinical Practice*, 56(3), 197–205. https://doi.org/ 10.1016/s0168-8227(01)00374-6 51.

Asamani, J. A., Ismaila, H., Plange, A., Ekey, V. F., Ahmed, A. M., Chebere, M., Awoonor-Williams, J. K., & Nabyonga-Orem, J. (2021). The cost of health workforce gaps and inequitable distribution in the Ghana Health Service: an analysis towards evidence-based health workforce planning and management. *Human Resources for Health*, 19(1), 43. https://doi.org/10.1186/ s12960-021-00590-3

Boateng, D., Agyemang, C., Beune, E., Meeks, K., Smeeth, L., Schulze, M. B., Addo, J., de-Graft Aikins, A., Galbete, C., Bahendeka, S., Danquah, I., Agyei-Baffour, P., Owusu-Dabo, E., Mockenhaupt, F. P., Spranger, J., Kengne, A. P., Grobbee, D. E., & Klipstein-Grobusch, K. (2018). Cardiovascular disease risk prediction in sub-Saharan African populations - Comparative analysis of risk algorithms in the RODAM study. *International Journal of Cardiology*, 254, 310–315. https://doi.org/10.1016/ j.ijcard.2017.11.082

Bonenberger, M., Aikins, M., Akweongo, P., & Wyss, K. (2014). The effects of health worker motivation and job satisfaction on turnover intention in Ghana: a cross-sectional study. *Human Resources for Health*, 12, 43. https://doi.org/10.1186/1478-4491-12-4323.

Calculator.net (2022). Sample size calculator. *Math*. Retrieved on 28th August 2022 from: https://www.calculator.net/math/sample-size-calculator

Carpenter, L. M., Swerdlow, A. J., & Fear, N. T. (1997). Mortality of doctors in different specialties: findings from a cohort of 20000 NHS hospital consultants. *Occupational and Environmental Medicine*, 54(6), 388–395. https://doi.org/ 10.1136/oem.54.6.388

Carter, H. E., Schofield, D., & Shrestha, R. (2019). Productivity costs of cardiovascular disease mortality across disease types and socioeconomic groups. *Open Heart*, 6(1), e000939. https://doi.org/ 10.1136/openhrt-2018-000939

Chamnan, P., & Aekplakorn, W. (2017). Cardiovascular Risk Assessment in Developing World. *InTech*. https://doi:10.5772/intechopne.69041

Clarke, E. (2003). The brain drain of health workers in Ghana. *International Conference on Occupational Health (Ed.27).* Retrieved on 4th September 2022 from htttps://www.equinetafrica.org/sites/default/files/uploads/documents/CLAHres.pdf

Cochran, W. G. (1977). Sampling Techniques (3rd Ed), *John Wiley & Sons*, New York. Retrieved on 5th August 2022 from htttps://www.academia.edu/29684662/Cochran_1997_Sampling_Techniques_Third_Edition

Dake, F. A., Tawiah, E. O., & Badasu, D. M. (2011). Sociodemographic correlates of obesity among Ghanaian women. *Public Health Nutrition*, 14(7), 1285–1291. https://doi.org/10.1017/ S136898001000287960.

Danquah, I., Bedu-Addo, G., Terpe, K. J., Micah, F., Amoako, Y. A., Awuku, Y. A., Dietz, E., van der Giet, M., Spranger, J., & Mockenhaupt, F. P. (2012). Diabetes mellitus type 2 in urban Ghana: characteristics and associated factors. *BMC Public Health*, 12, 210. https://doi.org/10.1186/1471-2458-12-21050.

Dauchet, L., Amouyel, P., Hercberg, S., & Dallongeville, J. (2006). Fruit and vegetable consumption and risk of coronary heart disease: a meta-analysis of cohort studies. *The Journal of Nutrition*, 136(10), 2588–2593. https://doi.org/10.1093/jn/136.10.258859.

