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ASSESSING SERVICE AVAILABILITY AND READINESS FOR CARDIOVASCULAR DISEASE CARE IN SELECTED HEALTH FACILITIES IN THE UPPER EAST REGION

BY

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DECLARATION

I, Aboyah Matthew Ayinnongmah, affirm that this thesis is my original work conducted under the supervision of Dr. Leonard Baatiema, except where due reference has been made to existing works. I further declare that no portion of this research has been submitted previously, either within this University or elsewhere, for the purpose of obtaining another degree.

Date: 14/03/2025

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DEDICATION

This project is dedicated to my family for their unwavering support.

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I am deeply grateful to the Almighty God for His unwavering mercy, guidance, and countless blessings throughout this academic journey.

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LIST OF ABBREVIATIONS

ACD	Atherosclerotic Cardiovascular Disease
ACE	Angiotensin Converting Enzymes
AHA	American Heart Association
AIDS	Acquired Immune Deficiency Syndrome
ARBs	Angiotensin Receptor Blockers
CCB	Calcium Channel Blockers
CHE	Catastrophic Health Expenditure
CHPS	Community-based Health Planning and Services
CT	Computer Tomography
CVC	Cardiovascular Care
CVD	Cardiovascular Disease
CVDs	Cardiovascular Diseases
DALY	Disability Adjusted Life Years
ECG	Electrocardiogram
EHRs	Electronic Health Records
GBD	Global Burden of Disease
GHS	ERC Ghana Health Service Ethical Review Committee
Hb	Hemoglobin
HDL	High Density Lipoprotein
HIV	Human Immune Virus
HL	Healthy Lifestyle
IHD	Ischemic Heart Disease
LDL	Low Density Lipoprotein
LMICs	Low-Middle Income Countries
NCDs	Non-Communicable Diseases
PEN	Package of Essentials for Non-communicable diseases
POCT	Point of Care Testing
SARA	Service Availability and Readiness Assessment

SDI	Service Delivery Indicators
SPA	Service Provision Assessment
SSA	Sub-Saharan Africa
USA	United State of America
USAID	United States Agency for International Development
WHF	World Heart Federation
WHO	World Health Organization
YLD	Years Lived with Disability

DEFINITION OF TERMS

Service availability: The degree to which various healthcare facilities offer the necessary cardiovascular disease (CVD) services.

Service readiness: The capacity of healthcare facilities and personnel to deliver quality CVD care.

Cardiovascular Diseases: Are a group of disorders of the heart and blood vessels and include coronary heart disease, stroke, peripheral arterial disease, rheumatic heart disease, and congenital heart defects.

Cardiovascular Disease care: Comprises a range of medical services and interventions aimed at preventing, diagnosing, treating, and managing disorders that affect the heart and blood vessels.

ABSTRACT

Background: In 2019, an estimated 17.9 million people lost their lives to cardiovascular diseases (CVDs), accounting for 32% of global deaths. In Ghana, CVD-related fatalities remain a leading cause of mortality, particularly among individuals over 45 years. However, research indicates that the preparedness of health facilities to provide CVD services is generally inadequate in rural areas, including the Bolgatanga East, Talensi, and Nabdam Districts.

Objective: The objective of the study is to evaluate the service availability, readiness, and utilization of CVD services in selected health facilities in Bolgatanga East, Talensi and Nabdam Districts.

Methods: The study adopted a cross-sectional study design using quantitative methods to gather data from all the district hospitals and health centers in the three districts. A structured questionnaire, review of facility records and in-person observations were all employed to collect the relevant data. Collected data was analyzed using STATA I/C 18 (Stata Corp LLC, Texas, USA). Descriptive statistics was presented in tables and graphs. Relevant data was analyzed using the WHO-SARA manual to assess the readiness of health facilities to provide CVD services. Human resources, diagnostic capacity, basic equipment, essential medicines and commodities, infrastructure and guidelines were assessed based on the availability of each tracer item in the respective domains. The mean score for each domain was calculated based on the availability of tracer items within each domain. The overall readiness index was calculated by summing the scores for all domains and dividing by the total number of domains. The readiness score ranges from 0 to 100, with higher scores indicating a greater level of preparedness for providing CVD healthcare services.

The readiness score was compared to a predetermined cut-off of 70, and the facilities with a score above the cut-off deemed "ready".

Results: The health facilities provide services like health promotion, disease prevention, diagnosis and treatment for CVD related diseases including hypertension, CHD, stroke, heart failure, dyslipidemia and diabetes mellitus. Basic treatments are undertaken by most of the health facilities; however, only 13% of the facilities provide long term care for some diseases with no facility providing long term care for stroke and dyslipidemia. The readiness score of health facilities to deliver CVD health care ranged from 30.8 to 70.7. The Talensi district hospital scored the highest of 70.7 whilst Biung health center scored the lowest of 30.8%. Apart from the hospital, the rest of the facilities had a score below the cut-off score of 70 implying sub- optimal readiness to provide CVD care services. The most obvious reasons resulting in the low readiness score were inadequate diagnostic capacity and a lack of essential medicines.

Cardiovascular disease service utilization remained low across all districts, indicating potential gaps in detection and management.

Conclusion: The study reveals the low level of readiness of the health facilities to provide CVD services. The WHO-SARA index for service readiness is met by the only the Talensi District Hospital, but all other facilities are below it, showing deficiencies in staffing levels, diagnostic capabilities, and medication supply. With scores as low as 20%, many health centers including the Biung, Datuko, and Duusi health centers are ill-prepared to handle cardiovascular problems. A mismatch between disease burden and healthcare availability may result in under diagnosis and poor management, as indicated by the underutilization of CVD services. Reducing the disease burden and enhancing Ghana's overall healthcare delivery need strengthening health centres that provide vital cardiovascular care services.

CHAPTER ONE

INTRODUCTION

1.0 Background to the Study

According to the World Health Organization (WHO, 2020), an estimated 17.9 million people lost their lives to cardiovascular diseases (CVDs) in 2019, accounting for 32% of all global deaths. More recent data from the World Heart Federation (WHF, 2023) indicate that CVD-related deaths have surged by 60% globally over the last 30 years, with four out of five fatalities occurring in low- and middle-income countries (LMICs). Similarly, the American Heart Association (AHA) reported that in 2020, around 19.1 million deaths were attributed to CVD worldwide, with an age-adjusted mortality rate of 239.8 per 100,000 people (Tsao et al., 2022).

Over the past 25 years, socio-demographic shifts have contributed to significant reductions in CVD mortality in regions with high Service Delivery Indicators (SDI). However, many areas have experienced little to no improvement (Roth et al., 2017). The rising prevalence of CVD is largely driven by an aging population, an increasing burden of cardiovascular risk factors, and better survival rates following cardiovascular events (Bansilal et al., 2015). The economic implications of CVD are substantial, as the condition significantly contributes to the escalating costs of healthcare and places a considerable socioeconomic burden on the public (Flora & Nayak, 2019).

Despite being a major cause of mortality, CVD is largely preventable through the adoption of healthy lifestyle behaviors such as regular physical activity, balanced nutrition, adequate sleep, and smoking cessation. These habits influence both traditional risk factors and less commonly measured indicators like Cardiorespiratory Fitness (CRF) (Kaminsky et al., 2022).

CVD has emerged as a leading chronic disease burden in Sub-Saharan Africa (Koller & Agyemang, 2020). In Ghana, CVD ranks among the top two causes of death, second only to diarrheal diseases, according to the World Health Organization (2023). WHO estimates suggest that the probability of dying from CVD, cancer, diabetes, or chronic respiratory disease between ages 30 and 70 in Ghana is 20%. A study conducted in the Kasena Nankana District of the Upper East Region of Ghana found that CVD-related mortality is high and increasing, particularly among lower-income and middle-aged individuals (Oduro et al., 2022). Furthermore, the age-adjusted death rate for coronary heart disease in Ghana stands at 119.93 per 100,000 people, placing the country 79th globally (WHO, 2020). These statistics underscore the urgent need for effective interventions to curb the growing burden of CVD in Ghana. To address this challenge, the Ghana Heart Initiative, a national program aimed at enhancing CVD care and reducing mortality, conducted a cross-sectional study across 44 health facilities in the Greater Accra Region. The findings revealed major gaps in CVD management and emphasized the need for standardized national treatment guidelines, regular training and retraining of healthcare personnel, and overall improvements in healthcare system capacity and preparedness (Doku et al., 2023a).

A similar study conducted by Biswas et al. (2018) assessed the readiness of health facilities for diabetes and CVD services in Bangladesh using the WHO Service Availability and Readiness Assessment (SARA) tool. The results indicated that the overall readiness index for CVD services was 45.1%, with notable variations across different regions of Bangladesh. The study further identified insufficient trained staff and inadequate medication supply as key challenges to effective service delivery (Biswas et al., 2018).

These findings collectively reinforce the need for comprehensive strategies to improve CVD management in Ghana. Conducting assessments of service availability and health facility

readiness is essential for identifying gaps, optimizing resource allocation, and strengthening healthcare delivery for CVD patients.

1.1 Problem Statement

Over the past ten years, Ghana's burden of CVD mortality has been on the rise with CVDs becoming the leading cause of death in the country, accounting for over 20% of deaths in recent years (World Heart Federation, 2023). The federation also stated that the age-standardized CVD mortality rate remained high at 311 per 100,000 in 2019. CVD-related deaths are a leading cause of mortality, especially among individuals aged over 45 years in the country (Ofori-Asenso & Garcia, 2016). In 2010, CVDs were one of the top three causes of death in Ghana after diarrheal diseases and HIV/AIDS, highlighting the substantial impact of CVDs on mortality in the country (Sanuade et al., 2014). A study on autopsy cases at Korle Bu Teaching Hospital from 2006 to 2010 revealed that CVDs constituted about one-fifth (22.2%) of all causes of deaths during that period, emphasizing the significant burden of CVD-related mortality in Ghana (Sanuade et al., 2014). A study conducted in the Kasena Nankana District of the Upper East Region of Ghana found that CVD-related mortality is high and increasing, particularly among lower-income and middle-aged individuals (Oduro et al., 2022).

Despite the lack of a nationally representative population-based data on CVD deaths in Ghana, hospital-based studies have provided insights into the prevalence and impact of CVD-related mortality in the country (Sanuade et al., 2014). CVDs have grown to be extremely important in the field of national public health, hence the need for public health facilities to be prepared and ready to provide the needed services to support their management.

In Ghana, only 35.8% of Community-based Health Planning and Services (CHPS) compounds which are the first point of care in most communities had essential medicines

available, compared to 52.6% of health centres/clinics and 87.5% of hospitals (Ayanore et al., 2022). This disparity in service readiness across facility levels is concerning, as it suggests that many communities may not have access to essential CVD medicines and diagnostic services.

The service availability and readiness for cardiovascular disease (CVD) care in the Bolgatanga East District of Ghana is a significant public health concern that requires immediate attention. There is suboptimal performance of primary health care facilities in Ghana, particularly in the areas of essential medicines and diagnostic capacity (Hinneh et al., 2023) (Ayanore et al., 2022).

Furthermore, the Bolgatanga East, Talensi and Nabdam Districts are in the Upper East Region, which has been identified as having lower general service readiness compared to other regions in Ghana (Ayanore et al., 2022). This regional variation in service readiness highlights the need for targeted interventions to address the specific challenges faced by these districts.

There is a lack of locally generated data to inform planning and resource allocation for CVD care in Bolgatanga East District. Without context-specific evidence, health managers and policymakers are unable to make informed decisions on staff training, equipment distribution, financing, and integration of CVD care into primary health services.

To improve CVD outcomes and progress towards universal health coverage (UHC) in Ghana, it is crucial to assess the current state of service availability and readiness for CVD care (Ministry of Health, 2021) (Ayanore et al., 2022). This assessment would focus on identifying gaps in essential medicines, diagnostic capacity, and other key components of service readiness, as well as the factors contributing to these gaps in the districts.

The findings of this assessment can then inform policy and programmatic interventions to strengthen the health system and ensure equitable access to quality CVD care for all residents of the districts, ultimately reducing the burden of CVD.

1.2 Research questions

What is the readiness of selected health facilities in the Upper East Region to provide CVD services using the service availability and readiness assessment (SARA) framework?

1.2.1 Specific Research Questions

1. What is the nature and type of CVD services available at the selected health facilities in the Upper East Region?
2. What is the level of readiness of health facilities to offer CVD services?
3. What is the level of CVD service utilization in the selected health facilities in the Upper East Region?

1.3 Objectives

1.3.1 General objective

To evaluate the service availability, readiness, and utilization of CVD services in selected health facilities in the Upper East Region.

1.3.2 Specific Objectives

1. To determine the nature and type of CVD services available at the selected health facilities in the Upper East Region.
2. To assess the level of readiness of health facilities to offer CVD services.
3. To evaluate the level of CVD service utilization at the selected health facilities in the Upper East Region.

1.4 Justification of the Study

Cardiovascular diseases are the leading global cause of mortality, with their burden rising rapidly in Low- and Middle-Income Countries (LMICs), including Ghana (Cockburn et al., 2023). Many health facilities in LMICs, particularly in Ghana, struggle to provide adequate cardiovascular care (CVC) services due to limited resources, insufficient healthcare infrastructure, and inadequate training of medical professionals. Various studies have examined the availability and readiness of health facilities to deliver CVC services using the World Health Organization's (WHO) Service Availability and Readiness Assessment (SARA) framework.

For instance, a study in Nepal assessed the readiness of healthcare facilities for CVD services and found that the overall median readiness index was below 40 across different facility categories, highlighting the need for significant improvements (Biswas et al., 2018). Research findings consistently indicate that CVD service availability tends to be lower in primary healthcare centers and rural settings, while overall facility readiness for CVD services remains inadequate, necessitating urgent improvements.

