



**DETERMINANTS OF CARDIOVASCULAR DISEASES AND INTERVENTIONS
ADDRESSING CARDIOVASCULAR DISEASE AND RISK FACTORS IN SIERRA
LEONE**

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by

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ABSTRACT

Introduction

Sierra Leone is one of the least developed countries in the world facing a double burden of diseases. Communicable diseases are the leading cause of morbidity and mortality in the country, however, the cardiovascular disease (CVD) mortality rate surpasses that of the sub-Saharan Africa region, where 80% of CVD mortality occurs. This study aims to describe the determinants of CVD and analyse interventions that address CVD and risk factors in Sierra Leone.

Methodology

This is a literature review that employs a systematic approach in searching for peer-reviewed articles and grey literature in English from 1990 to 2023. Databases and search engines include the VU online library, Google Scholar, PubMed/Medline, and Google along with relevant websites such as the Ministry of Health and Sanitation in Sierra Leone and WHO. Key search terms were "Cardiovascular disease", "Determinants", "Interventions" and "Sierra Leone". These search terms were derived from the "Comprehensive Strategy to address cardiovascular disease" framework that was chosen for its comprehensive approach to the analysis of CVD interventions.

Results

The result shows that urbanization, cultural beliefs, and social networks are common distal determinants that are linked to the prevalence and control of CVD and risk factors. The use of smokeless tobacco as a proximal CVD determinant was reported more among women. In terms of interventions, many implemented strategies including focused health education, primary care clinics, and health in all policies approaches reported improvement in CVD and risk factors.

Discussion

This study highlights many determinants and interventions that influence CVD control in Sierra Leone. Cultural beliefs and social networks are very important determinants that impact how Sierra Leoneans understand the onset and management of CVD. Interventions for CVD control in Sierra Leone should therefore focus on target health education campaigns to combat the low knowledge of CVD and risk factors in the country. The Ministry of Health and Sanitation in Sierra Leone should develop strategies that focus on targeted mass media campaigns and primary care management of CVD and risk factors.

KEYWORDS: Cardiovascular disease, Determinants, Interventions, Sierra Leone

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BMI: Body mass index.....	16
CHOs: Community health officers.....	22
CHWs: Community health workers.....	18
CMNN: Communicable, maternal, neonatal, and nutrition.....	4
CVDs : Cardiovascular diseases.....	v
DALYs: Disability-adjusted life years.....	4
FBOs: Faith-based organisations.....	49
FCTC: Framework Convention on Tobacco Control.....	23
IHME: Institute for Health Metrics and Evaluation.....	5
LMICs: Low- and middle-income countries.....	5
MAFFS: Ministry of Agriculture, Forestry and Food Security.....	26, 49

MBSSE: Ministry of Basic and Senior Secondary Education	49
MDAs: Ministries, Departments and Agencies	49
MIC: Ministry of Information and Communications.....	49
MoHS: Ministry of Health and Sanitation	3
NCDs : Non-communicable diseases.....	v
NGOs: Non-governmental organisations.....	49
PEN: Package of essential non-communicable (.....	20
SARA: Service Availability and Readiness Assessment.....	12
WHO: World health organization	5

KEY TERMS

Cardiovascular diseases (CVDs): are group of disorders that account for the largest component of non-communicable diseases (NCDs). Heart attack and stroke are the most common types of CVDs. Many factors such as behavioral, cardiometabolic/biological, environmental, and social risk factors significantly contribute to the development of CVDs in the world (Boudreaux et al., 2022; Mensah, Roth & Fuster, 2019; Roth et al., 2020).

Determinants of CVD: These are defined as factors that influence the development of CVD. According to Fuster and Kelly (2010), determinants are divided into distal and proximal determinants. Distal determinants of CVD include globalization and demographic change, cultural and social norms, education, health inequality, and social determinant; proximal determinants are mostly behavioural and biological risk factors of CVD. Behavioural risk factors are tobacco and alcohol use, unhealthy diet, and physical inactivity which are significantly associated with the development and control of biological risk factors such as high blood pressure, high cholesterol and obesity, and high blood glucose. (Fuster & Kelly, 2010) Both behavioural and biological risk factors contribute to the development and control of CVD such as heart attacks and stroke. (Primatesta et al., 2001; Esteche et al., 2021; Fuster & Kelly, 2010).

Primary Health Care: is considered the most effective strategy to chronic diseases. This covers a person's physical, mental, and social well-being throughout their lifetime. It usually includes palliative care, disease prevention, treatment, and promotion (Behera, Prasad & Shyambhavee, 2022)

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INTRODUCTION

I am a Physician Specialist in Internal Medicine/Cardiology at the Ministry of Health and Sanitation in Sierra Leone. My work is primarily in two areas; the clinical management of Internal Medicine-related diseases, especially cardiovascular diseases, and the health administration of the internal medicine department at Jui Hospital. In my role as the head of the department, I was responsible for leading the clinical team, running health administrative tasks such as role assignments of clinicians and monitoring routine medical practices, as well as representing my department at national health-related meetings.

After four years of practicing as a Specialist, I realized the constraints of delivering health care in a resource-challenged setting are beyond the hospital setting and I knew my clinical skills were not enough to address the burden of chronic diseases. Chronic cases of HIV, Diabetes, Stroke, coronary heart diseases, and cardiovascular risk conditions such as uncontrolled hypertension and type 2 diabetes mellitus were the most common cases referred from the rural part of Sierra Leone to the medical department at Jui Hospital. So, I decided to engage in continuous professional development to acquire skills for innovative interventions.

I started in 2021. I was selected as one of 22 Specialists in Africa to embark on the first Heart Failure course sponsored by the Pan-African Society of Cardiology in collaboration with Cardiff University in the United Kingdom. In that course, I learned a multidisciplinary approach to managing heart failure in a resource-poor setting like Sierra Leone. At the end of the course, I was able to establish a multidisciplinary team of a doctor, a nurse, and a pharmacist to run a weekly heart failure clinic. However, I realized I needed to answer more questions beyond hospital-based interventions. This was the reason why I embarked on an MPH program at KIT Royal Tropical Institute and chose a thesis topic that provides a comprehensive approach to addressing CVD in Sierra Leone.

In Sierra Leone, the proportional mortality of CVD has increased in the past decade while communicable diseases' proportional mortality is declining but still remains the leading cause of death in the country (IHME, 2015). Moreover, the total absolute burden of CVD has increased, due to the combined effect of population growth and ageing of the population in Sierra Leone. However, the global allocation of resources for NCDs remains low even with the current threat it poses to the already fragile health system (Nugent, 2016). There is a paucity of implemented and scaled-up CVD interventions in Sierra Leone. This thesis reviews and analyzes the determinants of CVD and interventions to address CVD in Sierra Leone.

Chapter 1: BACKGROUND

This section describes the country's Demographic data, Socioeconomic and educational status and Health System

1.1 DEMOGRAPHICS OF SIERRA LEONE

Sierra Leone is a sub-Saharan African country located in the western part of Africa bordered by Guinea, Liberia, and the Atlantic Ocean (figure 1) (Statistic Sierra Leone, 2017).

Figure 1: Map of Sierra Leone depicting the four regions and 16 districts

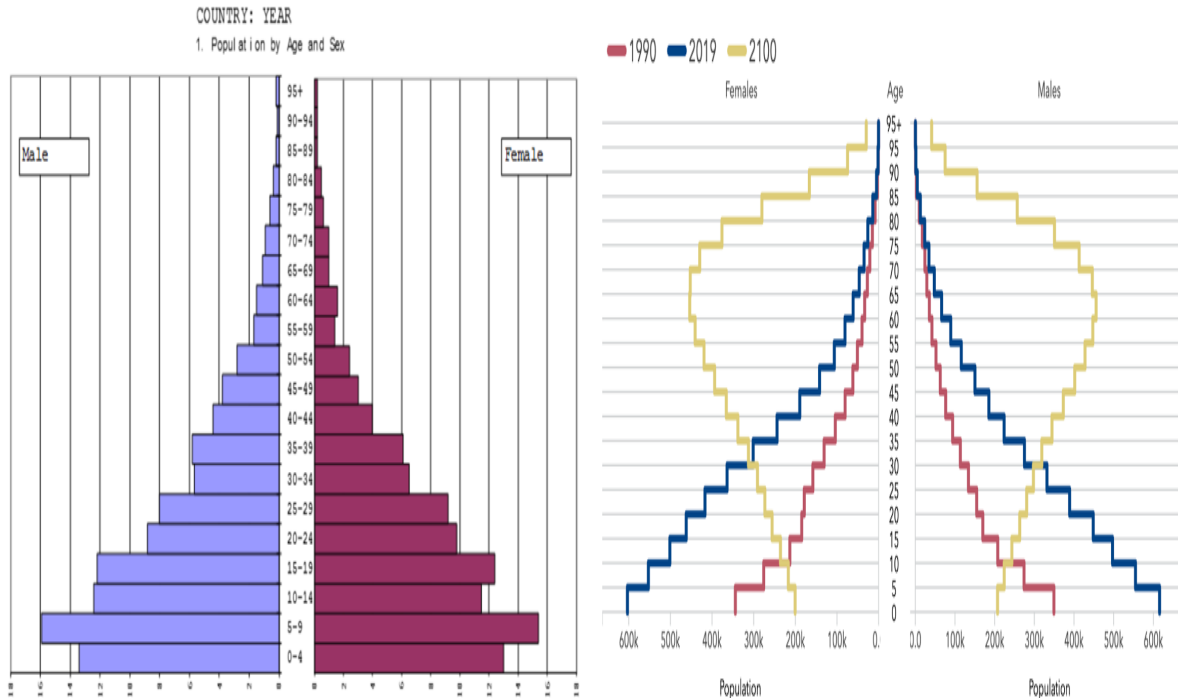


(Map of Sierra Leone, 2023)

It is a small country with a population size of about eight million in 2021 (Statistic Sierra Leone, 2021, 2017). Sierra Leone is a constitutional republic with a single house of Parliament and an elected president. The country has four regions (Western, Eastern, Southern, and Northern), 14 districts, 149 chiefdoms, and 12 wards (see Figure 1 above). Freetown is the main city and the economic centre where the central government seats; it is situated in the western part of the country and has a population of about 1 million people. Muslim religion (77%) accounts for the largest religion in Sierra Leone followed by Christianity (21.9%). Sierra Leone has about 20 ethnic groups and most people speak Krio, the common language. However, the official language is English (Statistic Sierra Leone, 2017). In 2015, more than half of the population

was below the age of 20 years old with an almost equal share of the sex ratio illustrated in Figure 2 below. (Statistic Sierra Leone, 2017, 2021).

Figure 2: Population pyramid in 2015 (left) and future age distribution in Sierra Leone(right)



(Statistic Sierra Leone, 2017, 2021; IHME, 2015)

However, the projected age distribution is changing, favouring an ageing population on the right diagram above (IHME, 2015). The trend of life expectancy in Sierra Leone is also rapidly increasing; the life expectancy at birth increased in Sierra Leone by 12 years from 2000 to 2019 compared to an increase of 6.7 in Guinea, 7 in Ghana and a global increase of 6.52 years (WHO, 2019c, 2019a, 2019b). The annual growth rate was reported to be 3.2% between 2004-2015. The western area rural has the highest growth rate of 8.5% and the lowest doubling time of 8 years in the country (Statistic Sierra Leone, 2017).