Dawber, T.R., Meadors, G.F., & Moore,O F.E. (1951). Epidemiological approaches to heart disease: the Framingham Study. *American Journal Of Public Health and the Nation's Health*, 41(3):279-281. https://doi.org/10.2105/ajph.41.3.279

de-Graft Aikins, A., Addo, J., Ofei, F., Bosu, W., & Agyemang, C. (2012). Ghana's burden of chronic non-communicable diseases: future directions in research, practice and policy. *Ghana Medical Journal*, 46(2 Suppl), 1–355.

Duodu, C. (2015). Assessment of Overweight and Obesity Prevalence Among Practicing Nurses and Midwives in the Hohoe Municipality of the Volta Region, Ghana. *Science Journal of Public Health*, 3(6):842. https://doi.org/10.11648/j.sjph.20150306.18

Dyrbye, L.N., & Shanafelt, T.D. (2011). Physician burnout: a potential threat to successful health care reform. *JAMA*, 305(19), 2009-2010. https://doi.org/10/1001/jama.2011.652

Evans, D. K., Goldstein, M., & Popova, A. (2015). Health-care worker mortality and the legacy of the Ebola epidemic. *The Lancet; Global Health*, 3(8), e439–e440. https://doi.org/10.1016/ S2214-109X(15)00065-0

Frank, E., Biola, H., & Burnett, C. A. (2000). Mortality rates and causes among U.S. physicians. *American Journal of Preventive Medicine*, 19(3), 155–159. https://doi.org/10.1016/ s0749-3797(00)00201-4

Godwin, M., Streight, S., Dyachuk, E., van den Hooven, E. C., Ploemacher, J., Seguin, R., & Cuthbertson, S. (2008). Testing the Simple Lifestyle Indicator Questionnaire: Initial psychometric study. *Canadian Family Physician*, 54(1), 76–7765.

Gulland, A. (2017). Is being a doctor bad for your health? *BMJ*, 357. https://doi.org/10.1136/bmj.j1803

Hasabullah, M., Kahtani, F., Balkhoyor, T., Al-Harbi, L., & Kinsara, A.J. (2002). A Comparison of Four Cardiovascular Risk Assessment Instruments in Saudi Patients. *Cureus*, 12(2), e7093. https://doi.org/10.7759/cerus.7093. https://www.cureus.com/articles/26280-a-comparison-of-four-cardiovascular-risk-assessment-instruments-in-saudi-patients

Hassan, D., Patel, K. K., Peddemul, A., Sikandar, R., Singh Kahlon, S., Nair, S., T, S., Rathinavelu, S., & Alfonso, M. (2023). Knowledge, Attitude, and Health Practice towards Cardiovascular disease in Health care providers: A systematic review. *Current Problems in Cardiology*, 48(8), 101206. https://doi.org/10.1016/j.cpcardiol.2022.101206

Hassanejad, R., Mansourian, M., Marateb, H., Mohebian, M. R., Gaziano, T. A., Jackson, R. T., Angelantonio, E. D., & arrafzadegan, N. (2021). Developing Non-Laboratory Cardiovascular Risk Assessment Charts and Validating Laboratory and Non-Laboratory-Based Models. *Global heart*, 16(1), 58. https://doi.org/10.5334/gh.890

Hegde, S.K, Venkateshwaran, S.R., & Sasankh, A.K. (2015) Prevalence of Diabetes, Hypertension and Obesity among Doctors and Nurses in a Medical College Hospital in Tamil Nadu, India. *National Journal of Community Medicine*, 4(8):235–9. Retrieved on 25th August 2023 from:https://www.researchgate.net/publication/281449079

Huang, H. L., Pan, C. C., Wang, S. M., Kung, P. T., Chou, W. Y., & Tsai, W. C. (2016). The incidence risk of type 2 diabetes mellitus in female nurses: a nationwide matched cohort study. *BMC Public Health*, 16, 443. https://doi.org/10.1186/ s12889-016-3113-y53.