Given these challenges, there is a critical need to evaluate the availability and preparedness of health facilities in Bolgatanga East, Talensi, and Nabdam Districts in delivering CVD care, as well as to assess the utilization of available services. This assessment will help identify existing gaps in CVD management and inform practical strategies aimed at enhancing the capacity of the healthcare system to deliver effective CVD care. Implementing evidence-based interventions and scaling up successful programs can strengthen health system readiness and service availability for CVD care. Additionally, identifying gaps in service delivery at various health facilities will provide valuable insights to guide policy formulation and intervention strategies, ultimately contributing to reducing the burden of CVDs in the region.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

This literature review explores existing research on health service availability and readiness for CVD care, particularly in resource-limited settings. It examines the structure and functionality of primary health care facilities, the availability of essential medicines and commodities, basic equipment and trained personnel. The review also discusses relevant policies, global best practices, and existing gaps in healthcare service provision. It aims to provide the basis for assessing the capacity of health facilities in the Upper East Region to provide quality services for CVDs.

2.1 Cardiovascular Diseases.

CVDs are a group of disorders of the heart and blood vessels and include coronary heart disease, cerebrovascular disease, rheumatic heart disease, and other conditions (World Health Organization, 2023). The prevalence of CVDs varies across different geographical regions, with factors such as rural residence and regional disparities influencing the prevalence of CVD (Heart Association, 2022). The determinants of CVDs include underlying social, economic, and cultural changes such as globalization, urbanization, and population ageing, as well as poverty, stress, and hereditary factors (World Health Organization, 2020). The most important behavioral risk factors of heart disease and stroke are unhealthy diet, physical inactivity, tobacco use, and harmful use of alcohol (World Health Organization, 2023). Additional risk factors include physiological conditions such as high blood pressure, high cholesterol levels, and increased blood sugar or glucose. Ensuring the availability of essential medicines for non-communicable diseases and basic health technologies in all primary healthcare facilities is crucial for providing necessary treatment and counseling to those in need (World Health Organization, 2023).

2.2 The Global Burden of Cardiovascular Diseases

Cardiovascular diseases (CVDs) remain the leading cause of death globally, responsible for approximately 17.9 million fatalities each year (World Health Organization, 2020). More than 80% of these deaths result from heart attacks and strokes, with nearly one-third occurring prematurely in individuals below 70 years (World Health Organization, 2020). CVDs, including ischemic heart disease, stroke, heart failure, peripheral artery disease, arrhythmias, and valvular disorders, continue to be a primary driver of global mortality and a substantial contributor to the burden of disease (Mensah et al., 2023).

Recent estimates indicate that in 2022 alone, cardiovascular diseases were responsible for approximately 19.8 million deaths worldwide, equating to 396 million years of life lost and 44.9 million years lived with disability (YLD) (Mensah et al., 2023). Notably, since nearly 34% of these deaths occur in individuals under 70, many cases could be effectively treated or prevented through existing safe and evidence-based interventions (Mensah et al., 2023).

According to Vaduganathan et al. (2022), CVDs remain the foremost cause of death globally, significantly impacting public health and imposing substantial economic burdens on healthcare systems. The Global Burden of Diseases, Injuries, and Risk Factors (GBD) Study, which has monitored mortality and disability trends since 1990, provides critical insights into the evolving patterns of cardiovascular health at global, regional, and national levels (Vaduganathan et al., 2022).

2.3 Burden of Cardiovascular Diseases in Sub-Saharan Africa

Cardiovascular disease (CVD) has become a growing public health challenge in Sub-Saharan Africa (SSA), with research indicating a significant increase in its prevalence and associated risk factors over time (Alhuneafat et al., 2023; Yuyun et al., 2020).

Between 1990 and 2019, the prevalence of CVD in SSA surged by 131.7%, while the age-standardized prevalence rate increased slightly by 2.1% (Alhuneafat et al., 2023). The most commonly reported conditions include ischemic heart disease, stroke (CVA), and rheumatic heart disease. Additionally, CVD-related deaths rose from 564,140 to 1,003,893, although there was a 14.4% reduction in overall death rates (Alhuneafat et al., 2023). Notably, cases of non-rheumatic valvular disease demonstrated a significant rise.

Sub-Saharan Africa continues to grapple with a dual burden of infectious diseases and non-communicable diseases (NCDs), with lifestyle-related factors such as poor dietary habits and physical inactivity contributing to the escalating prevalence of CVD (Obonyo & Etyang, 2023). Addressing these health challenges requires a multi-sectoral approach, policy interventions, and strengthened healthcare systems to effectively reduce the impact of CVD in the region (Obonyo & Etyang, 2023).

2.4 Frameworks for Assessing Service Availability and Readiness

This section looks at some of the frameworks and models that have been used to assess healthcare service availability and readiness for cardiovascular disease (CVD) care. Some of the key frameworks and models include:

2.4.1 Service Availability and Readiness Assessment (SARA)

The Service Availability and Readiness Assessment (SARA), developed by the World Health Organization (WHO) in collaboration with the United States Agency for International Development (USAID), serves as a comprehensive tool for assessing health system preparedness across various domains, including infrastructure, human resources, medical equipment, essential medicines, and health information systems (Cockburn et al., 2023; Thapa et al., 2023a). The SARA framework has been utilized in multiple countries, such as Nepal and Bangladesh, to evaluate the preparedness of health facilities in delivering CVD

care (Cockburn et al., 2023; Thapa et al., 2023). The SARA framework evaluates service availability, which includes the physical presence of healthcare services, such as infrastructure, essential health personnel, and service utilization (Cockburn et al., 2023). Additionally, it examines service-specific readiness, reflecting the capacity of health facilities to deliver and effectively manage specific healthcare services (World Health Organization, 2015b; Cockburn et al., 2023).

2.4.2 Service Provision Assessment (SPA)

SPA is another tool developed by the USAID Demographic and Health Surveys Program, which is based on the SARA framework with additional questions (Cockburn et al., 2023). The Service Provision Assessment (SPA) tool has been used to assess the readiness of health facilities for CVD care in low- and middle-income countries, providing insights into the availability and quality of services (Cockburn et al., 2023) (Thapa et al., 2023b). For instance, a study analyzing SPA data from 30 countries assessed the quality of maternal and newborn health services, aligning the SPA's metrics with the World Health Organization's Quality of Care Framework. This research highlighted the SPA's effectiveness in identifying areas for improvement in maternal and newborn healthcare delivery (Wang et al., 2019).

In Ethiopia, SPA data was employed to assess healthcare facilities' readiness to provide antenatal care. The study evaluated the availability of essential equipment, supplies, and trained personnel, identifying gaps in service provision and offering recommendations to enhance antenatal care quality (Berhanu et al., 2024).

Furthermore, the SPA tool has been instrumental in evaluating the readiness of health facilities to deliver maternal and child nutrition services. An analysis of SPA surveys across 10 countries examined indicators related to nutrition intervention readiness and delivery within antenatal and sick child care services. The findings underscored the need for improved

provider training and counseling on nutrition-related topics to bolster service quality (DHS Program, 2017).

2.4.3 Package of Essentials for Non-Communicable Diseases (PEN)

In addition to the SARA framework, the Package of Essentials for Non-Communicable Diseases (PEN) developed by the WHO has been used to assess the readiness of health facilities to provide care for CVD and other non-communicable diseases.(Arsyad et al., 2022). The PEN has been used in countries like Indonesia to assess the readiness of public primary health care facilities for CVD care (Arsyad et al., 2022). These frameworks consider factors such as infrastructure, human resources, technology, and financial resources to evaluate the capacity of health systems to manage CVDs and other non-communicable diseases effectively (Thapa et al., 2023).

These frameworks and models have been instrumental in understanding the readiness of health facilities to provide CVD care and identifying areas for improvement. They provide a standardized approach to evaluating health system readiness and help inform the development of strategies and interventions to enhance the quality of CVD care in various health facilities.

2.5 Infrastructure and Facilities for CVD:

Baatiema et al. (2021) reported that only a limited number of healthcare facilities in Ghana offer comprehensive stroke and hypertension care. Furthermore, access to rehabilitation services remains inadequate, with poor integration of post-acute stroke care into the healthcare system. Similarly, Nyarko et al. (2018) identified the lack of trained healthcare professionals and inadequate medical equipment as critical barriers to effective CVD service delivery. Doku et al. (2023) conducted a study that identified significant gaps in cardiovascular disease (CVD) care in Ghana, underscoring the urgent need to bridge these

deficiencies to enhance the health system's capacity for effective CVD management. The study revealed a critical shortage of essential medical equipment and supplies across all levels of care in the 44 health facilities implementing CVD interventions in the Greater Accra region. Baatiema et al., (2017) state that Ghanaian hospitals face difficulties such as poor infrastructure, a lack of specialists, and restricted access to necessary drugs and rehabilitative programs for acute stroke care. The study indicated that there are obstacles to receiving evidence-based care, and those in low- and middle-income nations are very different from those in high-income nations.

The Community-based Health Planning and Services (CHPS) program in Ghana, which offers primary healthcare, was identified to be unable to detect or address CVD and its risk factors (Haykin et al., 2020). Enhancing the capacity and resources of primary healthcare centers, optimizing data collection for cardiovascular disease (CVD), and equipping lower-tier health facilities with the necessary tools and support are crucial steps toward improving CVD outcomes in Ghana (Doku et al., 2023; Musinguzi et al., 2019; Haykin et al., 2020).

The availability of specialized units, equipment, and facilities for cardiovascular disease (CVD) diagnosis and treatment in Ghana faces significant challenges (Doku et al., 2023).

There is a lack of appropriate equipment for diagnosis, monitoring, and treatment, as well as suboptimal health worker knowledge in CVD management (Doku et al., 2023).

De-Graft Aikins et al., (2014) exposed how ill-equipped public basic healthcare institutions are to treat patients with cardiovascular disease (CVD). These include medical staff members lacking knowledge and skills required to diagnose and manage NCDs. The study also emphasized the scarcity and high cost of CVD medications and supplies. Additionally, a qualitative study in rural Ghana by Patil et al., (2023) revealed sparse awareness, prevention,

and treatment of CVD, particularly in rural regions, indicating significant deficits in the infrastructure for CVD control.

These findings highlight the critical need to address gaps in specialized units, medical equipment, and healthcare infrastructure for CVD diagnosis and treatment in Ghana to enhance the health system's capacity for effective CVD management (De-Graft Aikins et al., 2014; Doku et al., 2023; Musinguzi et al., 2019; Patil et al., 2023).

2.6 Human Resource

Several studies have examined the availability and quality of healthcare professionals, including cardiologists, nurses, and support staff, in Ghana. The Ghana Heart Initiative identified deficiencies in healthcare workers' knowledge of cardiovascular disease (CVD) risk factors and significant gaps in CVD management within the health system, which require urgent attention to improve patient outcomes (Doku et al., 2023). Additionally, healthcare facilities across different levels lacked the necessary medical equipment and supplies to effectively manage CVD emergencies in a timely manner (Doku et al., 2023).

A review conducted by Christmals et al. (2018) highlighted a shortage of healthcare personnel and limited capacity for CVD care in Ghana, with healthcare workers expressing concerns about workforce shortages, inadequate support, and a lack of resources to provide quality care. Similarly, Wood et al. (2021) found that awareness of critical CVD risk factors, such as diet, smoking, and obesity, was inconsistent among healthcare providers. This issue is particularly severe in rural areas like the Upper East Region, where a limited number of medical professionals, widespread poverty, subsistence agriculture, and low literacy rates further exacerbate the challenges of managing CVD (Wood et al., 2021).

These findings underscore the urgent need to increase the number of trained healthcare professionals, improve healthcare workers' knowledge and skills, and enhance community

awareness of CVD. Strengthening primary healthcare facilities, investing in workforce development, and addressing resource constraints are crucial for improving CVD care in Ghana (Wood et al., 2021).

Multiple initiatives have been introduced to bolster the health workforce for CVD care in Ghana. One such initiative is the Ghana Heart Initiative, which was established in 2018 as a nationwide program focused on improving CVD care and lowering mortality rates. This initiative seeks to enhance the capacity of primary healthcare centers to evaluate risk factors and implement preventive and treatment measures (Doku et al., 2023).

Additionally, task-shifting strategies have been introduced, allowing nurses to take on responsibilities in CVD diagnosis and management, thereby improving access to care within the country's resource-constrained health system (Wood et al., 2021).

Community-driven initiatives have been examined as a strategy to enhance primary healthcare services for CVD management in underprivileged urban areas (De-Graft Aikins et al., 2014). Research indicates that many healthcare professionals in Ghana lack adequate training in non-communicable disease (NCD) diagnosis and management, highlighting the need for capacity-building programs for cardiologists, nurses, and support staff to enhance CVD care delivery (De-Graft Aikins et al., 2014; Sanuade et al., 2021).

The mass media, especially radio, plays a vital role in raising public awareness about chronic diseases in Ghana (Sanuade et al., 2021). However, existing media content on NCDs often draws from varied national and international sources, which may not always be relevant or culturally appropriate for the Ghanaian context. Strengthening the quality and accuracy of media content on CVD can contribute to better public awareness and improved disease prevention strategies (Sanuade et al., 2021).

In summary, addressing the human resource gaps in CVD care requires a multi-faceted approach, including expanding training programs for healthcare workers, enhancing community engagement, and strengthening primary healthcare services. These strategies are essential for improving healthcare system capacity, reducing the CVD burden, and ultimately improving cardiovascular health outcomes in Ghana (Sanuade et al., 2021).