1.2 SOCIOECONOMIC AND EDUCATIONAL STATUS

In 1961, Sierra Leone declared its independence from the United Kingdom. A one-party state ruled for 28 years, leading to ten years of war from 1991 to 2002. The war resulted in economic and infrastructural collapse with thousands of lives lost (Kaldor & Vincent, 2006). Because of the effect of the war, Sierra Leone is still ranked among the least developed countries in the world (ranked 181 out of 184 countries) (MoHS, 2020b; The Sierra Leone NCDI Poverty Commission Report, 2020). The poverty rate in 2018 was 57% with large disparities across the country. The northern region account for the largest (77 per cent); Freetown has the least poverty rate of 23 per cent followed by 49 per cent in other urban areas to 74 per cent in rural areas (World bank, 2022).

In Sierra Leone, the literacy rate varies: 62% of men and 43% of women have formal education. Also, 70% of women and 56% of men do not have access to mass media (television, radio, or

newspaper) at least once a week and have very limited access to the internet.(StatsSL & ICF, 2020)

1.3 HEALTH SYSTEM AND SERVICE DELIVERY

Sierra Leone's health system is among the most fragile facing a double burden of diseases: communicable and non-communicable diseases. This fragility of the health system was largely a result of the decade of civil war and mistrust which further deteriorated with the Ebola epidemic in 2014-2015, and the just ended covid-19 pandemic (Barr et al., 2019).

The Ministry of Health and Sanitation (MoHS) is the governing body of the health system in Sierra Leone. The healthcare system in Sierra Leone is organized into two levels: the primary and secondary levels. The primary level includes community health posts (community health posts and maternal and child health posts) and community centres. The secondary level is where specialized care can be found. It is comprised of district and regional hospitals (The Sierra Leone NCDI Poverty Commission Report, 2020). CVDs and biological risk factors management are usually dealt with in hospitals because patients have direct entry points into all levels of healthcare in Sierra Leone (Barr et al., 2019; Youkee et al., 2021) and the primary levels are the least equipped to manage CVD conditions (Sierra Leone SARA Plus Report, 2017; MoHS, 2016a).

The patient to doctor ratio is very low in Sierra Leone. As of 2016, the physician population ratio was 3 physicians per 100,000 people in Sierra Leone. However, there are 50 State Enrolled Community Health Nurses to 100,000 people, and over 15,000 Community Health Officers (CHOs). The CHOs are mid-level healthcare professionals with three years of training and they are in charge of providing all primary medical services in some district hospitals as well as community health centers. Also, there are more State registered nurses than medical officers/doctors in the country (Chiyembekezo, Paul & Marta, 2018; MoHS, 2017, 2016a). The majority of healthcare workers are distributed in health facilities situated in urban areas with only 30% of the country's population (MoHS, 2016a). The functionality of the referral and back referral system is unclear.

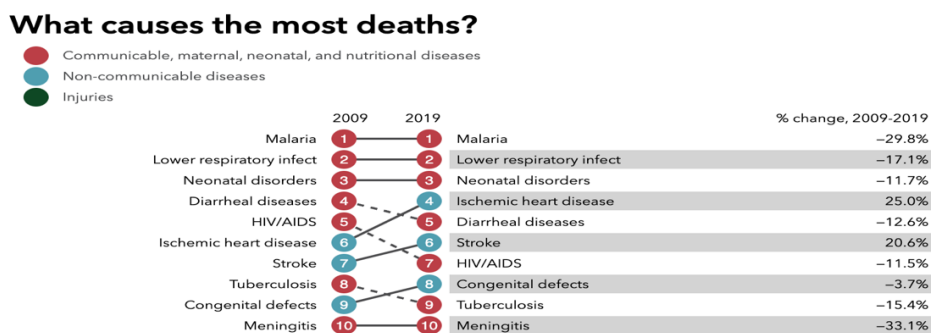
Although Sierra Leone's service coverage index slightly increased between 2005 and 2019 (18% to 39%), it is still a long way from having universal health coverage (Sierra Leone, 2021). According to Barr et al. (2019), the main sources of health expenditure in Sierra Leone are private individual out-of-pocket spending and foreign assistance. Since the private individual out-of-pocket payment makes up more than 50% of the health expenditure, many Sierra Leoneans (15%) are forced below the poverty line due to healthcare expenditures (Edoka et al., 2017; Sierra Leone, 2021). The current domestic general government health expenditure as a percentage of GDP is still very low (1%) (WHO, 2020a).

1.4 HEALTH SITUATION:

Sierra Leone is experiencing an epidemiological transition towards non-communicable diseases (NCDs) because of the increase in life expectancy as fewer people die at a younger age from communicable, maternal, neonatal, and nutrition (CMNN) conditions; people on average are now older than a decade ago. The life expectancy at birth has increased from 39 to 54 years between 1990 and 2017 (MoHS, 2021; World bank group, 2021).

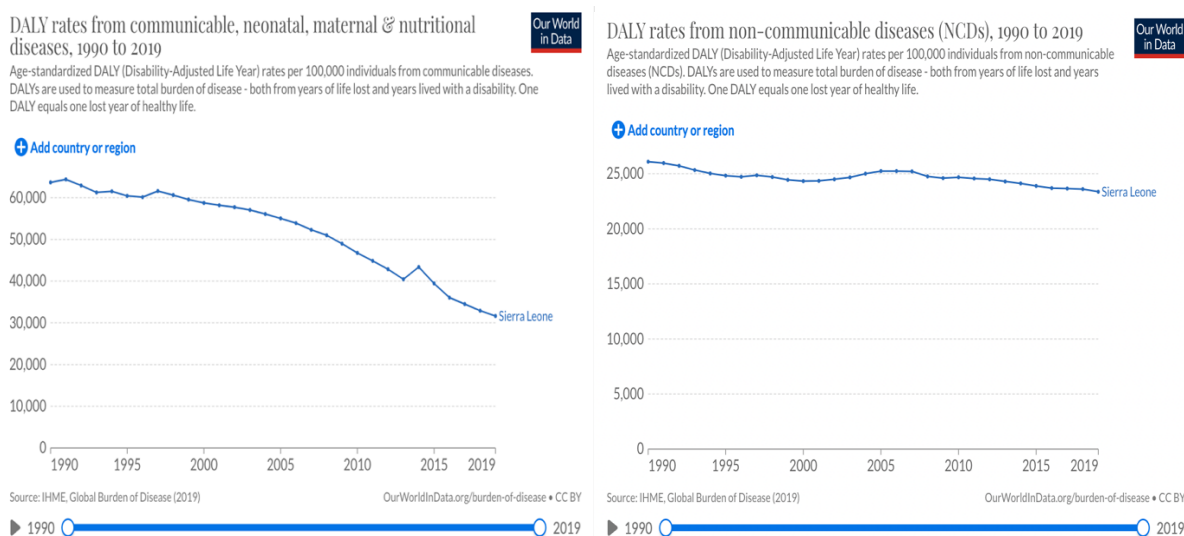
In terms of proportional mortality in Sierra Leone, CMNN conditions for example, Malaria remains the leading cause of death. However, ischemic heart disease and stroke have increased (see Figure 3 below) from the sixth and seventh leading cause of death in 1990 to the fourth and sixth leading cause of death respectively in 2019 gradually becoming important causes of mortality in the country. The age-standardized death and death rate for cardiovascular diseases has however slightly declined from 1990 to 2019 but much more slowly than the CMNN death rate (IHME, 2015).

Figure 3: Top 10 causes of death in 2009 and 2019 in all ages combined



The Disability-adjusted life years (DALYs) rates in Sierra Leone are also declining more faster for CMNN diseases (left figure 4 below) than for non-communicable diseases (right figure 4 below)

Figure 4: DALY rate for communicable and non-communicable diseases from 2009 to 2019



(IHME, 2015; Our World in Data, 2019a, 2019b)

Chapter 2: PROBLEM STATEMENT, JUSTIFICATION AND OBJECTIVES

2.1 PROBLEM STATEMENT

In 2017, about 17 million people died from cardiovascular disease (CVD) in the world. CVD is the leading cause of death and disability worldwide (Geraedts et al., 2021; Mensah, Roth & Fuster, 2019). Low- and middle-income countries (LMICs) account for 80% of the global burden of the CVDs (Yusuf et al., 2001). In sub-Saharan Africa, CVDs are projected to be the leading cause of morbidity and mortality in 2030 (Gouda et al., 2019; Holmes et al., 2010). Moreover, the highest risks of dying from NCDs including CVD were particularly reported in sub-Saharan Africa (Bennett et al., 2018).

There is a dearth of data on the national burden of CVD in Sierra Leone. According to Institute for Health Metrics and Evaluation (IHME), in 2019, the estimated age-standardized incidence rate of CVD is 674.6 per 100,000 population higher than the sub-Saharan Africa Region of 604.7 per 100,000 population. The DALYs and mortality rate of CVDs are also higher than in sub-Saharan Africa (IHME, 2019d). The death and DALY rates have declined in Sierra Leone, but moderately and the relative share of CVD in the total burden is expected to increase. There is also a high prevalence of biological risk factors of CVD in Sierra Leone (Zembe et al., 2022). According to the last STEPS survey done in Sierra Leone in 2009, about 70% of the population had at least one NCD or CVD risk factor and about 27% had three or more NCD risk factors (WHO, 2009). The overall risk score for CVD in Sierra Leone is 6%, greater than most LMICs countries of 1.6-2.7% (Odland et al., 2022; Peiris et al., 2021). Moreover, because most of the treatment and management of CVD takes place at expensive hospital levels, CVD will become an increasing financial burden to the country.

2.2 JUSTIFICATION

Sierra Leone is one of the world health organization (WHO) member states that made a commitment to reduce by 25% of the mortality rates of the four NCDs (cancers, cardiovascular diseases, chronic respiratory diseases, and diabetes by 2025 among people aged 30-70 years. (Bennett et al., 2018). The mortality rate has not significantly declined in the past decade (IHME, 2019d) making a 25% reduction almost impossible to achieve by 2025.

To reduce the burden of CVD, interventions with the goal to prevent risk factors and early management of the disease are needed (Fuster & Kelly, 2010). Even in LMICs, it has been demonstrated that preventing CVD risk is both affordable and scalable (Beaglehole et al., 2008). Also, addressing CVD risk factors will result in more efficient care, reduced medical expenses, and a reduction in the overall morbidity and mortality from CVD (Fuster & Kelly, 2010). In Sierra Leone, the key aim of universal health coverage is to ensure early contact with the health system (MoHS, 2020c); however, very few CVD interventions are implemented to ensure early contact with the health system or address CVD as a whole. (MoHS, 2020c; WHO, 2009; Youkee et al., 2021) Insights on successfully implemented global CVD interventions are critical for ongoing health systems strengthening and control of CVD in Sierra Leone.

This thesis aims to describe the determinants of CVD and analyse interventions that address CVD and risk factors in Sierra Leone. The most appropriate, feasible, and effective local and global interventions are included in the recommendation to stakeholders.

2.3 GENERAL OBJECTIVE

To describe the determinants of CVD in Sierra Leone and review interventions that address CVD and risk factors in Sierra Leone and provide recommendations to policymakers to implement effective interventions as a stepping stone to attain universal health coverage in Sierra Leone.

2.3.1 Specific objectives

1. To examine and analyse the determinants of CVD in Sierra Leone
2. To identify, analyze and compare globally implemented best practices of CVD interventions
3. To critically review current CVD interventions in Sierra Leone.
4. To provide specific recommendations on interventions to reduce CVD burden in Sierra Leone.