Kasu, E.S., Ayim, A., & Tampouri J. (2015). Prevalence of obesity among health workers in Kadjebi District of Ghana. *Journal of Biology, Agriculture and Healthcare*, 5(2):155-166.Retrieved on 1st August 2022 from: https://www.iiste.org/Journals/index.php/JBAH/article/view/19556

Katz R. M. (1983). Causes of death among registered nurses. *Journal of occupational medicine: official publication of the Industrial Medical Association*, 25(10), 760–762. https://doi.org/10.1097/00043764-198310000-00017

KBTH. (2022). Child Health – Korle-Bu Teaching Hospital. Retrieved on 15th June 2022 from: https://kbth.gov.gh/departments-centres/department-of-child health/

KBTH. (2022). Department of Surgery – Korle-Bu Teaching Hospital. Retrieved on 15th June 2022 from: https://kbth.gov.gh/departments-centres/department-of-surgery/

KBTH. (2022). Medicine & Therapeutics – Korle-Bu Teaching Hospital. Retrieved on 15th June 2022 from: https://kbth.gov.gh/departments-centres/department-of-medicine/

KBTH. (2022). Obstetrics & Gynaecology Department – Korle-Bu Teaching Hospital. Retrieved on 15th June 2022 from: https://kbth.gov.gh/departments-centres/obstetrics-gynaecology-department-2/

KBTH. (2022). Pharmacy Department – Korle-Bu Teaching Hospital. Retrieved on 15th June 2022 from: https://kbth.gov.gh/departments-centres/pharmacy-department/

KBTH. (2022). About us: Brief History – Korle-Bu Teaching Hospital. Retrieved on 15th June 2022 from: https://kbth.gov.gh/brief-history/

Kodaman, N., Aldrich, M. C., Sobota, R., Asselbergs, F. W., Poku, K. A., Brown, N. J., Moore, J. H., & Williams, S. M. (2016). Cardiovascular Disease Risk Factors in Ghana during the Rural-to-Urban Transition: A Cross-Sectional Study. *PloS one*, 11(10), e0162753. https://doi.org/10.1371/journal.pone.016275336.

Kuan, P. X., Chan, W. K., Chua, P. F., Yeo, J., Sapri, F. E., Bujang, M. A., & Said, A. (2020). Lifestyle factors associated with cardiovascular risk among healthcare workers from the tertiary hospitals in Sarawak. *Malaysian family physician : the official journal of the Academy of Family Physicians of Malaysia*, 15(1), 15–2244.

Leong, L., & Chia, S. E. (2012). Prevalence of cardiovascular risk factors among health care staff in a large healthcare institution in Singapore. *Singapore medical journal*, 53(8), 517-521.

Loscalzo, J. (2016). *Harrison's Cardiovascular Medicine (3rd ed.)*. New York: McGraw-Hill / Medical; ISBN-10 (125983574X)

Mensah, G. A., Roth, G. A., Sampson, U. K., Moran, A. E., Feigin, V. L., Forouzanfar, M. H., Naghavi, M., Murray, C. J., & GBD 2013 Mortality and Causes of Death Collaborators (2015). Mortality from cardiovascular diseases in sub-Saharan Africa, 1990-2013: a systematic analysis of data from the Global Burden of Disease Study 2013. *Cardiovascular journal of Africa*, 26(2 Suppl 1), S6–S10. https://doi.org/10.5830/CVJA-2015-036 34.

Ministry of Health. (2011). GHWO: Human Resources for Health Country Profile Ghana Human Resources for Health Country Profile Human Resources for Health Country Profile Ghana. Retrieved on 15th July 2022 from: https://www.moh.gov.gh/wp-content/uploads/2016/02/Ghana-hrh-country-profile.pdf

Mitchell, J. A., Bornstein, D. B., Sui, X., Hooker, S. P., Church, T. S., Lee, C. D., Lee, D. C., & Blair, S. N. (2010). The impact of combined health factors on cardiovascular disease mortality. *American heart journal*, 160(1), 102–108. https://doi.org/ 10.1016/j.ahj.2010.05.00145.