2.7 Influence of health policies and regulations on the allocation of financial resources for CVD care.

The allocation of financial resources for cardiovascular disease (CVD) care in Ghana is shaped by health policies and regulatory frameworks, necessitating a comprehensive and strategic approach. Various studies have examined the role of national policies and programs in influencing financial resource distribution for CVD care.

The National Policy for the Prevention and Control of Chronic Non-Communicable Diseases (NCDs) in Ghana provides a structured framework to address the burden of CVD. This policy incorporates specific budgetary allocations for NCDs at all levels of the healthcare system, emphasizing the significance of financial resources in strengthening CVD care (Ministry of Health, 2023). Additionally, national health policies play a crucial role in enhancing access to CVD services. Research suggests that expanding health insurance coverage can substantially increase access to essential CVD care services (Gyamfi et al., 2019). Baatiema et al. (2021) recommended that Ghana's National Health Insurance Scheme (NHIS) expand its coverage to include essential CVD medications and rehabilitation services, ensuring affordability and continuity of care for patients.

CVDs pose a substantial economic burden on households across Sub-Saharan Africa, often leading to catastrophic health expenditures, particularly in regions with low health insurance coverage (Adeniji & Obembe, 2023). Policies and programs aimed at reducing the financial

burden of CVD on households, including financial protection mechanisms, are necessary to prevent economic hardship caused by CVD-related healthcare costs (Adeniji & Obembe, 2023). The NHIS is designed to minimize out-of-pocket healthcare expenses and provide financial protection against catastrophic expenditures, offering significant benefits to insured individuals and their families (Kusi et al., 2015).

Furthermore, research by Abor & Abor (2020) highlights the negative impact of global health crises, such as the COVID-19 pandemic, on healthcare financing sources, including government funding and donor contributions. These findings emphasize the need for sustainable financing mechanisms to support CVD care and ensure long-term investment in affordable and accessible cardiovascular health services.

2.8 Integration of Technology in CVD care in Ghana

The integration of digital health technologies into CVD care in Ghana presents a promising opportunity to enhance diagnostics, treatment, and healthcare access. Santo & Redfern (2020) explored the potential applications of digital health tools, including telemedicine and diagnostic technologies, in CVD management. Their study highlighted challenges in ensuring comprehensive risk factor management across diverse populations and the importance of scientific evaluation of digital health interventions to assess their risks and benefits.

Another study by Haykin et al. (2020) investigated the implementation of a nurse-led primary care initiative for CVD management in Ghana and identified several barriers to accessing CVD care, including limited resources in the CHPS compounds, lack of transportation, and long distances to referral facilities. They emphasized the need for state policies to address rural transportation issues, advocating for sustainable transport services driven by community participation to improve access to healthcare.

The adoption of information systems is an essential aspect of improving CVD service efficiency and quality in Ghana. Research indicates that electronic health records (EHRs), telemedicine, and advanced diagnostic tools can significantly enhance CVD management. Telemedicine offers a practical solution for improving access to CVD care, especially in rural and underserved regions, by facilitating remote consultations and patient monitoring. Additionally, diagnostic technologies, such as electrocardiography (ECG) machines and point-of-care testing devices, can aid in early detection and management of CVD, leading to better patient outcomes (Dan B., 2015).

The increased use of EHRs fosters greater interoperability, ensuring that healthcare providers have seamless access to patient records, which reduces inefficiencies and minimizes medical errors. By improving EHR connectivity, the verification of benefits and prior authorization processes become more efficient, ultimately lowering healthcare costs (CVS Health, 2021). Furthermore, the secure integration of critical patient data, such as insurance details, laboratory results, weight, and diagnosis codes, enhances the overall efficacy and accessibility of CVD care services (CVS Health, 2021).

In conclusion, leveraging health policies, expanding financial resource allocation, and integrating digital health technologies are crucial strategies for strengthening CVD care in Ghana. Policies aimed at financial protection, improving health insurance coverage, and investing in digital health solutions will play a pivotal role in enhancing access, affordability, and the overall quality of cardiovascular healthcare services in the country.

2.9 Utilization patterns of CVD services by the population.

Several studies have examined the utilization of cardiovascular disease (CVD) services in Ghana, shedding light on disparities in access, awareness, and healthcare-seeking behaviors. A scoping review of CVD healthcare utilization in Sub-Saharan Africa, including Ghana,

revealed limited access to CVD care, particularly among low-income households and urban populations facing economic constraints (Chikafu & Chimbari, 2019).

Research on public awareness of CVD and its associated risk factors in three communities in Accra highlighted the critical need for focused CVD education to improve prevention and management efforts (Sanuade et al., 2021b). Similarly, a qualitative study in rural Ghana identified significant gaps in CVD awareness, prevention, and treatment, especially in remote areas where understanding of common CVD risk factors is insufficient (Patil et al., 2023c). This study further suggested that in addition to conventional risk reduction strategies—such as dietary modifications and physical activity—counseling approaches should incorporate community-specific beliefs and concerns regarding CVD, particularly those related to behavioral and mental health influences.

Additionally, research by Adeniji & Obembe (2023) found that households affected by CVD are significantly more likely to experience catastrophic health expenditures (CHE). Given the principles of equity in healthcare financing, there is a need for health insurance policies that prioritize coverage based on an individual's health needs, ensuring that healthcare financing interventions in Sub-Saharan Africa effectively address financial barriers to CVD care.

2.10 Barriers to accessing CVD care

Despite significant advancements in CVD treatment, access to timely and effective care remains a challenge due to various geographical, economic, and sociocultural barriers. Research by Baatiema et al. (2021) highlighted financial constraints as a major obstacle, with 43.4% of stroke patients unable to afford medication, while 10.3% faced transportation difficulties, and 6.6% encountered long waiting times. These findings align with those of Agyemang et al. (2020), who pointed out that financial challenges and inadequate infrastructure significantly hinder CVD care utilization in SSA.

A qualitative study by Schultz et al. (2018) highlighted three major obstacles to CVD care: patients' resistance to lifestyle modifications, deficiencies within healthcare services, and restricted access to health facilities.

Additionally, socioeconomic status (SES)—which includes income levels, education, employment, and environmental factors—significantly influences CVD outcomes (Schultz et al., 2018).

Other factors impeding CVD care include: non-adherence to medication, transportation difficulties, language barriers, and geographical remoteness, which contributes to avoidable CVD-related mortality (Subedi et al., 2019).

Tackling these challenges necessitates a collaborative approach that engages healthcare providers, policymakers, and community organizations (Kalantarzadeh et al., 2022).

Implementing targeted policies and programs to eliminate financial and logistical barriers can enhance the health system's capacity to effectively manage CVD in Ghana.

2.11 Quality of CVD care provided in health facilities.

A study conducted in health facilities within the Greater Accra region by Doku et al. (2023) revealed significant gaps in the health system's ability to manage CVD. The study recommended the development of standardized national guidelines for CVD management across all healthcare levels, as well as regular training and retraining of healthcare providers.

Another study in three urban poor communities in Accra emphasized the urgent need for CVD education to enhance prevention and management efforts (Sanuade et al., 2021b). The research also underscored the weaknesses of Ghana's healthcare system in addressing non-communicable diseases (NCDs).

An analysis of the effects of CVD on primary healthcare services in economically disadvantaged urban communities highlighted deficiencies in care quality at the primary level and unfavorable community perceptions of healthcare services (De-Graft Aikins et al., 2014). The study emphasized the need to remove financial obstacles to CVD care to enhance accessibility and affordability.

In Ghana, CVD-related healthcare services are predominantly available in secondary and tertiary facilities, creating access challenges for rural and underserved populations. Ofori-Asenso & Garcia (2016) emphasized the need for a coordinated national effort to enhance the country's response to CVDs.

Research by Ratcliffe et al. (2020) further noted that poor patient experiences and dissatisfaction with care contribute to the underutilization of CVD services, which in turn increases avoidable mortality rates. To improve patient satisfaction, healthcare facilities must adopt patient-centered service models that prioritize efficiency and quality of care (Wu et al., 2021).

2.13 Conceptual Framework

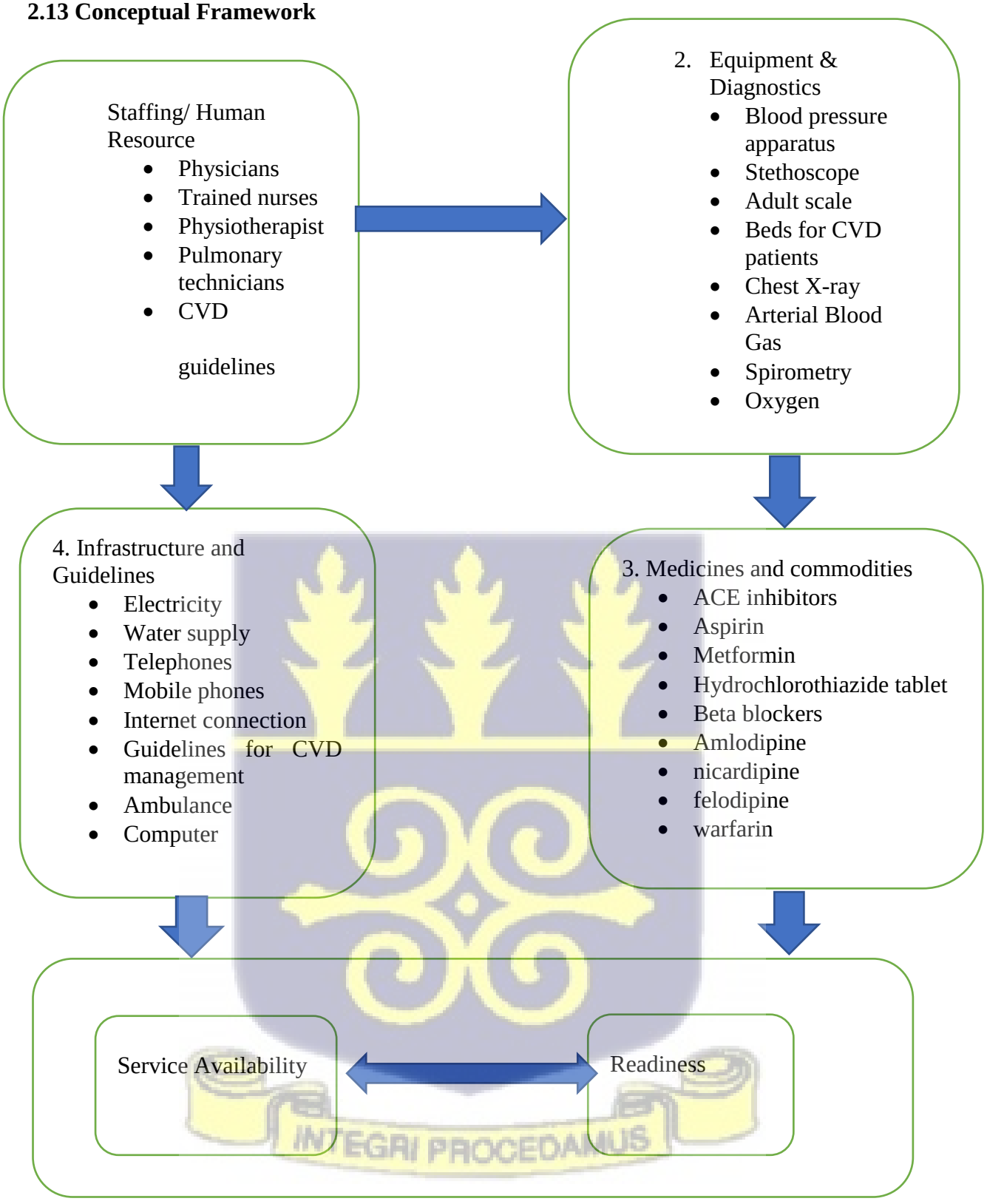

Figure 2.1 Conceptual framework Adopted from WHO SARA model

2.13.1 Narrative of Conceptual Framework

The presence of trained personnel and essential clinical guideline tracer items guarantees that healthcare facilities are equipped with skilled professionals and standardized protocols for the diagnosis, treatment, and management of cardiovascular diseases.

The diagnostic equipment tracer items ensure that health facilities have essential diagnostic technologies and facilities for the accurate assessment and monitoring of cardiovascular conditions. The availability of essential medicines and medical commodities tracer items ensures that healthcare facilities are adequately stocked with the necessary medications and supplies for the effective treatment and management of cardiovascular diseases. The basic amenities tracer items ensure that health facilities have basic infrastructure and amenities, such as water and sanitation, electricity, and waste management, necessary for the effective delivery of healthcare services. The basic equipment tracer items ensure that health facilities have essential medical equipment and supplies required for the diagnosis, treatment, and monitoring of cardiovascular conditions. The service-specific readiness tracer items ensure that health facilities have the capacity to provide interventions in key program areas, including cardiovascular care services. The service-specific readiness tracer items include trained personnel, standardized guidelines, necessary equipment, diagnostic capabilities, and essential medicines and medical supplies. . These tracer items for the SARA framework interact to guarantee general service readiness by assessing the availability and readiness of health facilities to provide CVC services. The tracer items cover various domains, including staff and guidelines, equipment, diagnostic capacity, essential medicines and commodities, infrastructure and basic equipment ensuring that health facilities have the necessary resources to deliver high-quality CVD care services.

2.14 Conclusion

The literature review provides an extensive information on the global burden of cardiovascular diseases, the burden of CVDs in Sub-Saharan Africa, frameworks for assessing service availability and readiness, infrastructure and facilities, human resources, the role of health policies and regulations in shaping financial resource allocation for CVD care, the effects of budgeting and funding mechanisms on service availability and preparedness, and the incorporation of technology in CVD management in Ghana are critical areas of focus. Implementing targeted policies and programs is essential to overcoming these challenges and strengthening the healthcare system's capacity to effectively manage CVDs nationwide.