Chapter 3: METHODS

This chapter describes the methodology and conceptual framework used in this study

3.1 STUDY DESIGN, AREA, AND POPULATION

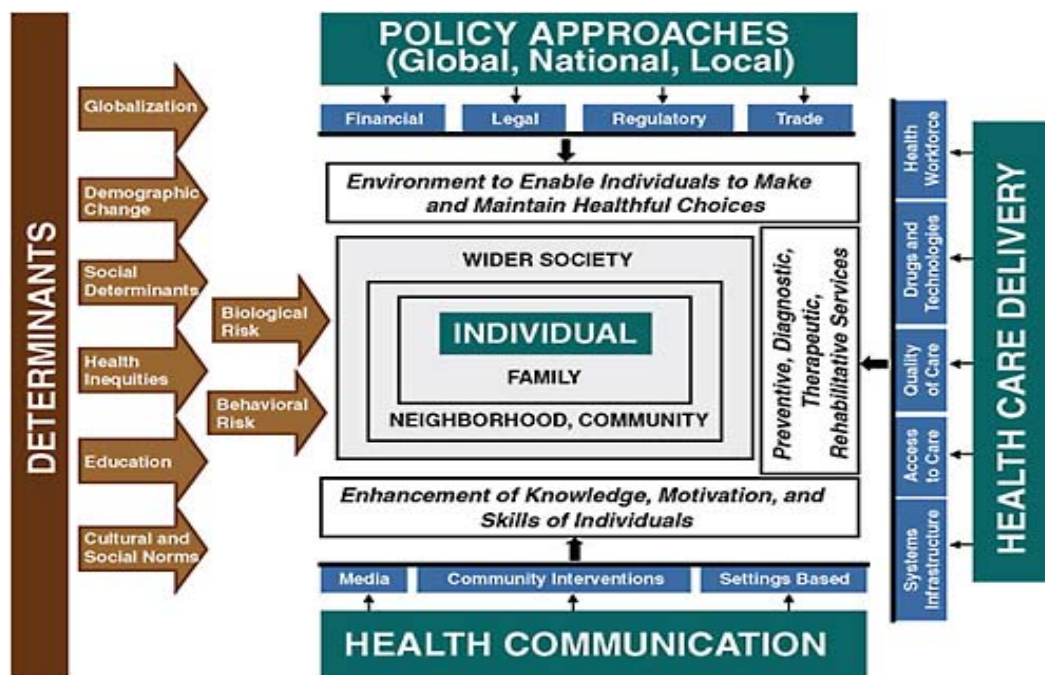
This is a literature review (grey literature and peer-reviewed). The inclusion and exclusion criteria are illustrated in Table 1 and the search strategy is illustrated in annex 1. The search strategy was mainly derived from the conceptual framework in Figure 5.

3.2 THE CONCEPTUAL FRAMEWORK

Few frameworks were found to be useful for this study. For example, the “Interventions proposed through NCD continuum of care framework” (Jayanna et al., 2019). This framework focuses on interventions throughout the continuum of care for NCD at the healthcare level. While found useful, it only addresses interventions at the healthcare facility level rather than an in-depth approach that includes interventions outside the health facility. The American Heart Association conceptual framework for public health practice in CVD prevention (Pearson et al., 2003) was also found useful but not comprehensive and contextual to developing countries.

The “Comprehensive strategy to address cardiovascular disease” framework was selected for this study because of its comprehensive approaches to CVD interventions. Furthermore, this framework has been validated by numerous studies evaluating interventions (Ajay, Watkins & Prabhakaran, 2017; Bakhtiari et al., 2020; Pearson, 2011). This framework is used in this study to guide the search strategy in Annex 1, analyse the data extracted for the literature review, and organise the findings.

Figure 5: A framework of comprehensive strategy to address cardiovascular disease



(Fuster & Kelly, 2010)

The framework is divided into two broad sections: determinants (brown boxes) and interventions (green boxes: health communication, healthcare delivery and policy approaches). The determinants of CVD are analysed in the context of the central part of the framework (individual, family, wider society and community) while the interventions address CVD and risk factors. The blue boxes are the specifications of the green boxes which may not all be address because of the scope of the study. Systematic reviews literatures and evidence-based guidelines from global health organization like WHO with impact the outcome of CVD and risk factors are therefore prioritize in this analysis.

The health communication interventions analyse media, community interventions, other settings based and other health information interventions that directly improve CVD risk factors. The health care delivery interventions address CVD and risk factors at the primary care level and at the referral level. The policy interventions analyse global and national policies of CVD that improve CVD and risk factors

Each interventions section is presented and discussed in the results section in the order of global evidence, importance in Sierra Leone and the status of the intervention in Sierra Leone.

3.3 DATA COLLECTION

3.3.1 Search strategy:

A systematic approach was used in conducting an extensive literature search in English. Peer-reviewed articles and grey literature were retrieved from multiple databases and search engines: VU online library, google scholar, PubMed/Medline, and Google. Searches on relevant websites such as the Ministry of Health and Sanitation in Sierra Leone, WHO, IHME, CVD alliances, and the World Bank were also done.

Key search terms like "Cardiovascular disease," "Determinants", "Health communication Interventions", "Healthcare delivery Interventions", "Policies" and "Sierra Leone" were derived from the "Comprehensive Strategy to address cardiovascular disease" framework. A detailed combination of search terms can be found in Annex 1. The search terms were derived from the conceptual framework in Figure 5 and its narrative (Fuster & Kelly, 2010). Systematic reviews that describe the effect of CVD interventions on one or more CVD determinants were prioritised in this review and guidelines of global health organizations like WHO and other best practices published were also prioritised. Snowballing on references of searched documents was used to retrieve additional documents.

3.3.2 Eligibility criteria

The inclusion and exclusion criteria are listed in Table 1 below. The main studies included in this review are published systematic reviews and publications from global health organizations like WHO.

Table 1: Eligibility criteria

Inclusion criteria	Exclusion criteria
Published articles and documents in English from 1990 to 2023.	Non-English articles before 1990 are excluded.

<p>Studies with implemented interventions that included comparison criteria either with control group or before and after comparison with the same group that measured intervention influence on any CVD condition (van de Vijver et al., 2012; Fuster & Kelly, 2010)</p>	<p>No comparison groups for interventions.</p> <p>Data from DHIS (district health information systems) in Sierra Leone were also excluded because they were inaccessible on the website</p> <p>Studies without reported outcomes on any of the CVD determinants or treatment outcomes of at least one of the biological risk factor such as hypertension and diabetes.</p>
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3.3.3 Study selection

Documents retrieved from different sources mentioned in the search strategy above were screened; duplicated documents were identified and removed. The remaining documents were checked for eligibility, according to eligibility criteria in Table 1.

3.4 DATA EXTRACTION AND ANALYSIS

3.4.1 Data extraction

Annex 2 illustrates the variables/themes (in columns) extracted according to the eligibility criteria and framework of this study. This gives an easy comparative analysis of the data extracted by variables/themes.

3.4.2 Data Analysis

This literature review on CVD in Sierra Leone employs a systematic approach in analyzing the determinants and interventions of the retrieved documents according to the eligibility criteria above and sorted according to themes illustrated in annex 2

3.5 ETHICAL CONSIDERATIONS

For this literature review, ethical approval was not required from the Research Ethics Committee because this study only reviews existing published data.

3.6 STUDY LIMITATION

The review depended completely on previously published research in English. Non-English articles were excluded which may have added to the analysis of this study.

Chapter 4: RESULTS

4.1 DETERMINANTS OF CVD IN SIERRA LEONE

This section addresses the first objective of this thesis and uses the left part of the analytic framework above (Fuster & Kelly, 2010). It describes and analyzes the determinants of CVD in Sierra Leone with reference to global evidence.

4.1.1 Globalization and Demographic Change

Globalization is the movement of people, goods, and ideas from one place to the other including urbanization: the movement of people from rural to urban areas. Demographic change means the change in a population due to urbanization and population ageing (Fuster & Kelly, 2010; Diagne, 2017). Globalisation and urbanization are usually linked to increasing behavioural risk factors such as cigarette use, obesity, unhealthy diets, low physical activity and biological risk factors such as hypertension, diabetes and obesity. This is because of the increased movement of goods and food which makes it easier to adopt “Western diets” and the shift they cause from an agrarian society to a more urban society (Critchley, Johnstone & Unwin, 2010; Fuster & Kelly, 2010; Reardon et al., 2021; WHO/FAO, 2003; Iqbal et al., 2008). This is concerning because Sierra Leoneans like other citizens in developing countries, are exposed to these urban/western diets without education on the food content and health risks, and without medical care and proper public health systems that mitigate the risks in developed countries (Fuster & Kelly, 2010).

According to cross-sectional studies in Bo district in Sierra Leone, living in urban regions is linked to an increased cardiovascular risk (Odland et al., 2022, 2020). Many behavioural risk factors: unhealthy diet (for example salty snacks) and biological risk factors: diabetes are particularly prevalent among urban dwellers in Sierra Leone (Bockarie et al., 2021; Ceesay et al., 1997; Odland et al., 2022) and tobacco use is more common among rural dwellers (27%) than urban dwellers (16%) (StatsSL & ICF, 2020). With the movement of goods, there is a probability of increasing behavioural and biological risk factors among rural dwellers. Ongoing surveys are needed to understand the risk profile in these settings over time. Globalization and urbanization, on the other hand, offer food safety and the advantage of better access to health care. (Fuster & Kelly, 2010; Lynch, Nel & Binns, 2020; The World Bank, 2022) which is linked to a lower CVD burden. In Sierra Leone, urban dwellers had more access to CVD care and better control of hypertension than rural dwellers (Odland et al., 2020; Sierra Leone SARA Plus Report, 2017).

In terms of the ageing population's relationship with CVD, an increase in age as a determinant has been linked to the development and burden of CVD risk factors. This is because with older age comes cumulative exposure to CVD behavioural risk factors such as unhealthy diets, low physical activity, and smoking that may play a bigger role in the increase in CVD burden than just ageing and genetic composition (Fries, 2005). In Sierra Leone, ageing was linked to conditions like diabetes and hypertension in Sierra Leone (Ceesay et al., 1997; Odland et al., 2020, 2022; Russell et al., 2020, 2023a).

4.1.2 Social Determinants

These are the conditions in which people are born, grow, live, work, and age. They include genetic composition, environmental, sociocultural, and socioeconomic factors (Braveman & Gottlieb, 2014; Fuster & Kelly, 2010). Family history was linked to diabetes prevalence in a study in Sierra Leone (Ghazzawi, Thurtle & Kanu, 2021) and Male sex was linked to a higher rate of smoking in Sierra Leone (Ssl & International, 2014; Ssl & Macro, 2009; Odland et al., 2020). This is similar to global data (Ritchie, 2019). This may be the result of a combination of factors including sociocultural factors (Egbe et al., 2014; Lee, Gao & Ryff, 2020). Another finding of gender influence is reported among local studies. These studies reported that the female sex and gender are associated with increased almost all CVD risk factors (Bockarie et al., 2021, 2021; Lisk, Williams & Slattery, 1999; Odland et al., 2020; Russell et al., 2023b). This differs from the IHME estimated data (IHME, 2019b). Even though, this has not been fully understood, sex and gender may partly explain CVD burden (Clayton & Gaugh, 2022).

The influence of social networks on CVD management has also been reported in Sierra Leone. The health-seeking behaviour among people with CVDs and NCDs is significantly influenced by one's social network in Sierra Leone. The health-seeking journey begins after people seek advice from family, friends and neighbours and based on their advice a decision is made on where to go (soothsayers, churches, traditional healers etc). Health facilities are usually the last resort, especially in rural settings. The health-seeking behaviour however has much more factors at play such as the awareness and understanding of CVD and its complication (Ignatowicz et al., 2020), the supply-side (cost and proximity) factor, past healthcare experiences, and disease-specific factors, such as acute disease presentation. (Idriss et al., 2020). Work environment effect on CVD is yet to be reported in Sierra Leone where many workers especially health workers have reported working in a stressful environment, especially during the Ebola epidemic (Jones et al., 2020).