Mozaffarian, D., Wilson, P.W.F., & Kannel, W.B. (2008). Beyond established and novel risk factors: lifestyle risk factors for cardiovascular disease. *Circulation*, 117(23):3031–8. https://doi.org/10.1161/CIRCULATIONAHA.107.738732

Nilan, K., McKeever, T. M., McNeill, A., Raw, M., & Murray, R. L. (2019). Prevalence of tobacco use in healthcare workers: A systematic review and meta-analysis. *PloS one*, 14(7), e0220168. https://doi.org/10.1371/journal.pone.022016861.

Ofori-Asenso, R., & Garcia, D. (2016). Cardiovascular diseases in Ghana within the context of globalization. *Cardiovascular diagnosis and therapy*, 6(1), 67–77. https://doi.org/10.3978/ j.issn.2223-3652.2015.09.0246.

Ofori-Asenso, R., Agyeman, A. A., Laar, A., & Boateng, D. (2016). Overweight and obesity epidemic in Ghana-a systematic review and meta-analysis. *BMC public health*, 16(1), 1239. https://doi.org/10.1186/s12889-016-3901-457.

Olubiyi, O. A., Rotimi, B. F., Afolayan, M. A., Alatishe-Muhammad, B. W., Olubiyi, O. M., & Balami, A. D. (2022). The ten-year risk of developing cardiovascular disease among public health workers in North-Central Nigeria using Framingham and atherogenic index of plasma risk scores. *BMC public health*, 22(1), 847. https://doi.org/ 10.1186/s12889-022-13044-940.

Osei-Yeboah, J., Kye-Amoah, K. K., Owiredu, W. K. B. A., Lokpo, S. Y., Esson, J., Bella Johnson, B., Amoah, P., & Asumbasiya Aduko, R. (2018). Cardiometabolic Risk Factors among Healthcare Workers: A Cross-Sectional Study at the Sefwi-Wiawso Municipal Hospital, Ghana. *BioMed research international*, 2018, 8904548. https://doi.org/10.1155/2018/8904548

Owusu, A. Y., Kushitor, S. B., Ofosu, A. A., Kushitor, M. K., Ayi, A., & Awoonor-Williams, J. K. (2021). Institutional mortality rate and cause of death at health facilities in Ghana between 2014 and 2018. *PloS one*, 16(9), e0256515. https://doi.org/10.1371/ journal.pone.025651524.

Pandya, A., Weinstein, M. C., & Gaziano, T. A. (2011). A comparative assessment of non-laboratory-based versus commonly used laboratory based cardiovascular disease risk scores in the NHANES III population. *PloS one*, 6(5), e20416. https://doi.org/10.1371/journal.pone.0020416

Peters, R., Ee, N., Peters, J., Beckett, N., Booth, A., Rockwood, K., & Anstey, K. J. (2019). Common risk factors for major noncommunicable disease, a systematic overview of reviews and commentary: the implied potential for targeted risk reduction. *Therapeutic advances in chronic disease*, 10, 2040622319880392. https://doi.org/10.1177/2040622319880392

Ramsay, M., Crowther, N., Tambo, E., Agongo, G., Baloyi, V., Dikotope, S., Gómez-Olivé, X., Jaff, N., Sorgho, H., Wagner, R., Khayeka-Wandabwa, C., Choudhury, A., Hazelhurst, S., Kahn, K., Lombard, Z., Mukomana, F., Soo, C., Soodyall, H., Wade, A., Afolabi, S., … Sankoh, O. (2016). H3Africa AWI-Gen Collaborative Centre: a resource to study the interplay between genomic and environmental risk factors for cardiometabolic diseases in four sub-Saharan African countries. *Global health, epidemiology and genomics*, 1, e20. https://doi.org/10.1017/ gheg.2016.1763.

Sanuade, O. A., Anarfi, J. K., Aikins, A.d, & Koram, K. A. (2014). Patterns of cardiovascular disease mortality in Ghana: a 5-year review of autopsy cases at Korle-Bu Teaching Hospital. *Ethnicity & disease*, 24(1), 55–59.37.