CHAPTER THREE

METHODS

3.1 Study Design

This research is a cross-sectional, quantitative, facility-based study which was carried out from August to September 2024 among public health facilities in the Bolga East, Talensi and Nabdam districts of the Upper East Region. Data on service availability and readiness for CVD care were collected for each selected facility with the aid of a structured questionnaire.

3.2 Study Area

The study was carried out in Bolgatanga East, Talensi and Nabdam districts of the Upper East Region. These districts are notable areas for public health studies because of their varied geographic and sociodemographic features. Zuarungu is the district capital of the Bolgatanga East District and is home to the native Gurune-speaking Frafras and other ethnic groups such as Kusasis, Moshies, Akans, Ewes, etc., making up the minority. According to the 2021 Population and Housing Census, the Talensi District has a total population of 38,824, comprising 18,836 males and 19,988 females. The majority of the population adheres to Christianity, while smaller groups practice Islam or African Traditional Religion. Geographically, the district is situated between latitudes 10.15°N and 10.60°N and longitudes 0.31°W and 1.05°W, covering a land area of 867 km². Tongo serves as the administrative capital of the district. Talensi District shares its boundaries with Nabdam District to the north, Bolgatanga East District to the west, East Mamprusi Municipal to the southeast, West Mamprusi Municipal to the southwest, and Bawku West District to the east. Additionally, the district's total population, as reported in the 2021 Population and Housing Census, is 87,021, consisting of 43,849 males and 43,172 females. The Nabdam District, located in the Upper East Region of Ghana, was established in 2012 after being carved out of the former Talensi-Nabdam District. It was among the 46 newly created districts and municipalities inaugurated

on June 28, 2012, under Legislative Instrument (LI) 2105. The district, with Nangodi as its administrative capital, is situated between latitudes 10°47′N and 10°57′N and longitudes 0°31′W and 1°15′W. Covering a total land area of 251 km², Nabdam District shares boundaries with Bongo District to the north, Talensi District to the south, Bawku West District to the east, and Bolgatanga East District to the west. According to the 2021 Population and Housing Census, the district has a total population of 51,861, comprising 25,552 males and 26,309 females. The majority of the local population is engaged in farming and trading, with many others involved in various informal economic activities.

3.3 Study Population

The study population included the heads (in-charges) of all public health facilities in the Bolgatanga East, Talensi, and Nabdam districts, encompassing public health centers, clinics, and hospitals. In Ghana, CVD services are delivered across various levels of the healthcare system, from tertiary hospitals to health centers and clinics. The facility head or a management staff member with comprehensive knowledge of the facility's capacity and operations was selected to participate in the survey. All facilities that met the inclusion criteria were included in the study. In total, three (3) facilities from Bolgatanga East District, five (5) from Nabdam District, and nine (9) from Talensi District constituted the study population.

3.3.1 Inclusion Criteria

The facilities for the survey were selected based on the following criteria.

1. Public health facilities within the three districts: these include health facilities that are publicly owned and operated.
2. Public health facilities such as hospitals, clinics, health centers, CHPS compounds.
3. Facilities that provide primary health care and CVD care services.

3.3.2 Exclusion Criteria

The following health facilities were not selected for the survey.

1. Privately owned and operated health facilities
2. Facilities that specialize in areas unrelated to the survey, such as maternal health facilities.
3. Facilities that do not primarily offer healthcare services, such as administrative offices and training centers.
4. Facilities with incomplete or unreliable data that may compromise the survey results.

3.4 Sampling Method

The study was a census of all the district hospitals, health centers and clinics within the three districts which meet the inclusion criteria. This will ensure comprehensive coverage for CVD care services among facilities within the study area. Also, findings can be confidently generalized to the entire population of healthcare facilities in the three districts

3.5 Study Variables

3.5.1 Dependent variables

The dependent variables are service availability and readiness of the facilities for CVD care.

3.5.2 Independent variables

The independent variables are categorized into five key areas: (1) staff and guidelines, which include specialist doctors, general practitioners, nurses, public health workers, pharmacists, and laboratory technicians; (2) diagnostic capacity, covering assessments such as blood pressure, lipid profile, blood glucose, hemoglobin (Hb), and blood urea nitrogen levels; (3) basic equipment, encompassing ECG machines, sphygmomanometers, anthropometric measurement tools, and CT scanners; (4) essential CVD medicines and commodities, including antiplatelet drugs, anticoagulants, statins, beta-blockers, angiotensin-converting

enzyme (ACE) inhibitors/angiotensin-receptor blockers (ARBs), and calcium channel blockers (CCBs); and (5) infrastructure, which consists of essential amenities such as electricity, clean water, computers, internet connectivity, cellular networks, 24-hour hotlines, CVD management guidelines, and ambulance services.

Table 3.1: Study variables and scale of measurement

Variable	Description	Scale of measurement
Independent variables		
Type of facility	Hospital, clinic, health centre,	Ordinal
Staff and guidelines	General practitioner, Nurses Public health worker or health educator, Pharmacist, Laboratory technician Guidelines for CVD management	Nominal
Diagnostics	Blood Pressure, Blood Glucose, Hemoglobin (Hb), Total Cholesterol, HDL Cholesterol, LDL Cholesterol, Hemoglobin A1c, Serum Creatinine, Blood Urea Nitrogen	Nominal
Medicines and	Statin (e.g., atorvastatin, simvastatin),	Nominal

commodities	Antiplatelet (e.g., Aspirin, clopidogrel), Anticoagulation Drugs e.g., warfarin, heparin), Beta-Blocker (e.g., propranolol), ACE Inhibitor (e.g., captopril, lisinopril), Calcium Channel blockers (e.g., amlodipine),	
Basic Equipment	Sphygmomanometer, beds, Weight scale, Height scale, Thermometer, Stethoscope, Oxygen, ECG Machine, Glucometer POCT, Cholesterol POCT, Hemoglobin (Hb) meter POCT, CT scan.	Nominal
Infrastructure	Electricity, Water supply, Telephones (Hotline 24hours), Mobile Phones, Internet Connections,	Nominal

3.6 Data collection method

To help collect data on the service availability and readiness for CVD care in the three districts, I adapted and refined the WHO-SARA model inventory to focus specifically on aspects relevant to CVD healthcare. Additionally, the WHO Package of Essential Non-Communicable Disease Prevention checklist was utilized to assess diagnostic tests and essential medicines required for primary healthcare (World Health Organization, 2020). Additionally, the National Policy for the Prevention and Control of Chronic Non-Communicable Diseases in Ghana was incorporated and utilized in the study.

The data collection process was structured into multiple phases to comprehensively address the study objectives. During the initial phase, structured interviews were conducted using a standardized questionnaire to gather information from facility heads, as they possess the necessary knowledge to provide relevant data. A structured questionnaire was utilized to collect data on facility statistics, human resources, CVD-related training programs, and the range of CVD healthcare services offered.

Additionally, direct observations were carried out using a modified WHO-SARA inventory checklist to document the availability and functionality of essential CVD services, equipment, and medicines at the health facilities.

Finally, a review of facility records was conducted to assess the utilization of specific CVD services and diagnoses recorded by the various facilities from 2021 to 2023**.** Data was collected from August to September 2024.

3.12 Data Storage and Processing

Data collected is password protected on a computer. Codes were used to identify participants. The data collected was checked for errors and missing values. After that, the data was entered

into Microsoft Excel, double-checked for errors again, and then exported to STATA I/C 18 (Stata Corp LLC, Texas, USA) for analysis.

3.13 Data Analysis

The availability of CVD-related services was assessed by determining the percentage of health facilities capable of providing key services, including health promotion, disease prevention, diagnosis, treatment, and long-term care. This analysis was used to evaluate CVD healthcare availability across the three rural districts. To assess facility readiness for CVD service delivery, data was analyzed using the WHO-SARA manual (World Health Organization, 2015). Each tracer item within the domains was assigned equal weight. The domain score was calculated by dividing the total number of items present within a domain by the total number of items required in that domain and multiplying by 100. The overall readiness score was determined by summing the domain scores and dividing by the total number of domains. Readiness scores ranged from 0 to 100, with higher scores indicating better facility preparedness for CVD healthcare services. Facilities scoring 70 or above were classified as "ready." Data analysis was performed using STATA I/C 18 (Stata Corp LLC, Texas, USA).

3.7 Quality Control

A team of five research assistants was recruited and provided with comprehensive training to support data collection. The training sessions covered data collection techniques and research ethics to enhance their understanding of the methodologies used and to minimize potential errors. To ensure data quality, the questionnaire was pre-tested, the data collection process was closely monitored, and all collected data underwent thorough checks for accuracy and completeness.

3.8 Ethical Considerations

Ethical approval was obtained from the Navrongo Health Research Centre Institutional Review Board (NHRCIRB). Additionally, permission was secured from all relevant health facilities before initiating the study. Informed consent was sought from each participant to ensure their voluntary participation in the research.. Participants were informed of their right to withdraw from the study at any point during the study. Respondents who agreed to partake in the research were made to endorse the informed consent form and their anonymity was guaranteed by not writing their names. Completed questionnaires will be kept under lock and key and no third party will be granted access to them. The completed questionnaire shall be destroyed by burning only after a year. Approval was also obtained from the Upper East Regional Director of Health Services, as well as the District Directors of Health Services for Bolgatanga East, Talensi, and Nabdam. Additionally, permission was sought from the Medical Directors and management of the respective health facilities before data collection, with assurances of data confidentiality.

The findings of this study will be shared with the study population and the School of Public Health, University of Ghana. Furthermore, the results will be published in peer-reviewed medical journals, both in print and online

CHAPTER FOUR

RESULTS

4.1 Service Availability

Hypertension management is offered in 92.9% of health centres and in the hospital. Coronary heart disease management is available in 35.7% of health centres and in the hospital, as is heart failure management. Diabetes mellitus management is available in 57.1% of health centres and in the hospital, while stroke management is offered in 28.6% of health centres and in the hospital. Dyslipidaemia management is unavailable in health centres but is offered in the hospital. On the availability of cardiovascular disease (CVD) diagnosis and management, providers diagnose and manage CVDs in 85.7% of health centres. (Table 4).

Table 4: Assessment of Service Availability at the Included Health Facilities

Variable	Response	Health centres	Hospital
Hypertension management	No	1 (7.1)	0 (0.0)
	Yes	13 (92.9)	1 (100.0)
CHD management	No	9 (64.3)	0 (0.0)
	Yes	5 (35.7)	1 (100.0)
Heart failure management	No	9 (64.3)	0 (0.0)
	Yes	5 (35.7)	1 (100.0)
Diabetes mellitus management	No	6 (42.9)	0 (0.0)
	Yes	8 (57.1)	1 (100.0)
Stroke management	No	10 (71.4)	0 (0.0)
	Yes	4 (28.6)	1 (100.0)
Dyslipidaemia management	No	0	1 (100.0)
	Yes		0 (0.0)
Health providers in this facility manage cardiovascular diseases such as hypertension in patients?	No	2 (14.3)	0 (0.0)
	Yes	12 (85.7)	1 (100.0)

4.1.1 Service Availability Assessment Using the WHO SARA Tool

The chart depicts service availability across various health facilities. Service availability varies, with Gambibgo Health Centre having the highest availability at 90%, followed by Awudu Kpari Health Centre and Pwalugu Health Centre at 80% each. Talensi District Hospital, Nangodi Health Centre, and Zuarrungu Health Centre all report 70% availability. Winkogo and Gorogo Health Centres each indicate 60%, while Gambibgo Health Centre reports 50%. Sakote and Nangodi Health Centres show 40%, and Datuko, Duusi, Zuarungu Moshie, and Zanlerigu Health Centres report the lowest availability at 30% or less (Fig 2).

Figure 2 A bar chart showing the cardiovascular services availability of facilities using the WHO SARA tool

4.1.2 Assessing the cardiovascular disease health services at the various health facilities

Table 5 presents the results for the assessment of the types of cardiovascular disease services at the health facilities considered in this study. From the results Zuarungu Moshie center provided only hypertension management services only through diagnosing and treatment of hypertension. Zuarungu Health center provided Hypertensions management services, Heart failure and diabetes management services. At the Gambibgo Health center, diabetes and hypertension management services are provided. The Pelungu Health Center provides management services for hypertension, coronary heart disease, heart failure, diabetes mellitus, stroke and dyslipidaemia. Zanlerigu Health center provides hypertension management services. The Talensi District Hospital offers management services for hypertension, coronary

health disease, diabetes mellitus and stroke. Lastly the Nangodi Health center offers two management services for hypertension and coronary heart disease.

Table 5: Assessment of the Types of CVD Health Services at the Various Health Facilities

Facility Name	Hypertension management	CHD management	Heart failure management	Diabetes mellitus	Stroke management	Dyslipidaemia management
Zuarungu Moshie Center	Diagnoses Treatment	N/A	N/A	N/A	N/A	N/A
Zuarungu Health Center	Diagnoses Treatment H. Promotion	N/A	H. Promotion D. Prevention	Diagnosis Treatment D. Prevention	N/A	Treatment
Gambibgo Health Center	Diagnose Treatment H. Promotion	N/A	N/A	Diagnosis H. Promotion D. Prevention	N/A	N/A
Pelungu Health Center	H. Promotion D. Prevention Diagnosis LT care	• H. Promotion • D. Prevention • Diagnosis	• H. Promotion • D. Prevention	• H. Promotion • D. Prevention • Diagnosis	H. Promotion D. Prevention Diagnosis	• H. Promotion • D. Prevention • Diagnosis
Zanlerigu Health Centre	Diagnosis Treatment H. Promotion	N/A	N/A	N/A	N/A	N/A
Talensi District Hospital	H. Promotion D. Prevention Diagnosis Treatment LT care	H. Promotion D. Prevention Diagnosis Treatment LT care	H. Promotion D. Prevention Diagnosis Treatment LT care	H. Promotion D. Prevention Diagnosis Treatment LT care	H. Promotion D. Prevention Diagnosis Treatment	N/A
Nangodi Health Centre	H. Promotion D. Prevention Treatment	• D. Prevention	N/A	N/A	N/A	N/A

Table 5: Assessment of the Types of CVD Services at the Various Health Facilities (Cont.)