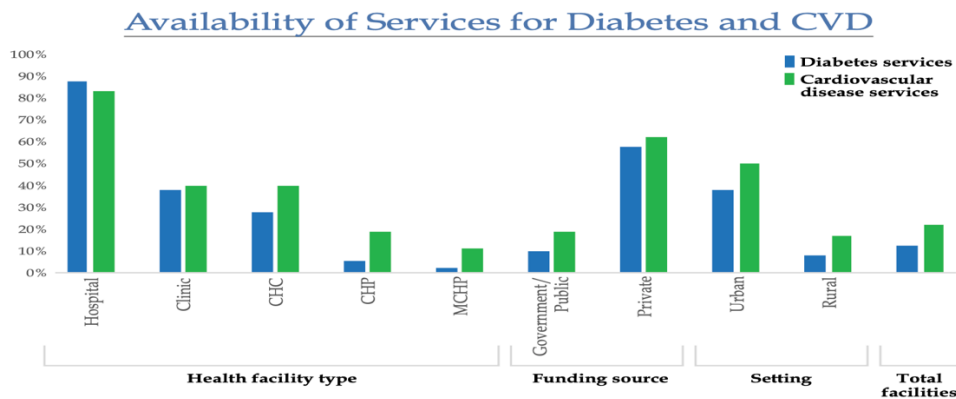
The socioeconomic factors or the interdependent relationship between health and income is widely studied. Contrary to developed countries (Fuster & Kelly, 2010), CVD and its risk factors are more prevalent among the highest socioeconomic groups in Sierra Leone (Bockarie et al., 2021; Ghazzawi, Thurtle & Kanu, 2021; Odland et al., 2020). However, the association between unemployment, poverty, and no education with CVD risk factors like hypertension have also been reported in Sierra Leone (Geraedts et al., 2021; Russell et al., 2023a; Odland et al., 2020). The influence of urbanization may have a greater impact on people with the highest socio-economic status in terms of indulgence in behavioural risk factors like physical inactivity and unhealthy diet. However, access to health facilities may be impeded by financial constraints for unemployed individuals. It is also worth noting that, the prevalence of major biological risk factors such as hypertension and diabetes are globally observed to increase and then decrease with increasing in gross domestic product (GDP). GDP or economic development is a major driver of the epidemiological transition in a country (Fuster & Kelly, 2010). Another far-fetched determinant is climate change. This has also negatively impacted agricultural produce globally (Zilbermint, 2020) and in Sierra Leone (Sesay, Sesay & Kallon, 2022). This can limit food choices through availability and affordability which may lead to more Sierra Leoneans eating less and fewer fruits and vegetables (Bockarie et al., 2021).

4.1.3 Health inequalities:

There are tremendous health inequalities seen in service availability in Sierra Leone; between rural and urban settings and among individuals with different socioeconomic statuses in society.

For instance, according to the Sierra Leone Service Availability and Readiness Assessment (SARA) survey done in Sierra Leone, only 20% and 11% of cardiovascular and diabetes mellitus (DM) services (figure 6 below) were available in health facilities respectively and these services were predominantly in urban areas and private facilities where people with high socio-economic status and lives in urban settings have more access (Sierra Leone SARA Plus Report, 2017).

Figure 6: Service availability for CVD and DM in Sierra Leone



(MoHS, 2020c; Sierra Leone SARA Plus Report, 2017)

Health inequalities are also observed between different disease responses. In Bo district, the overall facility readiness scores for CVD and risk factors care were 16.8%, compared to 41% for HIV (Odland et al., 2022). These are barriers that also contribute to Sierra Leoneans seeking private informal health care services such as the herbalists and informal drug peddlers (Idriss et al., 2020)

In terms of health financing sources, more than 50% of the current health expenditure in Sierra Leone is from out-of-pocket (MoHS, 2020c). There is currently no strategy in place to cushion the health cost of CVD compared to HIV, maternal and neonatal services which are largely donor supported in the country (Sierra Leone, 2021; World bank group, 2021). Also, hospitals have much more resources allocated to them than primary health care in Sierra Leone where chronic diseases are better managed (Beaglehole et al., 2008; WHO, 2020b; World bank group, 2021).

Health inequalities are also observed between rural and urban. Even though rural parts of the country also face significant challenges with NCDs and other conditions (Zou et al., 2020a), facilities in cities especially hospitals benefit the most in terms of resources. For instance, in 2016, the rural population which made up around 62% of the entire population was served by only 30% of the health workers in the country (MoHS, 2017). Also, the referral services for CVD remain poor (Zou et al., 2020a) These health inequalities contribute to the CVD burden and slow reduction of CVD mortality in Sierra Leone making the 2025 goal of a 25% reduction in mortality almost impossible to reach (Bennett et al., 2018)

4.1.4 Cultural and Social Norms

This is partly discussed under the social determinants above. In Sierra Leone, cultural norms are demand factors that influence the health-seeking behaviours of many Sierra Leoneans. A qualitative study on the perception of NCDs, reported that Sierra Leoneans have deeply

ingrained beliefs that link sickness to supernatural factors like witchcraft or evil spirits. These beliefs are more expressed among dwellers in rural settings but some people in urban settings also share the same. For instance, in the case of diabetic retinopathy or diabetic foot ulcer that does not heal, witchcraft may be cited as the cause and they will instead seek care from a "Yabai" woman-soothsayer to undo the witchcraft and relieve the symptoms (Idriss et al., 2020). (Idriss et al., 2020). These cultural beliefs contribute to the low knowledge and understanding of CVD and its complications in Sierra Leone (Ignatowicz et al., 2020)

4.1.5 Education

In Sierra Leone, people with tertiary education (Odland et al., 2020; Geraedts et al., 2021) have the highest burden of CVD and their risks. They, however, also have a greater chance of getting a diagnosis, treatment, and control of the condition for example hypertension than people with no formal education in Sierra Leone (Geraedts et al., 2021; Odland et al., 2020, 2022). The second highest burden is reported among people with no education. They have higher CVD risk factors than those with incomplete education. (Odland et al., 2022; Geraedts et al., 2021) Poverty and low education have been strongly linked to the control of CVD because of the financial constraints to seek healthcare among the poor (Blas, Sivasankara Kurup & Organization, 2010). The awareness and knowledge of CVD is also very low and it is reported as the greatest barrier to accessing and controlling CVD and risk factors in Sierra Leone (Ignatowicz et al., 2020)

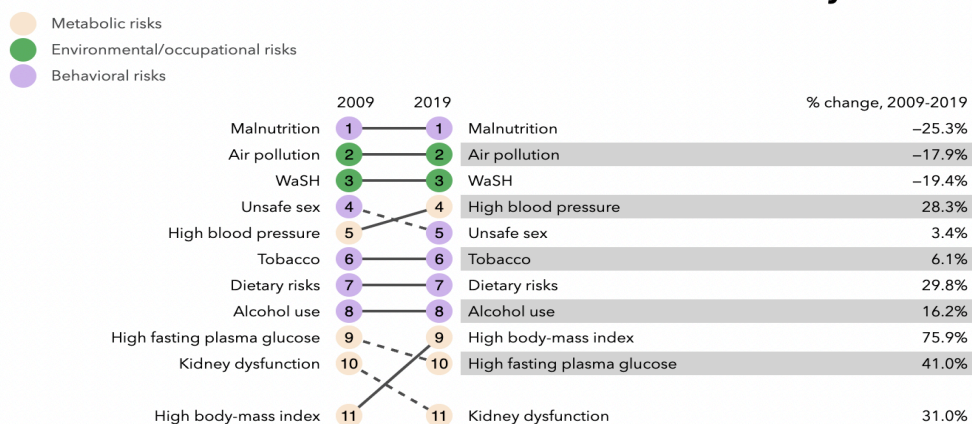
4.1.6 Behavioural and biological risk factors of CVD in Sierra Leone

These are the proximal determinants of CVD. Behavioural risk factors such as tobacco and alcohol use, unhealthy diet, and physical inactivity are significantly associated with the development and control of biological risk factors such as high blood pressure, high cholesterol and obesity, and high blood glucose. (Fuster & Kelly, 2010). Both behavioural and biological risk factors contribute to the development and control of CVD such as heart attacks and stroke. (Primatesta et al., 2001; Esteche et al., 2021).

According to the Institute for Health Metrics and Evaluation (IHME) in Figure 7 below, the CVD risk factors account for six out of the ten most common risk factors that caused the most deaths and disability in Sierra Leone in 2019 compared to five of ten in 2009. Also, while other risk factors are declining in percentage, CVD risk factors are increasing. For example, high blood pressure and high body mass index increased by 28.3% and 75.9% from 2009 to 2019 (IHME, 2015).

Figure 7: Risk factors that caused the most death and disability in 2009 and 2019.

What risk factors drive the most death and disability combined?



Top 10 risks contributing to total number of DALYs in 2019 and percent change 2009-2019, all ages combined (IHME, 2015)

a. Behavioural risk factors

Tobacco and alcohol use

Smoking and tobacco use is one of the most preventable causes of death (Roy et al., 2017). In Sierra Leone, it causes 3,300 deaths in 2017 and an economic loss of 404 billion leones (WHO, 2022a). According to a systematic review published in 2015 (Brathwaite et al., 2015), the prevalence of smoking in Sierra Leone is one of the highest in SSA (25.8% in Sierra Leone vs 1.8% in Zambia). And adult daily smoking in 2019 was 12% which is higher than most African countries like Nigeria at 3%, Ghana at 2% and twice Liberia at 6% (WHO, 2021). Alcohol also pose a substantial effect on cardiovascular health, especially daily heavy consumption and binge drinking.(Piano, 2017) The prevalence of alcohol use is recently reported at 37% among urban dwellers in Sierra Leone (Russell et al., 2023a).

The national demographic health survey in Sierra Leone reports a decline in the prevalence for both men and women from 37% and 12% respectively in 2008 to 18% and 3% in 2019 (Ssl & Macro, 2009; StatsSL & ICF, 2020). Males who smoke heavily (over 10 cigarettes in the previous 24 hours) have however increased from 39.0% in 2008 to 53.9% in 2013. Similar data for 2019 was not reported (Ssl & International, 2014; Ssl & Macro, 2009). The use of tobacco was more common among male (Ssl & International, 2014; Ssl & Macro, 2009; Odland et al., 2020) and rural dwellers (StatsSL & ICF, 2020) in Sierra Leone. However, the use of smokeless tobacco like snuff by mouth and nose is generally higher among women. The prevalence of smokeless tobacco use between rural and urban and its source (locally grown or imported) is unknown.

Notwithstanding, in 2017, the prevalence of tobacco use among high school adolescents in Sierra Leone was 24.6% (James et al., 2023), higher than in East Africa (Comoros) with a 14.3% prevalence of cigarette smoking and 5.8% for noncigarette tobacco products among the same age group (James et al., 2022). With the increasing invasion of tobacco companies and slow tobacco policy implementation in Sierra Leone, this trend might change especially among the

youth (Nasratu Kargbo, 2022; Politico SL, 2019). Ongoing studies are needed to understand this risk profile over time.