Sasu, D. D. (2022). Health system in Ghana - statistics & facts. *Statista.* Retrieved on 2nd May 2022 from: https://www.statista.com/topics/8915/health-system-in-ghana/

Shoebridge, A. (2021). Getting comfortable in a new job takes time. The key is managing your expectations. Retrieved on 20th September, 2022 from: https://www.linkedin.com/pulse/getting-comfortable-new-job-takes-time-key-managing-your-shoebridge

Tay, D. A., & Ocansey, R. T. A. (2022). Impact of Urbanization on Health and Well-Being in Ghana. Status of Research, Intervention Strategies and Future Directions: A Rapid Review. *Frontiers in public health*, 10, 877920. https://doi.org/10.3389/ fpubh.2022.87792019.

Uunger, T., Borghi, C., Charchar, F., Khan, N.A., Poulter, N.R., Prabhakaran, D., Ramirez, A., Schlaich, M., Stergiou, G.S., Tomaszewski, M., Wainford, R.D., Williams, B., & Scutte, A.E. (2020). 2020 International Society of Hypertension Global Hypertension Practice Guidelines. *AHA*, 75:1334-1357. https://doi.org/10.1161/HYPERTENSIONAHA.120.15026

Ulguim, F. O., Renner, J. D. P., Pohl, H. H., Olivera, C.F., & Braganca, G. C. M. (2019). Health workers: cardiovascular risk and occupational stress. *Rev Bras Med Trab*, 17(1):61-68. https://doi:10.5327/Z1679443520190302

van Dam, R. M., Li, T., Spiegelman, D., Franco, O. H., & Hu, F. B. (2008). Combined impact of lifestyle factors on mortality: prospective cohort study in US women. *BMJ (Clinical research ed.)*, 337, a1440. https://doi.org/10.1136/bmj.a1440 43.

Wallace, J. E., Lemaire, J. B., & Ghali, W. A. (2009). Physician wellness: a missing quality indicator. *Lancet (London, England)*, 374(9702), 1714–1721. https://doi.org/10.1016/ S0140-6736(09)61424-0

Wang, Y., & Wang, J. (2020). Modelling and prediction of global non-communicable diseases. *BMC public health*, 20(1), 822. https:// doi.org/10.1186/s12889-020-08890-4

WHO (2021). Obesity and overweight. Retrieved on 14th July 2022 from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

WHO. (2015). Attaining the nine global noncommunicable diseases targets; a shared responsibility. Global Status Report on Noncommunicable Diseases 2014. Retrieved on 14th July 2022 from: https://apps.who.int/iris/bitstream/handle/10665/148114/9789241564854_eng.pdf

WHO. (2015). Cardiovascular diseases: Avoiding heart attacks and strokes. Retrieved on 14th July 2022 from: https://www.who.int/news-room/questions-and-answers/item/cardiovascular-diseases-avoiding-heart-attacks-and-strokes

WHO. (2016). Global strategy on human resources for health: Workforce 2030. Retrieved on 14th July 2022 from: https://apps.who.int/iris/bitstream/handle/10665/250368/9739241511131-eng.pdf

WHO. (2020). HEARTS technical package for cardiovascular disease management in primary health care: risk-based CVD management. Geneva. Retrieved on 14th July 2022 from: https://apps.who.int/iris/bitstream/handle/10665/333221/9789240001367-eng.pdf

WHO. (2021) Cardiovascular diseases (CVDs). Retrieved on 21st July 2022 from: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)

WHO. (2022). World health statistics. Retrieved on 14th July 2022 from: https://apps.who.int/bookorders.

World Health Organization[WHO]. (2021). Cardiovascular diseases (CVDs). Retrieved on 14th July 2022 from: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)

Wright, A. A., & Katz, I. T. (2018). Beyond Burnout - Redesigning Care to Restore Meaning and Sanity for Physicians. *The New England journal of medicine*, 378(4), 309–311. https://doi.org/ 10.1056/NEJMp1716845

Yuyun, M.F., Sliwa, K., Kengne, A.P., Mocumbi, A.O., & Bukhman, G. (2020). Cardiovascular Diseases in Sub-Saharan Africa Compared to High-Income Countries: An Epidemiological Perspective. *Global heart*,15(1),15. https://doi.org/10.5334/gh.403

APPENDICES

APPENDIX 1 – PARTICIPANT'S INFORMED CONSENT

Introduction and Purpose: My name is DAVID DARKWAH, a post-graduate student from the School of Public Health, University of Ghana. I am carrying out a study in this department to assess the cardiovascular risk among clinical and paraclinical staff in Korle-Bu teaching hospital. I would be very grateful if you would agree to participate in it.