Facility Name	Hypertension management	CHD management	Heart failure management	Diabetes mellitus	Stroke management	Dyslipidaemia management
Sakote Health Center	Diagnosis Treatment	N/A	N/A	Diagnosis Treatment	N/A	N/A
Gorogo Health Center	D. Prevention	H. Promotion	D. Prevention	N/A	D. Prevention	N/A
Winkogo Health Centre	H. Promotion Diagnosis Treatment. D. Prevention.	H. Promotion D. Prevention	N/A	N/A	N/A	H. Promotion D. Prevention
Pwalugu Health Center	H. Promotion D. Prevention Diagnosis Treatment	H. Promotion D. Prevention Diagnosis Treatment	H. Promotion D. Prevention Diagnosis Treatment	H. Promotion D. Prevention Diagnosis Treatment	H. Promotion D. Prevention Diagnosis Treatment	H. Promotion D. Prevention Diagnosis Treatment
Duusi Health Centre	N/A	N/A	N/A	N/A	N/A	N/A
Datuko Health Centre	H. Promotion D. Prevention	N/A	N/A	H. Promotion D. Prevention	N/A	N/A
Awudu Kpari Health Center	H. Promotion D. Prevention Diagnosis Treatment	H. Promotion D. Prevention Diagnosis Treatment	H. Promotion D. Prevention Diagnosis Treatment	H. Promotion D. Prevention Diagnosis Treatment	H. Promotion D. Prevention Diagnosis Treatment	H. Promotion D. Prevention Diagnosis
Biung Health Centre	H. Promotion	N/A	N/A	N/A	N/A	N/A

H. Promotion= Health Promotion
D. Prevention= Disease Prevention
LT Care= Long Term Care
N/A= Not Available

4.2 Service readiness

4.2.1 Staff and Guidelines

The table 4 compares the availability of healthcare professionals and services between health centres and a hospital. General practitioners are available in 7.1% of health centres and 100% of the hospital, while full-time cardiologists are unavailable in both. Health centres have fewer nurses, with 85.7% reporting fewer than 20, compared to the hospital with more than 20 nurses. Public health workers are present in 92.9% of health centres and in the hospital. Pharmacists are available in 7.1% of health centres and in the hospital, while laboratory technicians are present in 64.3% of health centres and in the hospital. Dietitians are available in 14.3% of health centres and in the hospital, while physiotherapists are unavailable in both. National guidelines for CVD management are available in 76.9% of health centres but not in the hospital. Training in CVD management was received by 42.9% of health centre care providers and 100% of the hospital care providers in the past two years (Table 6).

Table 6: Assessment of Staff availability at the Included Health Facilities

Variable	Response	Health centres	Hospital
General Practitioner	No	13 (92.9)	0 (0.0)
	Yes	1 (7.1)	1 (100.0))
Cardiologist full time	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
Nurses	<20	12 (85.7)	0 (0.0)
	>20	2 (14.3)	1 (100.0)
Public Health Worker	No	1 (7.1)	0 (0.0)
	Yes	13 (92.9)	1 (100.0)
Pharmacist	No	13 (92.9)	0 (0.0)
	Yes	1 (7.1)	1 (100.0)
Laboratory Technician	No	5 (35.7)	0 (0.0)
	Yes	9 (64.3)	1 (100.0)
Dietitian	No	12 (85.7)	1 (100.0)
	Yes	2 (14.3)	0 (0.0)
Physiotherapist	No	14 (100.0)	1 (100.0)

	Yes	0 (0.0)	0 (0.0)
The facility has national guidelines for the diagnosis and management of cardiovascular diseases available	No	3 (23.08)	1 (100.0)
	Yes.	10 (76.9)	0 (0.0)
Health provider(s) of CVDs services have received training in the diagnosis and management of CVDs in the last two years.	No	8 (57.1)	0 (0.0)
	Yes	6 (42.9)	1 (100.0)

4.2.2 Medicines and Commodities

As shown in Table 7, Benazepril, Enalapril, Captopril, Nazepril, Ramipril, Simvastatin Felodipine, Nicardipine and warfarin are unavailable (0.0%) in all facilities. Lisinopril, aspirin, atorvastatin, nifedipine, and amlodipine are available in some health centres and the hospital, while clopidogrel, and heparin are available only in the hospital.

Table 7: Assessment of Medicines at the Included Health Facilities

Variable	Response	Health centres	Hospital
Benazepril	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
Enalapril	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
Captopril	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
Nazepril	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
Lisinopril	No	11 (78.6)	0 (0.0)
	Yes	3 (21.4)	1 (100.0)
Ramipril	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
Aspirin	No	11 (78.6)	0 (0.0)
	Yes	3 (21.4)	1 (100.0)
Clopidogrel	No	14 (100.0)	0 (0.0)
	Yes	0 (0.0)	1 (100.0)

Atorvastatin	No	13 (92.9)	0 (0.0)
	Yes	1 (7.1)	1 (100.0)
Simvastatin	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
Nifedipine	No	2 (14.3)	0 (0.0)
	Yes	12 (85.7)	1 (100.0)
Amlodipine	No	4 (28.6)	0 (0.0)
	Yes	10 (71.4)	1 (100.0)
Felodipine	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
Nicardipine	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
Warfarin	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
Heparin	No	14 (100.0)	0 (0.0)
	Yes	0 (0.0)	1 (100.0)
Furosemide	No	8 (57.1)	1 (100.0)
	Yes	6 (42.9)	0 (0.0)

4.2.3 Diagnostics

Diagnostics such as electrocardiogram, echocardiography, X-ray, CT scan, cholesterol POCT, and laboratory facilities are absent in health centres but available in the hospital. Ultrasound equipment is available in 14.3% of health centres and the hospital. Glucometers are present in 85.7% of health centres and the hospital (Table 8).

Table 8: Assessment of Diagnostic capacity at the Included Health Facilities

Variable	Response	Health centres	Hospital
Electrocardiogram	No	14 (100.0)	0 (0.0)
	Yes	0 (0.0)	1 (100.0)
Echocardiography	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
Ultrasound Equipment	No	12 (85.7)	0 (0.0)
	Yes	2 (14.3)	1 (100.0)
X-ray	No	14 (100.0)	0 (0.0)
	Yes	0 (0.0)	1 (100.0)
CT scan	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
Cholesterol POCT	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
Glucometer	No	2 (14.3)	0 (0.0)
	Yes	12 (85.7)	1 (100.0)
Laboratory Facilities	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)

4.2.4 Infrastructure

The table 9 summarizes the infrastructure of health centres and a hospital, focusing on communication, emergency transportation, power, and water supply. Functioning landline telephones are available in 14.3% of health centres and 100% of the hospital, while cellular phones supported by the facility are available in 64.3% of health centres and 100% of the hospital. Computers are present in 85.7% of health centres and the hospital, with internet access available in 71.4% of health centres and 100% of the hospital. Functional ambulances or emergency vehicles stationed at the facility are available in 64.3% of health centres and the hospital, with 71.4% of health centres also having access to ambulances from nearby facilities.

Table 9: Assessment of Communication Equipment and Emergency Transportation

Variable	Response	Health centres	Hospital
COMMUNICATION EQUIPMENT			
Does this facility have a functioning land line telephone that is available to always call outside client services are offered?	No	12 (85.7)	0 (0.0)
	Yes	2 (14.3)	1 (100.0)
Does this facility have a functioning cellular telephone or a private cellular phone that is supported by the facility?	No	5 (35.7)	0 (0.0)
	Yes	9 (64.3)	1 (100.0)
Does this facility have a functioning computer?	No	2 (14.3)	0 (0.0)
	Yes	12 (85.7)	1 (100.0)
Is there access to email or internet within the facility today?	No	4 (28.6)	0 (0.0)
	Yes	10 (71.4)	1 (100.0)
EMERGENCY TRANSPORTATION			
Does this facility have a functional ambulance or other vehicle for emergency transportation for clients that is stationed at this facility or operates from this facility?	No	5 (35.7)	0 (0.0)
	Yes	9 (64.3)	1 (100.0)
Does this facility have access to an ambulance or other vehicle for emergency transport for clients that is stationed at another facility or that operates from another facility in near proximity?	No	4 (28.6)	0 (0.0)
	Yes	10 (71.4)	1 (100.0)

Electricity is available in all facilities but lacks a secondary backup source in 85.7% of health centres. Generators serve as backup power for 14.3% of health centres and the hospital, with 100% of hospital generators reported functional. Water is predominantly supplied through pipes into 61.5% of health centres and the hospital, while 15.4% of health centres rely on piping onto facility grounds, 7.7% use tubewells or boreholes, and 15.4% rely on other sources (Table 10).

Table 10: Assessment of Power and Water Supply at the Health Facilities

Variable	Response	Health centres	Hospital
POWER SUPPLY			
Does your facility have electricity from any source (e.g. electricity grid, generator, solar, or other)	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
What is the facility's main source of electricity?	National grid	14 (100.0)	1 (100.0)
	Generator	0 (0.0)	0 (0.0)
	Solar system	0 (0.0)	0 (0.0)
	Other	0 (0.0)	0 (0.0)
Other than the main or primary source, does the facility have a secondary or backup source of electricity? IF YES: What is the secondary source of electricity?	No Second. Source	12 (85.7)	0 (0.00)
	Central supply		
	Generator	2 (14.3)	1 (100.0)
	Solar system	0 (0.0)	0 (0.0)
	Others	0 (0.0)	0 (0.0)
If facility has a generator, is the generator functional?	No	5	0 (0.00)
	Yes	2	1 (100.0)
	Don't Know		
WATER SUPPLY			
What is the commonly used source of water for the facility currently?	Piped into facility	8 (61.5)	1 (100.0)
	Piped onto facility Grounds	2 (15.38)	0 (0.00)
	Tubewell/Borehole	1 (7.7)	0 (0.00)
	Others	2 (15.38)	0 (0.00)

4.2.5 Basic Equipment

Table 11 outlines the availability of basic equipment in health centres and a hospital. Electrocardiograms are absent in all health centres but are available in the hospital. Oxygen supply is present in 7.1% of health centres and the hospital. Sphygmomanometers are available in 78.6% of health centres and the hospital. Adult weighing scales, thermometers, and stethoscopes are available in all the health facilities. Height scales are available in 85.7% of health centres and the hospital. CT scans, cholesterol point-of-care testing (POCT), and laboratory facilities for lipid profiles are absent in all health facilities. Hemoglobin meters and

glucometers are available in 85.7% of health centres and the hospital. Beds for CVD patients are present in 35.7% of health centers.

Table11: List of Basic Equipment Available for CVD Management

Variable	Response	Health Centres	Hospital
Electrocardiogram machine	No	14 (100.0)	0 (0.0)
	Yes	0 (0.0)	1 (100.0)
Oxygen supply	No	13 (92.9)	0 (0.0)
	Yes	1 (7.1)	1 (100.0)
Sphygmomanometer	No	3 (21.4)	0 (0.0)
	Yes	11 (78.6)	1 (100.0)
Adult weighing scale	No	0 (0.0)	0 (0.0)
	Yes	14 (100.0)	1 (100.0)
Height scale	No	2 (14.3)	0 (0.0)
	Yes	12 (85.7)	1 (100.0)
Thermometer	No	0 (0.0)	0 (0.0)
	Yes	14 (100.0)	1 (100.0)
CT scan	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
Hemoglobin (Hb) meter	No	2 (14.3)	0 (0.0)
	Yes	12 (85.7)	1 (100.0)
Cholesterol POCT	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
Laboratory facilities for lipid profile	No	14 (100.0)	1 (100.0)
	Yes	0 (0.0)	0 (0.0)
Glucometer POCT	No	2 (14.3)	0 (0.0)
	Yes	12 (85.7)	1 (100.0)
Beds for CVD patients	No	9 (64.3)	1 (100.0)
	Yes	5 (35.7)	0 (0.0)
Stethoscope	No	0 (0.0)	0 (0.0)
	Yes	14 (100.0)	1 (100.0)

4.2.5 Overall Facility Readiness Index Assessment Using the WHO SARA Tool

Table 12 summarizes the readiness index of various health facilities based on trained staff, essential drugs, diagnostic capacity, basic amenities, communication equipment, emergency ambulance access, power source, improved water source, and basic equipment. Talensi District Hospital ranks highest with an overall readiness index of 70.7%, excelling in basic amenities (100%) and diagnostics capacity (50%). Zuarungu Health Centre follows with a readiness index of 60.4%, notable for its basic amenities (75%). Sakote Health Centre has a readiness index of 59.8%, supported by strong scores in basic equipment (100%) and improved water source (87.5%). Pelungu Health Centre scores 59.2%, with significant strengths in basic amenities (100%) and emergency ambulance availability (100%). Nangodi Health Centre and Gambibgo Health Centre achieve scores of 55.8% and 49.9%, respectively. Other facilities, such as Duusi, Zuarungu Moshie, and Zanlerigu Health Centres, have indexes ranging from 40.8% to 46.6%. Facilities like Biung Health Centre (38.3%) and Datuko Health Centre (39.7%) score the lowest, indicating limited resources across multiple parameters, particularly in essential drugs and diagnostic capacity.