Physical inactivity

Physical activity has been shown to significantly reduce blood pressure (Wamba, Takah & Johnman, 2019) and other risks. Physical inactivity is not among the risk factors that cause the most deaths in Sierra Leone (IHME, 2015). The prevalence of physical inactivity is low in Bo district in Sierra Leone. Higher in urban (Russell et al., 2023a; Bockarie et al., 2021) than rural and higher among females than males. Many Sierra Leoneans engage in physical activities more at work and for transport than for leisure. Sedentary lifestyle and low activity were also observed among people with no education (Bockarie et al., 2021). However, if changes to work and transport occur, this risk might increase as leisure-time physical activities are very low in the country. Ongoing studies in different parts of the country are needed for a better understanding of this risk factor.

Unhealthy diet

Unhealthy diets such as salt intake have a mixed presentation in both urban and rural settings. Urban dwellers add less salt while cooking but add salt at the table and eat more salty snacks than rural dwellers. The addition of salt was also observed to increase with age. Less fruit intake is more prevalent among urban dwellers than rural dwellers. (Bockarie et al., 2021). The salt reduction can effectively contribute to controlling hypertension. (Wamba, Takah & Johnman, 2019)

Among the behavioural risk factors, very few studies reported data on alcohol use, dietary lifestyle and physical activities in Sierra Leone.

b. Biological risk factors

Raised blood pressure and hypertension

Hypertension is the number one risk factor for CVD in Sierra Leone (IHME, 2019b). In 2019, WHO estimated the age-standardized prevalence of high blood pressure among persons aged 30 to 79 to be 30.3% in Sierra Leone. This is higher than the African region prevalence of 27.4% (WHO, 2022b). The prevalence seems to be increasing in the capital city of Freetown from 23.4% in 1999 to 35.3% in 2023. (Lisk, Williams & Slattery, 1999; Russell et al., 2023a). The sample sizes and design of these studies differ limiting a concrete inference of the trend. Also, the per cent change in risk in Figure 7 has also increased by 28.5% in the last decades; this means that there is an increase in the importance of hypertensive risk factor's contribution to the overall mortality rate compared to other risk factors in the country (IHME, 2015). Hypertension also adds to the burden of maternal mortality in Sierra Leone. In 2016, pregnancy-induced hypertension accounted for 16% of maternal mortality and is the second leading cause of maternal mortality after postpartum haemorrhage (32%) (MoHS, 2016b).

Raised blood sugar and Diabetes mellitus

The prevalence of diabetes was reported as 2.4% in 1997 compared to 8.3% in 2023 (Ceesay et al., 1997; Russell et al., 2023a; Odland et al., 2020). These studies are however from different

demography and time period in Sierra Leone. However, there is an estimated proportional increase of 41% in terms of its importance (IHME, 2015). Diabetes is more commonly reported among urban dwellers (Odland et al., 2020; Ceesay et al., 1997). The prevalence of diabetes is estimated to continue to increase (Global nutrition report, 2022)

Overweight/Obesity

Obesity or high body mass index (BMI) also has a significant change of 75.9% in risk over the last decade in Sierra Leone (IHME, 2015). This is more common in urban dwellers (Odland et al., 2020). The prevalence of obesity is estimated to continue to increase with women significantly more obese than men (Global nutrition report, 2022).

High cholesterol:

Studies that included this risk factor only analysed a smaller sample of individuals in their overall study. The prevalence is between 6-21% (Russell et al., 2023b; Odland et al., 2020).

4.2 CVD INTERVENTIONS

4.2.1 Health communication programs

Health communication interventions are crucial in effecting behavioural change especially when combined with policy and service delivery strategies. This section describes platforms for health education campaigns such as media, labelling and the influence community interventions and other settings such as schools, worksites, religious gatherings, supermarkets or markets etc have on people's behavioural choices (Fuster & Kelly, 2010; Mozaffarian et al., 2012). The global evidence is initially analysed followed by the importance and status of health communication in Sierra Leone

Global evidence

Media health education campaign

Mass media campaigns on healthy behaviour for CVD and NCD control have been widely implemented (Mozaffarian et al., 2012; Müller et al., 2016; Piette et al., 2015; van de Vijver et al., 2012). It includes health education on television, radio, print, and billboard advertisement; in-store media education, and leaflet mailed or delivered door-to-door (Mozaffarian et al., 2012). mHealth services such as SMS/text messages, smartphones, interactive voice response (IVR) or automated calls, and social media are all distinct platforms for media health education campaigns that can be employed in different settings including health facilities for patients with CVD and/or risk factors (Piette et al., 2015; van de Vijver et al., 2012).

A systematic review that included evidence from ecological studies, quasi-experimental studies, and cluster-randomized trials reported that focused media campaigns on particular foods are effective at increasing knowledge of and consumption of particular healthy foods, decrease in adiposity, and improving physical activity awareness and attitude. Focused media campaigns are also effective in fostering negative attitudes towards smoking, reduction in the initiation of smoking among youth and promoting tobacco cessation among current smokers (Mozaffarian et al., 2012). In another systematic review, physical activity and healthy diets were effectively promoted using electronic and mobile health (e-&mHealth) approaches. Mobile phone text messages or emails were sent two days weekly or daily (Müller et al., 2016).

In LMICs, mass media health education campaigns have been reported in systematic reviews to significantly contribute to the reduction of CVD risk factors such as tobacco and alcohol use, body weight, unhealthy diet behaviour such as reduction in salt, and improvement in knowledge of CVD and risk factors, improvement in physical activity, dietary behaviours, blood pressure, and blood sugar especially when it is combined with healthcare providers training and treatment guidelines implementation (van de Vijver et al., 2012; Ndejjo et al., 2021). The result of reduced tobacco and alcohol were inconsistent.

However, health education that seeks behaviour change through many modes of communication (television, radio, door-to-door etc) over a long period is more helpful when it gives very concrete actions that someone can follow up (Mozaffarian et al., 2012). Less concrete instructions are less effective. Health education strategies through media may prove to be well-studied with good outcomes. However, these researches are often complicated by a

variety of individual, organizational, and societal factors that influence health-related decisions and behaviours and it is difficult to measure these influences (uncontrolled social and environmental influences) that affect health care and health promotion strategies (Kreps, 2011). Most studies on health media campaigns were from Asia and even though humans are similar in habits, confirmation studies are still needed in African countries like Sierra Leone to validate these findings.

Labelling and consumer information

Labelling is another platform reported in reviews for health education campaigns. The effect of labelling on dietary behaviours, for example, nutrient facts labels has little or no evidence in a systematic review (Mozaffarian et al., 2012). Plain packaging (labelling) alone for smoking cessation campaigns evidence is unclear. Many tobacco strategies (eg. taxation, medication, labelling) are often implemented in combination. However, warning labels have effectively been utilized to raise public knowledge of tobacco health risks and reduce smoking rates (Mozaffarian et al., 2012). Labelling strategies to control alcohol use was not reported in this review. Also, evidence of the effect of labelling on locally grown tobacco that are often chewed was not found.

Community interventions (Local environment influence)

The neighbourhood or residential environment set-up may also influence behavioural change among people in the community (Mozaffarian et al., 2012). In a systematic review, the presence of nearby supermarkets with mostly healthy food was associated with healthier eating patterns and fewer CVD risk factors such as less adiposity in children and adults (Mozaffarian et al., 2012). However, when the environment supermarkets and stores have mixed options of healthy and unhealthy food, the association with health behaviour is not consistent across studies included in the systematic review. Many studies in the systematic review also did not find an association between the presence of fast-food restaurants around homes and adiposity among residents. However, the presence of fast-food restaurants around schools has an association with adiposity among students in those schools (Mozaffarian et al., 2012).

Also, increased physical activity and decreased adiposity or other metabolic risk factors are more consistently associated with better community settings such as good access to recreation and exercise areas, diverse destinations close to the home, quality and connectivity of sidewalks and bike lanes (behavioural changes are more obvious in children), safe roads and environment, and neighbourhood aesthetics like green space or vegetation, and enjoyable scenery (Mozaffarian et al., 2012). For smoking, the number of tobacco retail outlets around schools and homes is linked to greater smoking in communities and the presence of smoking quitlines in the community presents an effective approach to reducing tobacco use in the community (Mozaffarian et al., 2012).

Most of the studies included in the systematic review under this section were cross-sectional or observational studies, limiting inference about causality. Additional prospective or randomized or quasi-experimental studies are needed (Mozaffarian et al., 2012).

The role of community health workers and health education

Community health workers (CHWs) role is well established even in LMICs and resource-challenged health systems. Community health workers connect the community to health care

services and facilities (Jeet et al., 2017). In Ghana, CHWs successfully carried out health education campaigns on salt reduction at churches, schools and community centres. This intervention was reported to significantly reduce both systolic and diastolic blood pressure in a randomized controlled trial ($p < 0.05$) (Cappuccio et al., 2006).

A systematic review that included sixteen trials on the effectiveness of CHW delivering NCD control intervention from LMICs (including Ghana and Nigeria and south Africa-one study from each), reported an increase in smoking cessation, and a decrease in blood pressure and blood sugar in CHW programs that included health promotion, treatment adherence and follow-up of particular smoking, blood pressure and blood sugar. These studies have low to moderate quality, particularly because of considerably high heterogeneity. CHW's definition also varies from study to study. (Jeet et al., 2017)

Other Settings

a. School-based settings

In a systematic review, some school-based strategies are linked to improving dietary behaviours among students. These include garden-based education programmes, environmental changes or standards that increase the availability of healthy food options in cafeterias and vending machines, and comprehensive diet and physical activity interventions. The presence of beverage vending machines at school was linked to a roughly threefold higher risk of children consuming snacks, beverages, or both in place of lunch and a greater likelihood that they would choose less healthy options even in the presence of plenty of healthy foods and drinks. Also, school-based health education alone without the availability of healthy options or restriction of unhealthy options has less evidence of the effect on healthy diet behaviour (Mozaffarian et al., 2012).

For physical activity, school-based strategies that increase physical activities are those that increase the availability of playgrounds, the types of playground spaces and tools in addition to other diet and physical activity interventions such as health education (Mozaffarian et al., 2012). For smoking, school-based interventions including the reduction of tobacco retail outlets and advertisements around the school and the increase in the enforcement of anti-tobacco restrictions reduce the use of tobacco among students (Mozaffarian et al., 2012). This setting's influence on behaviour works better with environmental policies (Mozaffarian et al., 2012).

b. Worksites settings

Worksites food and drink information and labelling alone may not be effective but together with a change in food and drink options particularly in worksite canteens can improve dietary behaviour. (Mozaffarian et al., 2012). Workplace fitness centres, and skip-stop elevators (stop at every third floor requires staff to climb the stairs to other floors) feasible staircases particularly among men workers increase physical activity (Mozaffarian et al., 2012). Comprehensive workplace approaches such as health education on nutrition, tobacco cessation strategies, stress management, regular physical activity, screening and CVD management programs, and change in the workplace environment together significantly improves health behaviour and risk factors such as decreased consumption of red meat, smoking, body fat, systolic blood pressure, and increased consumption of fruits and vegetables, and physical activity particularly among staff with higher CVD risk (Mozaffarian et al., 2012).

The importance of health communication strategies on CVD in Sierra Leone

In Sierra Leone, CVD risk factors are proportionally increasing (IHME, 2019a). Sierra Leone is currently facing the impact of globalization and Urbanization; with estimated increasing diabetes and obesity (Global nutrition report, 2022). However, there is low knowledge of CVD and its risk factors, especially in rural settings (Ignatowicz et al., 2020).