Requirement: Your participation would involve a 15-minute interview with you to answer some questions about yourself that are relevant to the study. Following the questionnaire measurements of your current weight, height, waist circumference, and blood pressure will be taken.

Benefits: You may not have any immediate or direct benefits from my interview, but your responses will provide helpful information to make relevant authorities aware of the cardiovascular risk among health workers. It will also provide evidence for making recommendations to relevant authorities on ways to strengthen and improve the health system workforce.

Risks: As part of this assessment, measurement of your blood pressure, weight, height, and waist circumference will be taken. These tests are however not invasive, will come at no financial cost to you, and will be and will be done by qualified personnel.

Voluntary withdrawal: If you indeed decide to take part, you are allowed to withdraw whenever you wish to. You are also allowed to skip answering any of the questions or refuse any clinical assessment that you are not very comfortable with.

Confidentiality: The information you would provide is going to be treated with strict confidentiality. Apart from my research team and members of the Ethics Committee of this hospital, nobody shall have access to the information since it shall be under lock and key. We also assure you that your name shall not appear or be mentioned in any report that will come out from this study.

Ethical approval: As part of our duty to conform to standard practice and to ensure your safety, ethical approval has been sought from the Institutional Review Board of Korle-Bu Teaching Hospital (KBTH-IRB) to carry out this study.

Before taking Consent

Do you have any questions you wish to ask about the study? Yes |____| No |____|

If yes, please, indicate the questions below)

……………………………………………………………………………………..

…………………………………………………………………………………………………

In case you have any questions later please, do not hesitate to contact **DAVID DARKWAH,** Department of Epidemiology, School of Public Health, University of Ghana. (Tel: 0553194759) Email: mobikey12@gmail.com

PARTICIPANT'S CONSENT

I have read, or I have let somebody read or translated all the necessary information that I need to know concerning this study and have fully understood it. I have decided on my own accord without any coercion to allow my ward to take part in this study. However, by deciding to participate in this study, I am not waiving any of my rights by signing or thumb printing this consent form.

Signature: OR

.... L/R Thumb Print…………..

Interviewers Statement

I, the undersigned, have explained this consent to the **participant** in the English language/Ga/Twi, and that she/he understands the purpose of the study, procedures to be followed, as well as the risks and benefits of the study.

The participant has fully agreed to participate in the study.

Signature of Interviewer………………………………………………………………....

Date……………………………………………………………………………………

Address…………………………………………………………………………….

APPENDIX 2 - QUESTIONNAIRE

Date of Interview: ☐☐/☐☐/☐☐☐☐

D D / M M / Y Y Y Y

Interviewer: ____

☐☐ ☐☐

Time Interview Started

Introduction

My name is David Darkwah, a student from the School of Public Health, University of Ghana. This questionnaire aims to assess the factors affecting cardiovascular risk among clinical and paraclinical staff in Korle Bu teaching hospital. You will be asked a few questions and anthropometric measurements will be taken after completion of the questionnaire. Be rest assured that any information collected will be kept confidential. General findings will be made available to relevant authorities to make important decisions that will bring about positive change in our health system. The entire interview will last about 15-20 minutes.