Table 12: A results showing the overall cardiovascular services readiness of facilities using the WHO SARA tool

Facility Name	Trained staff	Essential Drugs	Diagnostics Capacity	Basic Amenities				Basic Equipment	Overall Readiness index
				Commun. Equipment	Emergency Ambulance	Power Source	Improved Water source		
Zuarungu Moshie Health Centre	25.0	11.8	12.5	50.0	100.0	25.0	100.0	87.5	49.1
Zuarungu Health Centre	62.5	23.5	12.5	75.0	50.0	75.0	100.0	75.0	60.4
Gambibgo Health Centre	25.0	11.8	12.5	50.0	100.0	25.0	100.0	75.0	49.9
Pelungu Health Centre	50.0	17.6	25.0	100.0	50.0	25.0	100.0	75.0	59.2
Zanlerigu Health Centre	37.5	11.8	12.5	50.0	50.0	25.0	100.0	50.0	40.8
Talensi District Hospital	62.5	41.2	50.0	100.0	50.0	75.0	100.0	87.5	70.7
Nangodi Health Centre	50.0	11.8	12.5	75.0	50.0	75.0	100.0	87.5	55.8
Sakote Health Centre	37.5	35.3	12.5	100.0	100.0	25.0	100.0	87.5	59.8
Gorogo Health Centre	25.0	5.9	25.0	75.0	0.0	25.0	100.0	75.0	43.4
Winkogo Health Centre	37.5	29.4	12.5	50.0	0.0	25.0	100.0	75.0	32.2
Pwalugu Health Centre	37.5	11.8	12.5	50.0	0.0	25.0	100.0	50.0	40.8
Duusi Health Centre	25.0	11.8	12.5	50.0	100.0	25.0	100.0	75.0	46.6

Datuko Health Centre	37.5	0.0	0.0	50.0	50.0	25.0	100.0	75.0	39.7
Awudu Kpari Health Centre	37.5	11.8	12.5	50.0	0.0	25.0	100.0	50.0	40.8
Biung Health Centre	12.5	11.8	0.0	0.0	100.0	25.0	100.0	75.0	38.3

4.2.6 Overall cardiovascular services readiness of facilities using the WHO SARA tool

Figure 3 presents a bar chart of the overall cardiovascular services readiness of facilities using the WHO SARA tool. From the chart, Talensi District Hospital ranks highest with an overall readiness index of 70.7%, excelling in basic amenities (100%) and diagnostics capacity (50%). Zuarungu Health Centre follows with a readiness index of 60.4%, notable for its basic amenities (75%). Sakote Health Centre has a readiness index of 59.8%, supported by strong scores in basic equipment (100%) and improved water source (87.5%). Pelungu Health Centre scores 59.2%, with significant strengths in basic amenities (100%) and emergency ambulance availability (100%). Nangodi Health Centre and Gambibgo Health Centre achieve scores of 55.8% and 49.9%, respectively. Other facilities, such as Duusi, Zuarungu Moshie, and Zanlerigu Health Centres, have indexes ranging from 40.8% to 46.6%. Facilities like Biung Health Centre (38.3%) and Datuko Health Centre (39.7%) score the lowest, indicating limited resources across multiple parameters, particularly in essential drugs and diagnostic capacity.

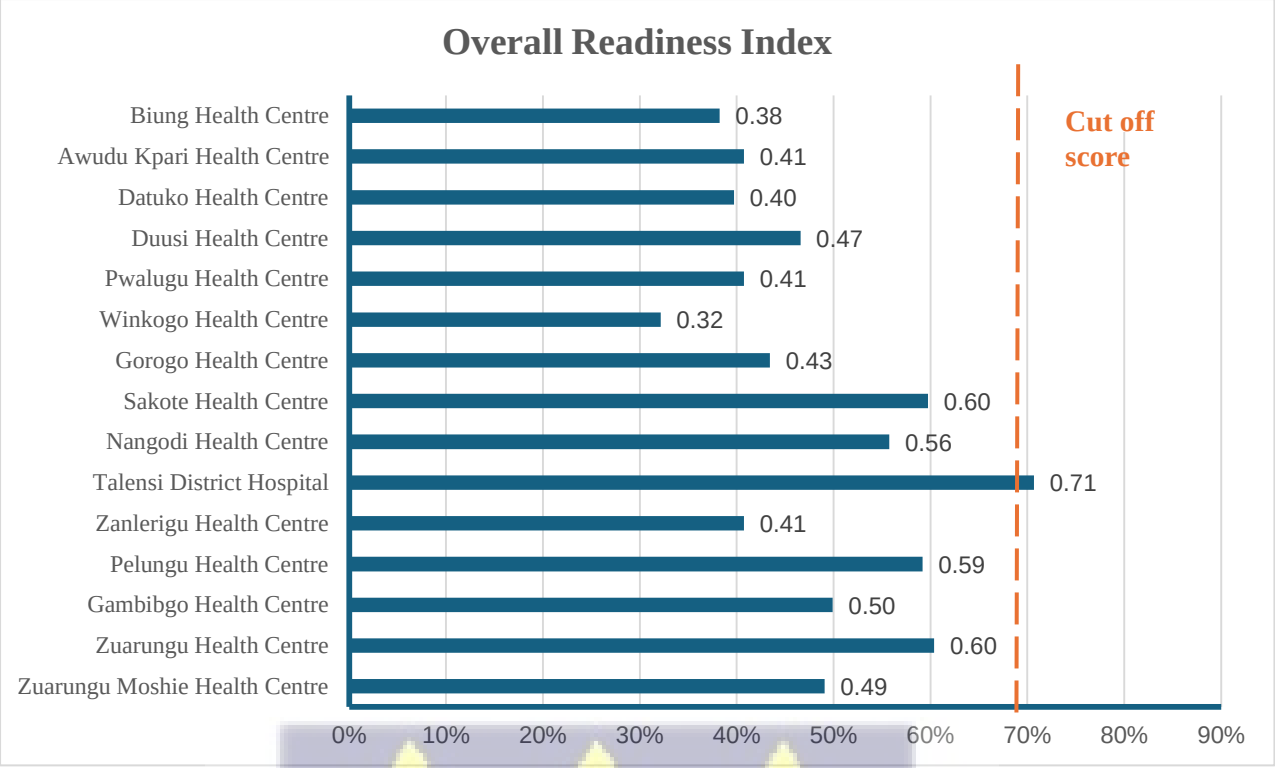

Figure 3: A bar chart showing the overall cardiovascular services readiness of facilities using the WHO SARA tool

4.3 Cardiovascular Service Utilization Assessment for Included Health Facilities

In Talensi, total attendance declined from 98,726 in 2021 to 91,993 in 2023, with hypertensive patient visits increasing from 1.08% in 2021 to 1.23% in 2022, before dropping to 0.48% in 2023. Diabetes mellitus patient visit was between 0.01% and 0.04%, while no CVD patient visit was recorded across the years. At the District Hospital, attendance was from 21,853 in 2021 to 25,789 in 2023. Hypertensive patient visits were 2.49% in 2022 but fell to 0.36% in 2023. Diabetes mellitus visit was 0.01% to 0.05%, and CVD patient visits declined from 0.11% in 2021 to 0.02% in 2023. In Bolgatanga East, attendance fluctuated, dropping to 12,937 in 2022 before rising to 14,452 in 2023. Hypertensive visits decreased from 1.63% in 2021 to 0.61% in 2023, with no diabetes mellitus or CVD visits recorded throughout the years. Finally, Nabdam's attendance decreased from 17,948 in 2021 to 13,614

in 2023. Hypertensive visits increased from 1.06% in 2021 to 1.83% in 2023, while diabetic visit was from 0.01% in 2021 to 0.10% in 2023. No CVD patient visits were recorded in Nabdam during this period.

Table 13: CVD services utilisation among included health facilities

District	Indicator	2021	2022	2023
Talensi	Total OPD attendance	98726	96433	91993
	HPT patient visits	1062 (1.08%)	1189 (1.23%)	440 (0.48%)
	Diabetes mellitus patient visits	35 (0.04%)	7 (0.01%)	6 (0.01%)
	CVD patient visits	0 (0.00%)	0 (0.00%)	0 (0.00%)
District Hospital	Total OPD attendance	21853	25290	25789
	HPT patient visits	348 (1.59%)	629 (2.49%)	93 (0.36%)
	Diabetes mellitus patient visits	11 (0.05%)	3 (0.01%)	3 (0.01%)
	CVD patient visits	25 (0.11%)	14 (0.06%)	6 (0.02%)
Bolgatanga East	Total OPD attendance	14394	12937	14452
	HPT patient visits	234 (1.63%)	158 (1.22%)	0.61%
	Diabetes mellitus patient visits	0 (0.00%)	0 (0.00%)	0 (0.00%)
	CVD patient visits	0 (0.00%)	0 (0.00%)	0 (0.00%)
Nabdam	Total OPD attendance	17948	14776	13614
	HPT patient visits	190 (1.06%)	149 (1.01%)	249 (1.83%)
	Diabetes mellitus patient visits	2 (0.01%)	9 (0.06%)	13 (0.10%)
	CVD patient visits	0 (0.00%)	0 (0.00%)	0 (0.00%)

CHAPTER FIVE

DISCUSSION

5.0 Summary of Main Findings

The study found that all the included facilities offer cardiovascular health services. These services included health promotion, diagnosis and disease management. On the disease management, majority of the facilities (92.9%) offer hypertension management, a third (35.7%) offer CHD management while about half 57.1% offer diabetes management. Assessing the service availability using the SARA tool, the evidence suggests that only five facilities met the WHO service availability cut off score of 70% for cardiovascular disease management. The assessment reveals that only one facility i.e. the Talensi District Hospital was ready to offer cardiovascular health management services with a readiness index of 70.7%. All the other facilities did not meet the WHO requirement with an overall readiness index below 70%.

The study reveals a significant disparity in healthcare staffing between health centers and the hospital. General practitioners are available in only 7.1% of health centers, while specialized personnel like cardiologists and physiotherapists are entirely absent across all facilities. Nurses are present everywhere but are far fewer in health centers, with only 14.3% having more than 20 nurses.

Health centres provide services for common conditions like hypertension and diabetes (92.9%) but lack specialized care for coronary heart disease (35.7%), heart failure (35.7%), and stroke (28.6%), with dyslipidaemia management entirely absent. National CVD guidelines are inconsistently available, found in 76.9% of health centres but absent in the hospital, and only 42.9% of health centre staff have received CVD training in the past two years. These findings reveal insufficient decentralization of CVD care, with heavy reliance on the hospital for specialized services, limiting early detection and management at the

community level. Additionally, the lack of staff training underscores a need for improved professional development to enhance outcomes.

Essential medicines and diagnostics for CVD management are largely unavailable in health centres, with key drugs like clopidogrel and warfarin and diagnostic tools like ECGs and echocardiography only found in hospitals. While some health centres stock basic medications like aspirin and have glucometers, these are inadequate for comprehensive CVD care. This reliance on hospitals for advanced diagnostics and treatment delays care and worsens outcomes. Improving the supply chain for medicines and equipping health centres with essential diagnostic tools is crucial to strengthening primary care capacity.

Infrastructure in health centres is another area of concern. Functioning landlines, internet access, and ambulances are available in fewer health centres compared to the hospital. While electricity is available in all facilities, only 14.3% of health centres have backup generators, limiting resilience during power outages. Water supply is also uneven, with many health centres relying on external or less reliable sources. The lack of reliable communication and emergency transportation at health centres poses a significant risk to patient care, particularly for emergencies like acute cardiac events. Improved infrastructure, such as consistent power backup and reliable transportation systems, is essential to ensure seamless healthcare delivery.

The analysis of outpatient department (OPD) attendance from 2021 to 2023 reveals healthcare utilization patterns and gaps in managing non-communicable diseases (NCDs) across districts. Talensi experienced a decline in OPD visits, while Bolgatanga East and Nabdam showed fluctuating attendance, potentially influenced by community engagement. Hypertension (HPT) visits remained a small fraction of OPD cases, with Talensi declining from 1.08% in 2021 to 0.48% in 2023, whereas Nabdam rose to 1.83%, reflecting

inconsistencies in management. Diabetes mellitus visits were minimal across all districts, rarely exceeding 0.1%, indicating challenges in detection and awareness. Cardiovascular disease (CVD) visits were almost nonexistent, with the District Hospital recording a decline from 0.11% in 2021 to 0.02% in 2023, underscoring gaps in CVD diagnosis and care.

5.1 Types of cardiovascular disease services available at the selected health facilities

Cardiovascular disease services are available in all the facilities considered under this study. This is consistent with the Ghana Harmonized Health Facility Assessment 2022-2023 report which indicates that over 90% of the health facilities in Ghana have cardiovascular disease management services available (MoH et al., 2023). However, the results highlight a stark contrast between the district hospital and health centres regarding the availability of cardiovascular services. The observed disparities in service availability reflect the broader inequities in healthcare provision between district hospitals and health centres. The Talensi District Hospital achieved a service availability score of 90%, underscoring its role as the primary provider of advanced and comprehensive healthcare services in the region. In contrast, health centres such as Biung, Datuko, and Duusi scored as low as 20%, indicating a lack of essential medical services, trained personnel, and diagnostic tools. Also, facilities such as Sakote, Nangodi, and Gambibgo Health Centres score between 40% and 50%, indicating that while some basic services might be available, they lack the resources and capabilities for more comprehensive care. These findings corroborate previous studies highlighting the limited capacity of primary healthcare facilities to manage non-communicable diseases (Hinneh et al., 2024; Ayanore et al., 2022; Nyarko et al., 2019). It also aligns with national SARA assessments, which have reported average service availability of 80% in hospitals and 50% in primary healthcare centres (WHO, 2018). Similar trends have been observed in other sub-Saharan African countries, where community health centres face major infrastructural

and human resource constraints in NCD management (Addo et al., 2018; Nyarko et al., 2019).