The status of health communication strategies on CVD in Sierra Leone

In Sierra Leone, publications on health communication strategies are limited. The health education division in the Ministry of Health's main focus is on reproductive, maternal, neonatal and child health (RMNCH) (HC3 Sierra Leone, 2023). The capital city-Freetown has an ongoing salt reduction health campaign which includes health awareness raising in health festivals, marketplaces and schools. This is championed by the NCD Transform Freetown Health Working Group in collaboration with the Ministry of Health and Sanitation (Freetown city council, 2022; MoHS, 2020b). Interventions to redesign urban settings to increase exercise are lacking in Sierra Leone. Urban mobility projects are ongoing in Freetown with several target goals of reducing congestion, increasing amenities, increasing safety etc (Freetown city council, 2022).

4.2.2 Healthcare delivery interventions

These include service delivery interventions to patients both at the primary care and referral care level to provide a better continuum of care for CVD and risk factors (Fuster & Kelly, 2010). Healthcare delivery interventions are crucial steps to complement other interventions. It is also an indispensable platform for the health education of individuals with behavioural or biological risks. These can include examples of one or more of the following: system infrastructure, access to care, quality of care, drugs and technologies, and health workforce interventions to improve CVD and risk factors (Fuster & Kelly, 2010; Mozaffarian et al., 2012).

Global evidence

Primary care and task shifting to improve CVD

The primary care approach has proven as a sustainable approach in the continuum of care for chronic diseases (Beaglehole et al., 2008; Jayanna et al., 2019; WHO, 2020b; Wroe et al., 2015; Xu, Powell-Jackson & Mills, 2020). WHO has provided a package of essential non-communicable (PEN) disease guidelines for low-resource settings like Sierra Leone (WHO, 2020b). The guide provides a step-wise method of CVD (risk) detection, diagnosis, treatment and care among other NCDs. In addition, healthcare delivery with established referral and back referral pathways do increase treatment adherence and better continuum of care (WHO, 2023a).

The use of non-physician clinicians in the management of chronic diseases is also widely employed in countries in Sub-Saharan Africa and is notable for its cheaper cost and shorter periods of training and success in rural placement (Mullan & Frehywot, 2007). A systematic review in LMICs (the majority of studies were from Africa) on the management of major NCDs such as cardiovascular disease, by non-physicians, revealed improvements in screening, diagnosis, and management. The quality and outcomes of care were comparable to those of

physician-led NCD clinics when non-physician health workers were given the necessary training, mentoring, and standardized clinical protocols (Joshi et al., 2014). In addition, task-shifting was also reported in Rwanda where Nurses led a type-2 diabetes clinic; with clinical mentoring, the nurses were able to make the right diagnoses, medication selections, regular laboratory monitoring decisions, and follow-up plans in 94%, 86%, 87%, and 92% of the cases, respectively (Ndayisaba et al., 2017).

A mixed approach which complements health care delivery intervention with other interventions such as media, e&mHealth, guidelines, task shifting, staff training etc to improve CVD and risk factors are also reported in some studies. A randomized controlled trial that was conducted in two health facilities in Malawi and South Africa, employed diabetic education counselling, behavioural change SMS-text messages, and clinical management. After a year, a significant decrease in SBP and a nonsignificant decrease in HbA1c were reported (Farmer et al., 2021). Another review including 19 studies in LMICs reported a significant decrease in both systolic and diastolic blood pressure, blood sugar, weight, BMI, and waist circumference and improved physical activities and diet habits and smoking cessation when staff training, health education and guidelines were implemented to manage hypertension (van de Vijver et al., 2012). Follow-up appointments scheduled at frequent intervals and reminders sent to patients also showed an improvement in treatment adherence (van de Vijver et al., 2012).

Other approaches (drugs and technology and system infrastructure)

Another complementary approach is the polypill approach to improve the quality of care in patients with CVD. In a randomized control trial, within 6 months following myocardial infarction, treatment with a polypill including aspirin, ramipril, and atorvastatin resulted in a significantly decreased risk of serious adverse cardiovascular events such as cardiovascular death compared to the standard care (Castellano et al., 2022). The intervention however requires consistent availability of CVD drugs and this is a concern in LMICs (Hakim et al., 2022; Sierra Leone SARA Plus Report, 2017)

Public disclosure of health facilities' performance, audit and feedback also affects the quality of healthcare and provider's behaviour in many settings (Jamtvedt et al., 2006; Marshall et al., 2000). Pay-for-performance (P4P) schemes have varying evidence of effectiveness in the United State and Europe (Campbell et al., 2009; Epstein, 2007; Grossbart, 2006; Lindenauer et al., 2007; Petersen et al., 2006). However, very little are reported on P4P value for money, raises the standard of medical procedures, or enhances patient outcomes. There are often short-term marginal effects when it works (Cashin et al., 2014).

The importance of healthcare delivery interventions in Sierra Leone

The age-standardized mortality rate of cardiovascular disease is higher in Sierra Leone compared to the sub-Saharan region and the world (Our World in Data, 2019c). This is partly explained by the low CVD service availability (Sierra Leone SARA Plus Report, 2017). The physician to patients ratio is also very low (MoHS, 2016a) and the task-shifting and integrated approach is largely unpracticed in the country with very few exceptions (Kachimanga et al., 2021; Zou et al., 2020a). With the increase in prevalence and higher mortality rate of CVD in Sierra Leone, the importance of healthcare delivery interventions for continuity of care and preventive interventions like policy and health communication cannot be overemphasized.

The status of healthcare delivery interventions in Sierra Leone

CVD and risk factors with other NCDs are still being addressed almost entirely at the tertiary care level and patients usually present with uncontrolled CVD conditions like hypertension and complications like heart failure (Youkee et al., 2021; Zou et al., 2020b). The referral system is not well established (Zou et al., 2020b). The culture of back referral to the community centres and PHUs is generally not practised in Sierra Leone. There are also limited services across the country, more in urban and private facilities (Sierra Leone SARA Plus Report, 2017; MoHS, 2020c).

Also, there is no prevention and control comprehensive national CVD plan in operation (Idriss et al., 2018). And the CHWs' current scope of work does not include NCDs or CVD (MoHS, 2020a). The desk guide developed by the Ministry of Health and Sanitation to serve as a quick reference guide for outpatient settings in hospitals is probably the only CVD-related treatment guideline in Sierra Leone (MoHS, 2019). This guide incorporates the integrated WHO PEN guideline (WHO, 2020b).

Lessons learnt from studies on health service delivery interventions in Sierra Leone

Two studies on task shifting and primary clinic approaches to improve continuous care of CVD and biological risk factors outcomes were found. Clinical training for CHOs on NCDs management especially hypertension and diabetes management was found to be effective in health centres in Bombali district in Sierra Leone. In addition to clinical management, the CHOs were also trained in counselling, treatment cards were adapted and mentorship was provided especially through a WhatsApp group. Patients with hypertension were reported to have decreased blood pressure for at least the first two months of the study. The study reported many challenges that influence the outcome such as faulty or lacking equipment such as BP machines, lack of drugs, financial barriers, lack of follow-up was a typical issue due to the distance to healthcare facilities and lack of mobility. In terms of referrals, CHOs said that they believed referral procedures weren't always working. (Zou et al., 2020a).

Another study in Sierra Leone implemented an integrated NCD clinic in Kono. This study employed the WHO PEN guideline and trained CHO and community health nurses to follow up with patients with hypertension and diabetes. The study reported a significant decrease in blood pressure among patients with hypertension alone or with diabetes for at least six months. In addition, in many patients, hypertension was controlled and the BMI was reduced. Follow-up care was a big challenge in both studies which may have influenced the study outcomes; subjects analysed may be very different from those who dropped out. Also, these studies were only conducted in two parts in Sierra Leone and the latter study provided drugs to patients without cost to patients. This limit the inference of these studies to other settings where patients face many more challenges like the cost and availability of drugs, distance etc (Zou et al., 2020a; Kachimanga et al., 2021)

4.2.3 Policy Strategies

Policy strategies create the right environment to enable people to make and maintain healthy habits. This section analyses policies and intersectoral policies for CVD control at global, national or local levels. These can include implemented examples of either financial, regulatory, legal and trade policies on several CVD-related risk factors (Fuster and Kelly, 2010).

Global evidence

Taxation and other financial revenues

The interest to improve health including the reduction of CVD risk factors through economic or financial approaches is gradually growing. In addition to the health impact of taxes resulting in lower consumption of unhealthy foods and beverages, tax revenue also provides additional finance for health preventive programs and/or subsidies to raise the consumption of healthy food (Mozaffarian et al., 2012). For instance, earmarked tax on tobacco and other goods was used to reduce tobacco use in Panama and supported Ghana's health insurance programme (Daniel, 2021; Bloom, 2022). Taxation also reduces the use of certain harmful products like tobacco. In a systematic review, tobacco taxation strongly reduces tobacco use, particularly among youth (Mozaffarian et al., 2012). However, tobacco companies have developed strategies that may partially offset the effects of tax increases on consumption such as the development of less expensive generics and price-related marketing strategies like multipack discounts and couponing. Tobacco tax laws will need to change to reflect these business tactics if they are to have the greatest impact, especially in LMICs (Mozaffarian et al., 2012).

Tobacco control and food policies

One of the most advanced areas of CVD-related policy is tobacco control laws and regulations (Fuster & Kelly, 2010). The Framework Convention on Tobacco Control (FCTC) recommended by WHO includes comprehensive tobacco control strategies (WHO, 2005, 2013). Smoke-free legislation has shown the benefits of improved health. In a meta-analysis, smoke-free legislation lowered acute myocardial infarction mortality rate by 8% (Gao et al., 2019). Also, community smoking bans, and total smoke-free worksite policies, showed convincing reports on reduced rates of cardiovascular events, an increase in smoking cessation, decreased number of cigarette smoke among those who continue to smoke and reduce exposure to second-hand smoke (Mozaffarian et al., 2012).

Policies to reduce certain nutrients like sugar and fat in foods are greatly effective in improving the dietary habits of the population (Mozaffarian et al., 2012). Mauritius is an example; the government implemented policies to alter the composition of cooking oil made available for consumption in the population by reducing the content of palm oil in the country. After 5 years, mean cholesterol levels decreased in the population (Dowse et al., 1995; Uusitalo et al., 1996). Agricultural policy and other inter-sectoral policy to increase agricultural produce, and improve healthy food transportation and marketing has a great long-term impact on CVD reduction (Mozaffarian et al., 2012). The policy on food prices and agricultural produce may only affect the dietary habit of vulnerable populations such as people of low socioeconomic

status and youths (Mozaffarian et al., 2012). Advertisement of food on television influences food beverages purchase, consumption and preferences especially among children. Policies restricting the advertisement of unhealthy food would be effective in improving the diet habits of children (Mozaffarian et al., 2012) .

Another policy that can influence healthy behaviour is the effect of reduced national food prices. In a study from South Africa, the daily consumption of fruits and vegetables increased when healthy food purchases were discounted by 10% and 25%, respectively. Additionally, those who received discounts of 10% and 25% were more likely to regularly consume three or more servings of wholegrain foods and less likely to regularly consume foods high in sugar and salt (An et al., 2013). One study isn't possible to make a conclusion but however, it presents the role of price in healthy food choices.

Synopsis of integrated intersectoral policy activities to control CVD

Intersectoral policies present an opportunity to effectively reduce CVD (Fuster & Kelly, 2010, Anon, 2017). In Finland, "health in all policies" tremendously declines CVD risk factors and the burden of diseases in the country. In 1972, with the help of WHO, Finland came up with a comprehensive project after repeated field surveys for distal and proximal CVD risk factors like cholesterol level in North Karelia Finland. The project target was the reduction of the general population's high cholesterol level through dietary changes (Puska & Ståhl, 2010). They employed several strategies including health education through neighbourhood radio station and newspapers, posters, meetings, and leaflets. They also conducted debates surrounding the dairy farming community's resistance to the use of margarine in place of butter (Puska & Ståhl, 2010).