SECTION A – DEMOGRAPHIC CHARACTERISTICS

(FW instruction: Circle the relevant option and write in the box on the right)

Q1. **Respondent code:** [ ][ ][ ]		
Q2. **Sex:** Male (1) Female (2)	[ ]	*q2sex*
Q3. **Age (completed years):** [_________]		
Q4. **Religion** Christian (1) Muslim (2) African Traditional Religion (3) Other (specify) ___________________ (8)		*q4relgn*
Q5. Marital status Single (1) Married (2) Widow/Widower (3) Separated (4) Divorced (5) Co-habiting (6) Other (8)		*q5ms*
Q6. Place of residence Rural (1) Urban (2)		*Q6por*

Other (8)		
Q7 Which of these Departments are you primarily affiliated to? (Choose one) Internal Medicine (1) Surgery (2) Child Health (3) Obstetrics and Gynecology (4)		*Q7dep*
Q8. Occupation Medical Doctor (1) Nurse (2) Pharmacist (3) Allied Health Worker (5) Other (please specify ………………………… (8)		*Q8ocpn*

SECTION B – SIMPLE LIFESTYLE INDICATOR QUESTIONNAIRE

Lifestyle Indicator	Answer options						Code
Diet: To answer these questions, think about your eating habits in the past year. Indicate how often you eat the following foods (**times per week**). Please include all meals, snacks, and eating out							
Q9. Lettuce or green leafy salad, with or without other vegetables	< 1/wk	1/wk	2-3x /wk	4-6x /wk	1/day	≥ 2/day	**q9gren**
Q10. Fruit: include fresh, canned, or frozen, but do not include juices	< 1/wk	1/wk	2-3x /wk	4-6x /wk	1/day	≥ 2/day	**q10frut**
Q11. High fiber cereals or whole grain bread: this includes cereal such as Raisin bran, Fruit and Fiber, cooked oatmeal, bread which are whole wheat, multi,grain, rye or pumpernickel	< 1/wk	1/wk	2-3x /wk	4-6x /wk	1/day	≥ 2/day	**q11fibr**
Exercise: To answer the following questions please indicate how many times per week you take part in the following activities for at least 30 minutes or more at a time:							

Q12. Light exercise: light gardening and light housework (dusting, sweeping, vacuuming), leisurely walking (walking your dog), bowling, fishing, carpentry, playing a musical instrument, volunteer work	0/ wk	1-3x /wk	4-7x /wk	≥ 2/day	**q12ltex**
Q13. Moderate exercise: a brisk walk, bicycling, skating, swimming, curling, gardening (raking, weeding, spading), dancing, Tai Chi or moderate exercise classes	0/ wk	1-3x /wk	4-7x /wk	≥ 2/day	**q13mtex**
Q14. Vigorous exercise: running, bicycling, x-country skiing, lap swimming, aerobics, heavy yard work, weight training, soccer, basketball, or other league sports	0/ wk	1-3x /wk	4-7x /wk	≥ 2/day	**q14vgex**

Alcohol: Please indicate how many drinks of the following types of alcohol you consume in an average week:			
Q15. Wine:	_____ drinks (3-5 oz.)		**q15wine**
Q16. Beer:	_____ drinks (10-12 oz or 1 bottle)		**q16beer**
Q17. Spirits:	____ drinks (1-1 1⁄2 oz.)		**q17sprt**
Smoking: Please indicate your smoking habits below			
Q18. Are you a smoker?	**Yes**	**No**	**q18smkr**

Q19. If yes, how long have you been smoking?	___________ years						**q19hlsk**
Q20. If not, did you ever smoke?	**Yes**	**No**					**q20evsk**
Q21. If yes, how many years ago did you quit?	____________ years						**q21qtsk**
Life Stress: To answer this question please circle the number which you feel best corresponds to the level of stress in your everyday life (1 = not at all stressful, 6 = very stressful)							
Q22. What is your level of stress	**1**	**2**	**3**	**4**	**5**	**6**	**q22los**

SECTION C – WHO NON-LABORATORY CARDIOVASCULAR RISK ASSESSMENT (TO BE FILLED BY INTERVIEWER)

In this section, your blood pressure, height, weight, waist circumference, and BMI will be recorded. You do not have to know the values unless you wish to.