Additionally, previous SARA reports by Nyarko et al. (2019) and WHO (2018) highlight how over-reliance on hospitals, due to poor health centre capacity, leads to delayed diagnoses, increased patient burdens, and declining quality of care, similar to the issues identified in the Talensi District Hospital. The findings also resonate with the study by Dzudie et al. (2017), who reported that primary health centres in sub-Saharan Africa often lack essential diagnostic tools, resulting in suboptimal cardiovascular care and misdiagnosis. The implications of this disparity are significant. Patients in rural or underserved areas may face barriers in accessing timely and adequate cardiovascular care. This can result in delayed diagnoses and complications, with patients relying heavily on the district hospital for specialized interventions.

5.2 Cardiovascular disease service readiness at the selected health facilities

From the study, the cardiovascular disease service readiness index further underscores significant gaps in the preparedness of health facilities to provide comprehensive care. While the Talensi District Hospital met the 70% readiness benchmark, most facilities scored below this threshold, with readiness indices ranging from 32.2% (Winkogo Health Centre) to 60.4% (Zuarungu Health Centre). This variation is consistent with findings by Ayanore et al. (2022), which report an average readiness score of 78% for health centres and 92.8% for hospitals in Ghana. Similar results have been documented in studies conducted in other sub-Saharan African countries, where readiness for NCD care, including CVD services, remains suboptimal due to financial and logistical constraints (Oyekale, 2019; Nyaaba et al., 2020). The results obtained are also in line with Doku et al. (2023), which highlighted the absence of equipment for timely CVD emergency diagnosis, inadequate management and monitoring of CVD care at all healthcare levels, and the lack of standardized protocols for CVD

management. The results obtained are consistent with a study conducted by Doku et al. (2023), which highlighted the absence of equipment for timely CVD emergency diagnosis, inadequate management and monitoring of CVD care at all healthcare levels, and the lack of standardized protocols for CVD management. Similar findings have been reported in Nigeria and Kenya, where low readiness scores among primary health facilities have resulted in delayed diagnosis and poor management of CVDs (Olack et al., 2015; Ojo et al., 2020). However, the findings of this study on readiness of the facilities to offer cardiovascular disease management services is inconsistent with a similar study conducted in Ghana by Hinneh et al., (2024). Hinneh et al concluded that all the health facilities are ready to offer cardiovascular disease management services. This variation from our study is due to the inclusion of only district hospitals in the Hinneh et al's study. The district hospitals often are referral facilities for hospitals, clinics and health facilities within the district. Our study considered a district hospital and health centers which are primary level of care. It is therefore not surprising that Hinneh et al realised that all the facilities were ready. Additionally, the results obtained indicates that the facilities considered fall below the average national health service readiness score for health centers as established by (Ayanore et al., 2022). From Ayanore et al, the average readiness score for health centers in Ghana is 78%, hospitals was 92.8%, whereas CHPS compound was 64.3%. This calls for urgent intervention from stakeholders.

The results obtained indicated a plethora of issues with cardiovascular services among health facilities included in this study. Firstly, we observed reduced score on trained staff available to carry out these services. It was observed that some health facilities such as Biung health center scored 12.5% and the highest scores 62.5% for the Talensi District hospital. The availability of trained staff is essential for delivering effective cardiovascular services, ensuring accurate diagnosis, timely treatment, and proper management of conditions. Skilled

personnel improve patient outcomes by addressing the growing burden of cardiovascular diseases with expertise and precision. Their presence is crucial for implementing preventive measures and reducing morbidity and mortality rates.

The availability of essential drugs is critical for effective cardiovascular care, enabling timely treatment and management of conditions like hypertension and heart disease. These medications help prevent complications, improve patient outcomes, and reduce mortality rates. Ensuring a consistent supply of essential drugs supports the delivery of comprehensive and equitable cardiovascular services. The included health facilities had poor score on essential drugs for management of cardiovascular diseases. Some health centers such as Datuko Health center had 0% and the highest had 41.2% for Talensi District Hospital. Additionally, the facilities had poor capacity to diagnose cardiovascular disease with two health centers scoring 0.0% and 50% in Talensi District Hospital. The findings from this study corroborates the study by Atiga et al that there are challenges with medical commodity for both public and private health facilities (Atiga et al., 2023). This highlights a huge gap in the ability of the health facilities to diagnose cardiovascular diseases which may subsequently lead to delayed diagnoses and increased cases or burden of cardiovascular diseases.

Most facilities had good score on the availability of communication equipment for majority of facilities. This reflects the importance the health facilities place on communication. The communication between health facilities would influence quick referrals and rapid response to emergencies. It is therefore not surprising that three facilities had excellent score of 100% for the availability of Emergence transport services. Nonetheless some that is four health centers scored 0% on the availability of emergency transportation. This could impair the transfer of critically ill patients to high facilities for proper care. At the hospitals, power supply is critical for some equipment to function, emergency procedures lightening, cold chain management and security from the results, only three facilities had good score for

Power supply. However, the remaining health centers had low score for power supply and all but one had poor score of 0% for improved water supply. All facilities scored good or excellent for basic health equipment such as stethoscope, weight scale, thermometer etc.

Several facilities, such as Biung Health Centre (38.3%), Datuko Health Centre (39.7%), and Duusi Health Centre (46.6%), have readiness scores far below the acceptable threshold. These low scores suggest critical deficiencies in the availability of trained healthcare providers, diagnostic tools, medications, and general infrastructure necessary for the effective management of cardiovascular diseases.

The results obtained are consistent with a study conducted by Doku in 2023 which highlighted the absence of equipment for timely CVD emergency diagnosis, inadequate management and monitoring of CVD care at all healthcare levels, and the lack of standardized protocols for CVD management (Doku et al, 2023). These findings have profound implications for the management of cardiovascular diseases in the assessed facilities. Firstly, the low readiness scores in most facilities imply that patients may face challenges in accessing timely and effective care for CVD. This could result in delayed diagnoses, poor disease control, and worse clinical outcomes, including higher morbidity and mortality rates. Secondly, the disparity in readiness across facilities highlights inequities in healthcare service delivery. Patients in rural or under-resourced areas may have to travel long distances to access better-equipped facilities like Talensi District Hospital, which could lead to financial and logistical burdens for already vulnerable populations.

Lastly, these gaps in readiness underscore the need for targeted investments in health system strengthening. This includes the training of healthcare providers in CVD management, improving diagnostic and therapeutic capacity, and ensuring a consistent supply of essential medicines and equipment. Addressing these gaps is essential not only for improving

cardiovascular outcomes but also for building a more resilient healthcare system capable of managing the growing burden of non-communicable diseases.

5.3 Level of Cardiovascular disease service utilization in selected health facilities

The utilization of CVD services was notably low across the studied districts, despite an increasing burden of cardiovascular diseases in Ghana. The proportion of outpatient department (OPD) visits for hypertension, diabetes mellitus, and CVD remained minimal, with hypertension visits ranging between 0.48% and 1.83%, diabetes mellitus visits never exceeding 0.1%, and CVD visits either declining or absent in most facilities. This underutilization is inconsistent with the estimated pooled prevalence of CVD in Ghana, reported at 10.3% (Doku et al., 2024), suggesting significant under diagnosis and misclassification of cases. These findings align with previous research on healthcare utilization trends in Ghana, which highlight barriers such as low disease awareness, financial constraints, and geographic inaccessibility as contributing factors to underutilization (Atiga et al., 2023; Dapaah & Nachinaab, 2019; Agyei-Baffour et al., 2018). Similar findings have been reported in South Africa, where limited access to primary care services has contributed to underutilization and late presentation of CVD cases (Gómez-Olivé et al., 2017).

5.4 Implications for CVD Management

The disparities in service availability and readiness have far-reaching implications for CVD management. The lack of trained healthcare providers, inadequate diagnostic tools, and limited essential drug availability impede timely diagnosis and intervention, increasing the risk of poor health outcomes. These findings are consistent with Doku et al. (2023), who highlighted the absence of equipment for timely CVD emergency diagnosis and inadequate disease monitoring systems in Ghanaian health facilities. Similarly, Heller et al. (2019) report that shortages in trained healthcare personnel, particularly in rural settings, contribute to delayed diagnoses and poor management of CVDs.

The observed gaps in emergency transport services, power supply, and essential medication availability further compound these challenges, increasing patient reliance on district hospitals for specialized care (Atiga et al., 2023; Dapaah & Nachinaab, 2019). Similar trends have been reported in other African settings, where poor health system readiness for NCD care has been linked to increased mortality and worsening disease burden (Haregu et al., 2015; Bovet et al., 2021). This situation has also been documented in Tanzania and Ethiopia, where limited emergency referral systems and poor road infrastructure have hindered timely access to specialized care for CVD patients (Berhe et al., 2021; Otieno et al., 2020).

These findings underscore the urgent need for targeted interventions to improve CVD service delivery at all levels of care. Strengthening health centres by equipping them with essential diagnostic tools, medications, and trained personnel can reduce the burden on district hospitals and improve accessibility to care. According to the World Bank (2020), strengthening the referral system and decentralizing cardiovascular care to primary health centres could enhance service delivery and reduce the burden on district hospitals. Furthermore, strategic investments in telemedicine, referral systems, and continuous medical education for healthcare providers could enhance early detection and management of CVDs (Ogedegbe et al., 2014; Vedanthan et al., 2017). Addressing these gaps is essential not only for improving cardiovascular outcomes but also for building a more resilient healthcare system capable of managing the growing burden of non-communicable diseases.

5.5 Strengths of the study

This study has a number of strengths which are outlined as follows. The study addresses an important aspect of healthcare; cardiovascular disease (CVD) service availability and readiness at a time when non-communicable diseases are becoming a growing public health burden in Ghana.

Unlike previous studies that focus solely on the presence of CVD services, this study evaluates both service availability and the readiness of facilities to effectively manage cardiovascular diseases. This provides a more in-depth understanding of healthcare system capacity.

The study also employs the WHO Service Availability and Readiness Assessment (SARA) tool, ensuring a systematic and internationally recognized framework for evaluating CVD services. This enhances the comparability of findings with similar studies globally.

These strengths make the study a valuable contribution to healthcare system strengthening and CVD management in Ghana.

5.6 Limitations of the study

The study focuses on public health facilities in only three out of fifteen districts, which may not fully represent the cardiovascular disease (CVD) service availability and readiness across the entire region. The findings may not be applicable to districts with different healthcare infrastructure, population demographics, or resource allocation.

By assessing only public health facilities, the study does not capture the contributions of private and faith-based healthcare providers, which play a significant role in healthcare delivery in Ghana. The exclusion of these facilities may result in an incomplete picture of CVD care availability and readiness.

Finally, the study is cross-sectional; it only provides a snapshot of service availability and readiness at a specific point in time. This limits the ability to assess trends over time or determine causality between health system factors and CVD care outcomes.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.0 Conclusion

This analysis highlights gaps in service delivery, diagnostic capacity, medicine availability, and staff distribution between health centres and the hospital. Targeted interventions are required to improve cardiovascular care access and quality across all facilities.

The results reveal a significant disparity between the district hospital and health centres in terms of cardiovascular services. The hospital's higher service score underscores its role as the main provider of advanced and comprehensive care in the region. In contrast, health centres, such as Biung, Datuko, and Duusi, score as low as 20%, indicating they are ill-equipped to manage cardiovascular diseases, which necessitate specialized services, medications, and diagnostic tools.

Most health facilities included in this study had poor service readiness index. Apart from the Talensi District Hospital which passed the WHO SARA index for service readiness, all other health facilities failed. This highlights the significant gap that exist between the district hospitals and the health centers. Considering the proximity of the health facilities to the community, there is the need to equip and enhance the health centers to provide essential cardiovascular care services. This would reduce the burden of cardiovascular diseases in Ghana.

The level of CVD utilisation is expected to be statistically like the burden of the diseases. There is therefore underutilisation of CVD services among these included health facilities. This situation is a public health canker and may consequently result in under diagnosis, misclassification, and limited specialized services, emphasizing the need for improved detection, management, and reporting of CVDs.

6.1 Recommendations

6.1.1 Policy recommendation

The findings indicate a need for strategic policy intervention to bridge the gap between health centres and hospitals. Key policy recommendation includes:

- **Infrastructure Investments**: considering the poor infrastructure score, upgrading existing communication, transportation, and utility systems in health centres by the Ministry of Health, NGO's such as USAID is vital to support efficient service delivery.

6.1.2 Research recommendations

This study has identified several gaps that exist in assessing health systems in Ghana. The findings of this study bring to bear critical research areas to address the high burden of CVD in Ghana. Some key research recommendations are:

- **Intervention:** Researchers should focus attention on investigating the impact of interventions that employ co-creation and co-design approach to address the low overall readiness index of health facilities towards CVD care.
- **Cost assessment:** Researchers should estimate the cost impact of the low overall readiness index and poor CVD service utilisation on CVD-related mortality and morbidity.
- **Strategies:** Future research should explore strategies to improve CVD detection and management at the primary healthcare level to ensure early intervention and better health outcomes in Ghana.

6.1.3 Public Health recommendations

Considering the poor CVD service utilisation, there is a need to educate the public on some cardiovascular complication signs and symptoms and the need to seek early care to prevent severe morbidities and mortalities.