One of the most significant collaborations was done with the powerful housewives' organization, Marttas, which had clubs in almost all villages. Marttas was where most housewives' food-purchasing and cooking habits were influenced. Another collaboration was with political decision-makers and the private sector. The lay leaders were trained as local agents of change in villages (Puska & Ståhl, 2010). Primary healthcare nurses, doctors, local food producers, and schools all played a coordinated role in the reduction of cholesterol in the population. The huge local dairy was initially dubious but soon began working with others to promote milk products with less fat. Other manufacturer follow healthy practices for example producing sausages with lesser fat (Puska & Ståhl, 2010).

Because of the huge success of this five years project in North Karelia, it was later scaled up to the entire Finland (Puska & Ståhl, 2010). The reduction of risk factors was very significant. For example, in 1972, more than 90% of the population used butter and in 2009, only 5% did. Consumption of fruits and vegetables also increased, blood pressure and smoking, and total fat consumption declined while an increased in polyunsaturated fat (good fat) was observed. More important, an 80% reduction in CVD mortality rate was observed among the working age in Finland. The Finland project illustrates that dietary changes to reduce cholesterol are possible with an intersectoral approach (Puska & Ståhl, 2010). Now, health in all policies is utilized by global health organizations (CDC, 2023; WHO, 2023c).

The recently published WHO guideline to control obesity also emphasizes the multisectoral policies approach (WHO, 2023a). This framework focused on the whole-of-society approach with political leadership, the people living with obesity, the communities, clinical providers, and civil society for participatory input in the design and delivery of services. An open and continuous dialogue is essential for successful interventions.

The importance of policy approach on CVD in Sierra Leone

In Sierra Leone, policy strategies are also very important to enable people to make and maintain healthy habits (Fuster and Kelly, 2010). With the increasing priority of CVD in the country, evidenced-based policies will set the landscape for appropriate interventions (MoHS, 2020c; Chiyembekezo, Paul & Marta, 2018).

The status of policy approach on CVD in Sierra Leone

Status of Sierra Leone National NCD Policies and Strategic Plans (MoHS, 2020a)

The main policy that addresses CVD and risk factors is the NCD policies and strategic plans. The first NCD policy and strategic plan was developed in 2013 by the Ministry of Health and Sanitation to address the growing concerns about NCD in the country. This policy and strategic plan was updated in February 2020 after the introduction of the Directorate of NCDs within the Ministry of Health and Sanitation in 2017 to prioritise the promotion of a healthy lifestyle and environment (MoHS, 2020b, 2020a). This policy was informed by the striking high NCD risk factors report from the first STEPS survey conducted in 2009 (Sierra Leone STEPS Survey, 2009). The then-minister of health and sanitation referred to the 2013 strategic plan as "a new beginning for interventions in NCDs in Sierra Leone" (MoHS, 2013, p. 1). However, the implementation of these proposed policies' activities are bottleneck by financial constraints (Idriss et al., 2018)

The National NCD policy was developed by the following guiding principles:

1. Ownership and accountability:
2. Integrated people-centred health services:
3. Universal health coverage
4. Focused on reducing inequities
5. Encompassing the entire continuum of care
6. Cost-effective evidence-based interventions
7. Cultural relevance
8. Community participation
9. Multisectoral partnership

Healthy lifestyle promotion, implementation of evidence-based NCD interventions and strengthening partnerships with stakeholders (MoHS, 2020a) are three of the six main objectives (see Annexe 3) of the NCD policy in Sierra Leone. A 2020-2024 strategic plan of activities was deduced from these six objectives; extensive CVD-related activities (see Annexe 3) such as the conduction of STEP survey, implementation of PEN at all peripheral units, scaling up of NCD management care in communities, and the development and harmonization of NCD management guidelines among others were proposed to control CVD (MoHS, 2020a.p.41-51).

The Tobacco control policy and law

The tobacco and nicotine law is a good example of established health-related policy in the country; it was recently assented to by the president of Sierra Leone in April 2023 (Sierra Leone Government, 2023). For this law, the Ministry of Health and Sanitation in Sierra Leone drafted the law with the help of many stakeholders and ministries in WHO, the Ministry of Finance, the Ministry of Trade etc (MoHS, 2020c; Sierra Leone Government, 2023; MoHS, 2020a). This law covers all tobacco and nicotine products, including newly emerging tobacco products like e-cigarettes. This regulation controls how tobacco and nicotine are sold, imported, manufactured, labelled, promoted, and advertised. The law also forbids smoking in public settings like workplaces, hospitals, theatres, restaurants, police stations, and homes with children (WHO, 2022a).

This law describes specific crimes and the consequences of each. For instance, section 36(1) (2) on the prohibition of tobacco sponsorship explain that a person shall not advertise or promote tobacco or tobacco and nicotine product through sponsoring or organising sport, cultural, artistic, recreational, educational or entertainment programs, event or activity. This offence is liable on conviction to a fine of not less than 10,000,000 leones or imprisonment for a term not less than two years or to both such fine and imprisonment (Sierra Leone Government, 2023). Sierra Leone is yet to join other countries like Ghana and Mali to sign the illicit trade protocol (United Nations, 2023); even though they are using MPOWER measures by employing the use of more expensive tobacco brand names strategy (WHO, 2021).

The implementation of the tobacco law however faces significant challenges from the tobacco sellers. According to a local newspaper, the sellers deem the law as “harsh and unfriendly” and tend to ruin the tobacco enterprise which is their source of livelihood (Sesay, 2022). Smuggling is a concern of many (Politico SL, 2019), but however, there are reports that smuggling has decreased in Sierra Leone despite a significant increase in cigarette taxes and the absence of other established tobacco control laws (Gallien & Occhiali, 2022). This is too early to judge since the President has just recently assented to the Tobacco law and many strategies like plain packaging are yet to be implemented to assess the effect of the law in full force (Sierra Leone Government, 2023; Politico SL, 2019)

There are other Ministries, Departments and Agencies (MDAs) policies included in the 2020-2024 NCD strategic plan documents for intersectoral collaboration (MoHS, 2020a.p.26). These include (see Annexe 4) the nutritional plan to improve the diet-related NCD or CVD, promote healthy food security with the Ministry of Agriculture, Forestry and Food Security (MAFFS) etc

Chapter 5: DISCUSSION

This study highlighted several interconnected determinants and interventions that influence the burden of CVD in Sierra Leone. This section is discussed in three parts: The changing burden and determinants of CVD, Awareness and communication strategies, policy strategies, health service interventions and limitations of this review.

The changing burden and determinants of CVD

The result shows that CVD is gradually accounting for more proportional deaths; from 7% in 2008 to 14% in 2016 (WHO, 2018; Idriss et al., 2018). The most important distal determinant associated with CVD in Sierra Leone is urbanization. The overall impact of urbanization (burden of CVD and control of CVD) is more reported in urban settings than rural settings (Geraedts et al., 2021; Odland et al., 2022; Bockarie et al., 2021), but some of its related risk factors like smoking are much more prevalent in rural settings (StatsSL & ICF, 2020). The reason behind this decline in tobacco use is unclear because the tobacco law was only recently passed in Sierra Leone and the implementation is slow. And the tobacco risk profile among youths and heavy smokers may be increasing. Another important finding was among women. Women have a higher overall CVD risk except for smoking in both urban and rural settings. However, smokeless tobacco use is also more common among women.

Another significant distal determinant is social network, cultural beliefs and low educational level. Sierra Leoneans especially in rural settings associate the onset of CVD or other chronic diseases with supernatural powers and witchcraft (Idriss et al., 2020). There is also a low level of awareness and understanding of CVD, which is reported as the main barrier to seeking CVD care (Ignatowicz et al., 2020). Cultural beliefs may play a significant role in the country's low knowledge and understanding of CVD, its complications and health-seeking behaviour in Sierra Leone. People may link their causes to supernatural origins for which they think traditional approaches are more appropriate than health facilities. Sometimes people may recur to traditional approaches because they have no alternative. But when good comprehensive primary health care is offered, people may see the difference and seek health care more than a traditional approach.

Physical inactivity is not very high compared to other risk factors like diet in Sierra Leone (IHME, 2015). Even though leisure exercise is not a routine practice in most Sierra Leone, many engage in physical activities at work and for transport (Bockarie et al., 2021). However, this does not protect people that stay at home. And if changes to work and transport occur, this risk might increase as the culture of leisure exercise is lacking in the country. Ongoing studies in rural and urban settings with better study design will give better understanding of these determinants over time.

Awareness-raising and communication strategies

Communication strategies can be used to address the low awareness and understanding of CVD risk factors and the dietary lifestyle of Sierra Leoneans. Repeated concise but clear mass SMS messages about the aetiology of CVD, their presentation, complications and control may be a better strategy of communication than the use of radio, television, and local newspapers. This is because fewer people have access to these media platforms (StatsSL & ICF, 2020). Messages for example, to reduce obesity and cholesterol, can be improved. For instance, instead of 'eat

less and exercise often’, instead the message can be more specific as such: ‘Please drink water instead of sugary drinks, eat the whole orange instead of drinking processed orange juice, and walk 15-30 minutes every day’.

Awareness raising and health communication can also employ a door-to-door strategy because of the low literacy rate, especially in rural areas. Schools, worksites, and social media such as Facebook, Twitter, and WhatsApp groups are possible platforms worth exploring.

Policy Strategies

Health in all Policies (Puska & Ståhl, 2010) approach can reinforce and make communication strategies far more effective. For example, without healthy foods and drinks policy in worksites and schools, behaviour change may become challenging. In addition to the policy on paper, worksites should provide healthy food in their canteens and restaurants and prohibit unhealthy food and drinks in their canteens to enforce behavioural change. This can also be implemented in School. With the law of tobacco and alcohol, the provision of alternate jobs for tobacco and alcohol sellers can ease smuggling. Smoking and alcohol cessation services in health centers and toll-free lines can complement these policies. Regional policies on tobacco are also very important to combat smuggling. The engagement of companies or importers of salty diets can also complement diet-related policies.

Another policy that can be consider is a policy that incorporate CVD and NCD into CHWs’ scope of work. They can play a significant role in health education, screening community members for risk factors of CVD, and guiding patients to primary care for further management. Even blood pressure can be done by CHW with appropriate automated equipment. Another intersectoral policy can be with the future built environment of worksite, schools, communities etc. For instance, urban design with bike lanes and walkable lanes; communities with parks. etc. can influence the behaviour of people to walk and exercise more.

Health service Interventions

Healthcare delivery interventions are crucial steps to complement behavioural change interventions and an indispensable platform for counselling individuals with existing CVD conditions for behaviour change. People are probably most receptive to change when they already suffer from signs or symptoms of CVD or are diagnosed with one of its biological risk factors such as hypertension.