Variable	**Measure**			**CODE**
Q23. Mean systolic blood pressure				q28msbp
Q24. Height (in meters)				q29hgt
Q25. Weight (in kilograms)				q30wgt
Q26. BMI (Kg/m2)				q31bmi
Q32. Waist circumference (in centimeters)				q32wstc
Q33. Have you ever been diagnosed with Diabetes mellitus?	Yes	No	Never tested	Q33dgdm
Q33. Have you ever been diagnosed with Dyslipidemia?	Yes	No	Never tested	Q34dgdl

THANK PARTICIPANT AND END INTERVIEW

Time Interview Ended ☐☐:☐☐ **am/pm**

APPENDIX 3 - CURRICULUM VITAE

DARKWAH, DAVID

C/O MR PHILIP DARKWAH,

P. O. BOX 1513, TEMA·

PHONE +233 553194759/ +233 275720929

mobikey12@gmail.com / ddarkwah009@st.ug.edu.gh

PERSONAL DATA.

Date of birth………………… 22nd Jan 1992

Nationality …………………..Ghanaian

Marital Status ………………...Single

Gender ………………………..Male

EDUCATIONAL BACKGROUND.

University of Ghana School of Public Health - 2021 till date (Master of Public Health)

University of Ghana Medical School - Aug 2014 to Sept 2017 (Bachelor of Medicine and Surgery)

University of Ghana Medical School - Sept 2011 to May 2014 (BSc. Medical Sciences)

Presbyterian Boys Senior High School - Sept 2007 to May 2011 (West African Senior School Certificate Examination)

St. Andrews Junior High School, Accra - Sept 2005 to May 2007 (Basic Education Certificate Examination)

WORK EXPERIENCE.

KORLE BU TEACHING HOSPITAL; Greater Accra Region, Ghana

Resident in Training: Department of Internal Medicine (Sept 2022 till date)

HO TEACHING HOSPITAL; Volta Region, Ghana

Medical Officer: Department of Psychiatry (Sept 2020- August 2021)

LEGON HOSPITAL; Greater Accra Region, Ghana June 2019 to June 2020

Medical Doctor (Senior House Officer)

KORLE BU TEACHING HOSPITAL; Accra, Ghana May 2018 to May 2019

Medical Doctor (House Officer)

Other experience - Participant at Management in Health (Online course) – University of Washington (ACE site group) – 2020

Personal Statement

I am a young and highly motivated medical doctor currently working at the Internal Medicine Unit of the Korle Bu teaching hospital since September 2021. During my time in this unit and my first-year housemanship at the medical block, I have observed many health workers work in the most stressful situations. I randomly ask health workers about their health only to be told they don't routinely check their blood pressure or lipid profile. Neither do they eat healthily nor find time to exercise or even have a good night's rest. I have since then developed an interest in the area of ensuring that the health worker himself is healthy in body, mind, and soul, to do his work effectively. I intend to contribute significantly to the body of knowledge in this area.

APPENDIX 4 – STC APPROVAL AND ETHICAL CLEARANCE

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

My Ref. No. KBTH/MD/G3/22
Your Ref. No.......................

KORLE BU TEACHING HOSPITAL
P. O. BOX KB 77,
KORLE BU, ACCRA.

Tel: +233 302 667759/673034-6
Fax: +233 302 667759
Email: info@kbth.gov.gh
pr@kbth.gov.gh
Website: www.kbth.gov.gh

18th November, 2022

DAVID DARKWAH
SCHOOL OF PUBLIC HEALTH
COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF GHANA

INSTITUTIONAL APPROVAL: KORLE BU TEACHING HOSPITAL-SCIENTIFIC AND TECHNICAL COMMITTEE/INSTITUTIONAL REVIEW BOARD (KBTH-STC/IRB/000157/2022

Following approval of your study entitled "Determinants of Cardiovascular Disease Risk among Clinical Health Workers in a Tertiary Health Facility, Accra-Ghana" by the Korle Bu Teaching Hospital-Scientific and Technical Committee/Institutional Review Board.

I am pleased to inform you that institutional approval has been granted for the conduct of your study in Korle Bu Teaching Hospital.

Please contact the Head of Department to discuss the commencement date of the study.

Please note that, this institutional approval is rendered invalid if the terms of the Institutional Reviewed Board/Scientific and Technical Committee approval are violated.

Sincere regards,

Dr. Ali Samba
Director of Medical Affairs
For: Chief Executive