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APPENDIX 1: PARTICIPANT INFORMATION SHEET

Project Title: Assessing Service Availability and Readiness for Cardiovascular Disease Care in selected health facilities in the Upper East Region**.**

Principal Investigator: Aboyah Matthew Ayinnongmah **Address**: School of Public Health, University of Ghana Email: maboyah@gmail.com

Contact: 0243341160/0502604023

Introduction/Purpose of study

This study seeks to assess the readiness of health facilities in the selected districts to provide cardiovascular disease care services.

The specific objectives to address the general objective are.

1. To determine the nature and type of CVD services available at the various health facilities in selected health facilities in the Upper East Region.
2. To assess the nature and type of CVD services ready for patient care at the various health facilities in selected health facilities in the Upper East Region.
3. To evaluate the level of CVD service utilization at the various health facilities in selected health facilities in the Upper East Region.

Study Procedure

This study will employ a cross-sectional study design using quantitative methods to assess the readiness of health facilities in the selected districts to provide cardiovascular disease care services. The population for this study will be the heads of the selected health facilities in the three districts. The health facilities will include health centers, clinics and hospitals.

A structured questionnaire, which consists of a standardized closed-ended questions worded in a specific way, asked in a set of chronological manner which requires participants of the study to choose from a set of already provided answers will be used to collect data for this study.

The estimated time to participate in this study is about forty-five minutes. The participants are expected to provide appropriate responses to the questions.

Potential Risks

There is minimal risk involved in participating in the study and the data collected.

Benefits

The benefit of the study will be the generation of relevant information on the availability and readiness of health facilities to provide cardiovascular disease services which will inform all stakeholders on the areas that need strengthening.

Cost

There will be no cost incurred since participants will be selected during their time at work.

Confidentiality

Information from you will be protected with due diligence.

Your name would not be provided on the questionnaire and the information obtained will not be shared with any third party except my supervisor who may access my records.

Compensation

There will be no compensation to participants for their participation in the study.

Voluntary participation/withdrawal

This study is strictly voluntary. Should you at any point during the study decide not to participate any further, you are free to terminate your participation of which you will not be penalized for terminating your participation. You will be duly informed of any change in information that may arise in course of the study.

Who to Contact for Further Clarification/Questions:

You may contact the principal investigator (Aboyah Matthew Ayinnongmah) on 0243341160, email: maboyah@gmail.com or my supervisor (Dr. Leonard Baatiema) on 0541230757, email:leobaatiemai@ug.edu.gh if you need any further information and explanation about this study. Also, you can contact the Chair of the Navrongo Health Research Center Institutional Review Board on 0591152102, or email: nhrcirb@gmail.com for further clarification on ethical issues.

APPENDIX 2: CONSENT FORM

Project Title: Assessing Service Availability and Readiness for Cardiovascular Disease Care in selected health facilities in the Upper East Region**.**

PARTICIPANT'S STATEMENT

"I have read or have had someone read all of the above, asked questions, received answers concerning areas I did not understand, and am willing to give consent for me, my child/ward to participate in this study. I will not have waived any of my rights by signing this consent form. Upon signing this consent form, I will receive a copy for my personal records."

Name:_____

Signature/thumbprint of participant/his/her Legal representative

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Witness to Consent Procedures **(Anybody who is not affiliated with the study)**

Name:
Signature
Investigator or attending Health Care Professional's Affidavit

Include the following statement:

"I certify that I have explained to the above individual(s) the nature and purpose of the study, potential benefits and possible risks associated with the participation in this research project. I have answered any questions that have been raised and have witnessed the above signature on the date indicated below**"**

Name: _____

Signature: Date:

APPENDIX 3: QUESTIONNAIRE

Questionnaire to Assess the Service Availability and Readiness for Cardiovascular Disease care in Selected Health Facilities in the Upper East Region.

Dear Respondent,

Your facility was selected to participate in this study. We will be asking you questions about the Service Availability and Readiness for Cardiovascular Disease care in your facility. This is purely for academic purposes and your responses shall be kept in strict confidence and will not be disclosed to anyone. Neither your name nor that of any other health worker respondents participating in this study will be included in the dataset or in any report. I am seeking your assistance to ensure that the information we collect is accurate. You may refuse to answer any question or choose to stop the interview at any time. However, we hope you will answer the questions, which will benefit the services you provide and the nation. If there are questions for which someone else is the most appropriate person to provide the information, we would appreciate if you introduced us to that person to help us collect that information. At this point, do you have any questions about the study? Do I have your agreement to proceed? _2024.

Contact the researcher.

Aboyah Matthew Ayinnongmah (0243341160/ 0502604023)

Section 1: General Information

Facility Identification

Facility Name:
Facility ID:
Location:
District:

Type of Facility (e.g., Hospital, Clinic, Health Centre): Ownership (e.g., Public)

2 Respondent's Information

Name: Position:

Contact Information: Date of Assessment:

MODULE 1: SERVICE AVAILABILITY		
SECTION 2: STAFFING		
I have a few questions on staffing for this facility. Please tell me how many staff with each of the following qualifications are currently assigned to, employed by, or seconded to this facility. Please count each member only once.	(A) ASSIGNED/EMPLOYED/SECONDED	(B) PART TIME
General practitioner (Doctor)		
Cardiologist		
Nurses		
Public health worker or health educator		
Pharmacist		
Laboratory technician		
Physiotherapist		

CVD SERVICES AVAILABLE (SELECT ALL THAT APPLY):		
Hypertension management	YES.....	1
	NO.....	2
Coronary heart disease management	YES.....	1
	NO.....	2
Heart failure management	YES.....	1
	NO.....	2
Diabetes mellitus	YES.....	1
	NO.....	2
Stroke management	YES.....	1
	NO.....	2
Dyslipidaemia management	YES.....	1

	NO..... 2
Others (please specify):	
For each, indicate the type of service provided, i.e. Health promotion, disease prevention, diagnosis, treatment rehabilitation/long-term care	

MODULE 2: SERVICE READINESS

SECTION 3: GUIDELINES AND PROTOCOLS

Do providers in this facility diagnose and/or manage cardiovascular diseases such as hypertension in patients?	YES, OBSERVED .....1 YES, REPORTED NOT SEEN ..... 2 NO.....3
Do you have the national guidelines for the diagnosis and management of cardiovascular diseases available in this facility today? IF AVAILABLE, ASK TO SEE THE DOCUMENT	YES..... 1 NO..... 2
Have you or any provider(s) of CVDs services received any training in the diagnosis and management of CVDs in the last two years.	YES..... 1 NO..... 2

SECTION 4: MEDICINES AND COMMODITIES

I would like to know if the following medicines are available today in this facility. I would also like to observe the medicines that are available. If any of the medicines I mention is stored in another location in the facility, please tell me where in the facility it is stored so I can go there to verify.

Are the following medicines available at the facility?

ACE inhibitors	
Benazepril	YES..... 1 NO..... 2
Enalapril	YES..... 1

	NO.....	2	
Captopril	YES.....	1	
	NO.....	2	
Nazepril	YES.....	1	
	NO.....	2	
Lisinopril	YES.....	1	
	NO.....	2	
Ramipril	YES.....	1	
	NO.....	2	
Antiplatelet agents			
Aspirin	YES.....	1	
	NO.....	2	
clopidogrel	YES.....	1	
	NO.....	2	
Lipid-lowering agents (e.g., statins)			
Atorvastatin	YES.....	1	
	NO.....	2	
Simvastatin	YES.....	1	
	NO.....	2	
Calcium Channel blockers			
Amlodipine, Nifedipine, Felodipine, Nicardipine	YES.....	1	
	NO.....	2	
Anticoagulation Drugs			
Warfarin, Heparin	YES.....	1	
	NO.....	2	
Diuretics			
Furosemide	YES.....	1	
	NO.....	2	
Other essential CVD medications (please specify):			

	SECTION 5: DIAGNOSTICS	A) Available		B) Functioning		
		Yes	No	Yes	No	Don't know
	I would like to know if the following diagnostic tests and associated equipment are available today in this facility.					
01	Electrocardiogram (ECG) machines	1	2	1	2	6
02	Echocardiography	1	2	1	2	6
03	Ultrasound equipment	1	2	1	2	6
04	X- ray machine	1	2	1	2	6
05	CT scan	1	2	1	2	6
07	Cholesterol POCT,	1	2	1	2	6
08	Laboratory facilities for lipid profile	1	2	1	2	6
09	Glucometer POCT	1	2	1	2	6
10	Others (please specify):	1	2	1	2	6

SECTION 6: INFRASTRUCTURE

This section will focus on questions related to infrastructure

COMMUNICATIONS

Does this facility have a functioning land line telephone that is available to always call outside client services are offered? CLARIFY THAT IF FACILITY OFFERS 24-HOUR EMERGENCY SERVICES, THEN THIS REFERS TO 24-HOUR AVAILABILITY.	YES.....	1
	NO.....	2
Does this facility have a functioning cellular telephone or a private cellular phone that is supported by the facility?	YES.....	1
	NO.....	2
Does this facility have a functioning computer?	YES.....	1
	NO.....	2
Is there access to email or internet within the facility today?	YES.....	1
	NO.....	2

AMBULANCE/TRANSPORT FOR EMERGENCIES

Does this facility have a functional ambulance or othe	YES.....	1

vehicle for emergency transportation for clients that is stationed at this facility or operates from this facility?	NO..... 2
Does this facility have access to an ambulance or other vehicle for emergency transport for clients that is stationed at another facility or that operates from another facility in near proximity?	YES..... 1 NO..... 2
POWER SUPPLY	
Does your facility have electricity from any source (e.g. electricity grid, generator, solar, or other)	YES..... 1 NO..... 2
What is the facility's main source of electricity?	NATIONAL GRID .....1 GENERATOR..... 2 SOLAR SYSTEM.....3 OTHER (SPECIFY).....96
Other than the main or primary source, does the facility have a secondary or backup source of electricity? IF YES What is the secondary source of electricity?	NO SECONDARY SOURCE.....0 CENTRAL SUPPLY OF ELECTRICITY (e.g. national or community grid).....1 GENERATOR (FUEL OR BATTERY-OPERATED GENERATOR) ..... 2 SOLAR SYSTEM..... 3 OTHERS 96
If facility has a generator, is the generator functional?	YES ..... 1 NO..... 2 DON'T KNOW 98
If the facility uses solar, is the solar system functional?	YES, FUNCTIONING..... 1 PARTIALLY, BATTERYNEEDS SERVICING/REPLACEMENT.....2 NO, NOT FUNCTIONAL .....3 DON'T KNOW 98
WATER SUPPLY	

What is the commonly used source of water for the facility currently?	PIPED INTO FACILITY ..... 1 PIPED ONTO FACILITY GROUNDS ..... 2 PUBLIC TAP/STANDPIPE .....3 TUBEWELL/BOREHOLE ..... 4 PROTECTED DUG WELL .....5 UNPROTECTED DUG WELL ..... 6 PROTECTED SPRING.....7 UNPROTECTED SPRING.....8 RAINWATER COLLECTION ..... 9 BOTTLED WATER ..... 10 CART W/SMALL TANK/DRUM11 TANKER TRUCK ..... 12 SURFACE WATER ..... 13 OTHERS _____96 (SPECIFY) DON'T KNOW .....98 NO WATER SOURCE.....00

BASIC EQUIPMENT

Please tell me if the following basic equipment and supplies used in the provision of client services are available and functional in this facility	**A) Available**		**B) Functioning**		
	Yes	No	Yes	No	Don't know
Electrocardiogram (ECG) machines	1	2	1	2	6
Oxygen supply	1	2	1	2	6
Sphygmomanometer	1	2	1	2	6
Adult weighing scale	1	2	1	2	6
Height scale	1	2	1	2	6
Thermometer	1	2	1	2	6
CT scan	1	2	1	2	6
Hemoglobin (Hb) meter	1	2	1	2	6
Cholesterol POCT	1	2	1	2	6

Laboratory facilities for lipid profile	1	2	1	2	6
Glucometer POCT	1	2	1	2	6
Beds for CVD patients	1	2	1	2	6
Stethoscope	1	2	1	2	6

APPENDIX 4: ETHICAL CLEARANCE

Navrongo Health Research Centre
Institutional Review Board (NHRCIRB)
Research & Development Division
Ghana Health Service
Post Office Box 114
Navrongo, UER – Ghana.

+233591152102 irb@navrongo-hrc.org nhrcirb@gmail.com UK-0043-7777

8 October 2024

My Ref.....

Your Ref.....

Mr. Matthew Ayinnongmah Aboyah
C/O BOX 329,
BOLGATANGA

ETHICS APPROVAL ID: NHRCIRB659

Dear Mr. Aboyah,

Approval of Protocol titled "Assessing Service Availability and Readiness for Cardiovascular Disease Care in Selected Health Facilities in The Upper East Region".

I write to inform you that the Navrongo Health Research Centre Institutional Review Board (NHRCIRB) has reviewed your protocol and is happy to grant you approval.

The following documents were reviewed and approved;

- Study Protocol version1.0 dated 12/08/2024
- Participant Information Sheet and Consent Form version 1.0 dated 12/08/2024
- Study Questionnaire version 1.0 dated 12/08/2024
- CVs of Investigators (Mr. Matthew Ayinnongmah Aboyah and Dr. Leonard Baatiema)

Please, note that any amendment to these approved documents must receive prior NHRCIRB approval before implementation. This approval expires on **7th October 2025.**

Kindly submit the findings of your study to the NHRCIRB before the expiration of this approval.

The Board wishes you all the best in your study.

Thank you.

Sincerely,

Dr. Thomas Anyorigiya

(Ag. Chairman)

Cc: The Director, NHRC, Navrongo