One of the bottlenecks of healthcare delivery in Sierra Leone is the emphasis on hospital-level care for NCDs (Youkee et al., 2021), and the neglect of integrated primary care. An elementary aspect of integrated primary care for major NCDs is the stepwise integrated risk evaluation that can be done by physicians and non-physician clinicians. Regardless of whether a patient comes with hypertension, diabetes, or obesity, the integrated risk assessment will look at physical activity, blood sugar, smoking behaviour, hyperlipemia, blood pressure, and BMI. With clear directives for referral, medicines use and counselling as per WHO PEN guidelines. (WHO, 2020b) Besides, the primary care level is the most appropriate level when it concerns continuity of care for these chronic conditions, and when it comes to taking into account the living

conditions close to the homes of patients with CVD (Beaglehole et al., 2008; Jayanna et al., 2019). The guide provides a step-wise method of CVD (risk) detection, diagnosis, treatment and care in resource-challenged settings like Sierra Leone (Bakhtiari et al., 2020; WHO, 2023b, 2017)

In addition, structured ongoing training, supervision, mentorship together with task shifting, treatment guideline and SMS-text messages directed to patients with existing CVD is a comprehensive approach that can be used for the management of CVD.

Limitation

The main limitation of this review is the fact that only articles published in English were included. Publishing bias is another limitation of the studies used in this review. Studies that did not show a positive effect of interventions may not have been published (Hopewell et al., 2009) and therefore not included.

The framework is very comprehensive; however, few modifications can improve the analysis of determinants and interventions better. For instance, social determinants as a heading were separated from education, cultural belief, social networks which are generally consider as social determinants. This makes it difficult to determine what and what not to include under social determinant heading. Also, community interventions do not nicely fit under health communication heading. Because there are lots of interventions that can be done in the community apart from health education to promote cardiovascular health such as community screening of risk, the establishment of parks etc.

Lastly, the cross-sectional studies included in this review cannot draw a causality inference resulting in analytical limitations. In terms of interventions, most studies analyzed were from LMICs in Asia which have different demographic, socioeconomic, and sociocultural contexts. However, pilot projects can be implemented to assess the feasibility for implementation and scale up in Sierra Leone.

Chapter 6: CONCLUSION AND RECOMMENDATION

6.1 CONCLUSION

The determinants of CVD and interventions to control CVD burden are complex but very relevant, requiring continuous research to understand the underlying factors influencing CVD development and control in Sierra Leone. The interrelated determinants of cardiovascular disease give a strong conceptual foundation for a strategy that coordinates across multiple sectors. CVD are better controlled with interventions that employed comprehensive public health care strategies which combine policies to tackle healthy food and drink availability in schools, worksites and communities, taxation of tobacco, health education and engagement with communities through screening of risk and provision of continuity of care.

6.2 RECOMMENDATION

To address the growing burden of CVD in Sierra Leone, the following recommendation and actions are suggested according to the findings in this review.

1. There is very low awareness and understanding of CVD and its risk factors and poor health-seeking behaviour in Sierra Leone. Ingrained cultural beliefs, social networks and cost are strongly linked with these factors. To address these factors, the Ministry of Health and Sanitation should:

Actions:

- Develop focused mass media campaigns for door-to-door communication in rural settings, schools, worksites, radio, television and other platforms.
- Advocate and lobby donors and MIC to fund the health education campaign for patients with CVD and risk factors through SMS-text messages
- Train Physicians and non-physician in focused health education counselling
- Advocate and take the lead for the development of policy to include CVD/NCD into CHW scope of work for door-to-door health education campaign

These actions can be implemented within five years starting concomitantly with meetings, training and advocacy with respective stakeholders.

2. There is very low human resources for health in Sierra Leone. The patient-to-physician ratio is lower than the recommended WHO standard. The Ministry of Health and Sanitation through the NCD directorate should:

Actions:

- Develop policies for task-shifting and implement WHO PEN guidelines at all primary care levels.
- Conduct periodic training and mentorship on primary care management of CVD and their risk factors for CHO and other non-physicians.

- Develop referral and back referral guidelines to implement in all health facilities which can lead to the decentralization of NCD services
- Lobby to local councils, managers of health facilities across the country and other implementing partners to increase funding for CVD control

This is a short-term recommendation that can be implemented within five years with the availability of funds.

3. Lack of essential drugs and diagnostic tools for CVD in facilities across the country. The NCD directorate should:

Actions:

- Advocate and lobby for the improvement of pharmaceutical regulation and the inclusion of CVD drugs into the list of essential drugs to increase the availability of essential drugs in health facilities across the country.
- Advocate for the provision of diagnostic tools such as BP machines, glucometers etc in all health facilities and establish a system of accountability and maintenance of these equipment.
- Advocate for the establishment of locally manufactured CVD essential drugs (Long-term: after five years) which can lead to improved quality of drugs.

With the exception of the last bullet point, these actions can be implemented within three to five years with the availability of funds.

4. Poor monitoring and surveillance. CVD risk indicators are sparsely captured, resulting in an incomplete understanding of the trend over time and less evidence-based interventions. This will be the foundation for specific pilot projects that will tailor interventions according to risk profiles and presentations This is an area for immediate and long-term intervention. The Ministry of Health and Sanitation should:

Actions:

- Advocate to include CVD risk indicators among routinely captured indicators in the hospital
- Provide periodic training, mentorship and supervision should be provided to strengthen the HMIS in all districts across the country

- Lobby for more CVD risk indicators other than tobacco and salt to be included in national surveys such as the demographic health surveys
- Lobby stakeholders and take the lead to conduct periodic STEP surveys to understand the current trend of CVD. This was last done in 2009.
- Lobby the Sierra Leone Ethic Committee to waive ethical fees for public health research by local health workers without external funds, this may serve as an incentive to increase research in the country.
- Conduct periodic monitoring and evaluation are needed to improve the service and consistency of case definition and accuracy of data recordings to inform NCD decisions

This implementation can begin within five years depending on funds availability.

5. The implementation of ‘health in all policies’ across ministries. The Ministry of Health and Sanitation through the NCD directorate should:

Actions:

- Initiate the discussion around the establishment of a ‘health in all policies’ strategic plan that should involve all sectors such as the Ministry of Agriculture, Ministry of Trade and Industry, Ministry of Finance, parliamentarians, Youth representatives, Traders/sellers’ unions representatives, heads of industries and factories, Farmers, and other stakeholders
- To lead in the development of such policy.
- Advocate and lobby donors and other stakeholders to implement the pilot project plan in five years.

This policy development can begin within five years.

6. Lack of national CVD guidelines. The NCD directorate should:

Actions:

- Lead in the establishment of standard protocols for the management of CVD
- Train physicians and non-physicians on the use of the guideline which should include clear reasons and instructions for referral to hospitals and back referral to health centres and the community.

This can be developed and implemented within two years.

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Chapter 8: ANNEXE

ANNEXE 1: RESEARCH TABLE

The search words used on databases and search engines (VU library, google scholar, PubMed/Medline, and Google)

	Problem/Issue	AND	Factors related terms	AND	Geography
OR	“Cardiovascular disease”		Prevalence		“Sierra Leone”
	Stroke		Burden		“West Africa”
	“Heart attack”		Trend		“Sub-Saharan Africa”
	“Heart disease”		Determinants		Africa
	CVD		Interventions		“Low- and middle-income countries”
	“Ischemic heart disease”		“Best practices”		“Developing countries”
	“Cardiovascular disease risk factors”		“Health communications interventions”		global
			“Population-based interventions”		
			“Individual behaviour risk-factor interventions”		
		“Community-based interventions”			
			“Health care delivery intervention”		

			“Clinical interventions”		
			“Policy approach”		
			“intersectoral policies”		

ANNEX 2: RESEARCH VARIABLE/THEMES

Authors	Documents	Documents	Documents
Year of publication			
Title			
Reference			
Type of CVD/risk factors			
Location			
Settings (urban/rural)			
Target Population/age considered			
Study period			
Study size			
Study design			
Aim of the study			
Type of interventions (according to figure 1)			
Coverage of the intervention			
Intervention outcome (Blood pressure)			
Intervention outcome (blood sugar)			
Intervention outcome (cholesterol)			
Intervention outcome (obesity)			

Intervention outcome (smoking)			
Intervention outcome (weight reduction)			
Intervention outcome (physical activity)			
Intervention outcome (Diet)			
Intervention outcome (alcohol)			
Intervention outcome (treatment of risk factors eg. HTN, DM)			

HTN: hypertension, DM: Diabetes

ANNEXE 3: PROPOSED CVD-RELATED POLICY ACTIVITIES IN SIERRA LEONE

The policy has six main objectives: strengthening leadership, mobilization of funds, healthy lifestyle promotion, implementation of evidence-based NCDs interventions, the establishment of a monitoring and evaluation system, and strengthening partnerships with stakeholders. (MoHS, 2020a). There are several broad activities under each objective in the strategic plan for 2020-2024 (MoHS, 2020a.p.41-51). Some CVD-related activities from the policy are listed below:

1. Advocacy to the directorate of drugs and medicine supplies and the national medical supplies agency for the inclusion of NCD medications and supplies in the updated cost-recovery programme for all levels of healthcare.
2. Advocacy to the RMNCAH directorate to prioritise prevention and early detection of NCDs
3. Advocate for the consumption of more fruits and vegetables to the Ministry of Agriculture, forestry and food security
4. Advocate for an alcohol-free school environment to the Ministry of basic secondary school education
5. Lobby to parliamentarians for passing of new laws such as tobacco and alcohol laws
6. Advocate for regulations and inclusion in legislation taxation for unhealthy foods like sugar-sweetened beverages to reduce the consumption of sugar
7. Development of health promotion strategies
8. Implementation of PEN at all peripheral units
9. Implementation of the NCD desk guide at health centres and hospitals after it is updated
10. Establishment of early detection of NCD
11. Promotion of family-based care
12. Development and harmonization of NCD management guidelines
13. Scaling up of NCD management care in communities
14. Development and implementation of a multisectoral NCD plan
15. Conduction of STEP survey
16. Advocacy for national surveys like the demographic health surveys to include NCD conditions and risk factors

17. Improve NCD inclusion into the national health metric information system
18. Establishment of the NCD newsletter
19. Conduction of research on tobacco and alcohol interventions impact etc

ANNEXE 4: OTHER MDAs AND NCDs/CVDs COLLABORATIONS

Other MDAs included in the 2020-2024 NCD strategic plan documents for intersectoral collaboration (MoHS, 2020a.p.26) are:

1. The National Food and Nutrition Security multisectoral Implementation Plan 2013-2017. This plan repeated mentioned NCD. The Ministry of Health and Sanitation are to provide health education and nutrition guidelines for NCDs. Currently, the prevalence of obesity in Sierra Leone is lower than the regional average. However, the progress toward achieving the diet-related non-communicable disease (NCD) targets is limited. Sierra Leone is also 'off course' to prevent the prevalence of overweight among under 5 children from increasing from the current 2.8% (Global nutrition report, 2022)
2. The Ministry of Agriculture, Forestry and Food Security (MAFFS) are to use Farmer Field Schools and agricultural extension to support the dissemination of key messages on preventive measures for NCDs (healthy lifestyle), provide support to small-scale farmers in the production of varieties of local nutritious foods, disseminate promotion materials on the consumption of micronutrient-rich foods, establish school and kitchen gardens and provide technical support in food fortification.
3. The Ministry of Basic and Senior Secondary Education (MBSSE), the Ministry of Technical & Higher Education (MTHE), and training organisations are to review all (primary, secondary, and tertiary) levels of curricula in order to incorporate new issues and developments related to micronutrients and to support the establishment of school gardens.
4. Non-governmental organisations (NGOs) and faith-based organisations (FBOs) collaborate in the distribution of IEC materials and assistance with nutrition and healthy living education to communities.
5. The engagement of the National Youth Commission and the Ministry of Youth Affairs (2009) in health promotion campaigns in communities.
6. The Ministry of Information and Communications (MIC) website is currently silent on health issues, particularly NCD issues, but they are now represented in the NCDI commission and may go on to play a significant role in NCD communications in the future (MoHS, 2020c).