UNIVERSITY OF CAPE COAST

NEIGHBOURHOOD BUILT AND PSYCHOSOCIAL ENVIRONMENT: INFLUENCE ON RISK OF CARDIOVASCULAR DISEASES AMONG ADULTS IN CAPE COAST METROPOLIS, GHANA

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BY

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Thesis Submitted to the Department of Health, Physical Education and Recreation of the Faculty of Science and Technology Education, College of Education Studies, University of Cape Coast, in partial fulfilment of the requirements for the award of Master of Philosophy Degree in Health Education

JUNE 2023

DECLARATION

Candidate's Declaration

I hereby affirm that this thesis is the result of my original work and that no portion of it has ever been submitted for credit toward another degree at this university or anywhere else.

Candidate's Signature:……………………………..….Date:………………......

Supervisors' Declaration

We certify that the thesis preparation and presentation were overseen in accordance with the standards for thesis supervision established by the University of Cape Coast.

Principal Supervisor's Signature:……………………….Date:………………...

Name: Dr. Edward Wilson Ansah

Co-Supervisor's Signature:……………………………..Date: ………………...

Name: Dr. Thomas Hormenu

ABSTRACT

This study evaluated the influence of the built and psychosocial surroundings on the risk of CVDs among adults in the Cape Coast Metropolis (CCM). A questionnaire was employed in this quantitative cross-sectional survey to collect data from adults (30-79 years) in CCM. Also, 2329 participants were sampled using a multistage sampling strategy. Frequencies and percentages were used to estimate the level of social support, neighbourhood stress, overweight/obesity and hypertension. Chi-square and binary logistic regression were used to analyse the influence of demographic, built and psychosocial environments on BP level and overweight/obesity. A p-value of 0.05 was set as the significance level, with a 95% confidence interval. Results indicated that social support and neighbourhood stress were moderate and high, respectively. The prevalence of hypertension, overweight, and obesity were 20%, 28%, and 22%, respectively. The risk of hypertension was low in males, married/cohabiting partners, never married, Junior High School (JHS) graduates, former smokers, those with no family history of hypertension, high walkable neighbourhood residents, and those who received moderate social support. However, the risk of hypertension was high among those aged 40-49, 50-59 and ≤60 years, current smokers, employed, retired, those who lived in high stressful neighbourhood, and healthy food environment. Also, the risk of overweight or obesity was relatively low in adults aged ≤60 and high among those who received 1001-2000 Ghana cedis monthly. Policies to ensure high walkable, low stressful, and encourage social support for adults in the CCM are recommended.

KEY WORDS

Built environment

Cardiovascular diseases

Food environment

Hypertension

Neighbourhood stress

Obesity

Social support

Psychosocial environment

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DEDICATION

To my mother, Mary Tawia, brothers; Samuel Obeng and Alex Obeng, and my sister, Mercy Obeng.

TABLE OF CONTENT

Content **Page**

DECLARATION ii

ABSTRACT iii

KEY WORDS iv

ACKNOWLEDGEMENTS v

DEDICATION vi

TABLE OF CONTENT vii

LIST OF TABLES xi

LIST OF FIGURES xii

LIST OF ACRONYMS xiii

CHAPTER ONE: INTRODUCTION 1

Background to the Study 1

Statement of the Problem 6

Purpose of the Study 7

Research Questions 7

Significance of the Study 8

Delimitation 9

Limitations 9

Definition of Terms 10

Organisation of the Study 11

CHAPTER TWO: LITERATURE REVIEW 12

Theoretical Base of the Study 13

Socio-Ecological Model and risk of CVDs 13

The Concept of Built Environment 17

Residential Area 20

Walkability 21

The Food Environment 22

Concept of Psychosocial Environment 26

Social Support 26

Stress 27

Cardiovascular Disease Risk Factors 28

Overweight and Obesity 29

Measurement of Overweight/Obesity 32

Hypertension 32

Measurement and Diagnosis of Hypertension 34

The Residential Area and Risk of CVDs 35

Neighbourhood walkability and risk of CVDs 38

Food Environment and CVDs Risk Factors 41

Conceptual Framework 46

Summary 48

CHAPTER THREE: RESEARCH METHODS 49

Study Design 49

Study Area 50

Population 53

Sampling Procedure 53

Inclusion criteria 56

Exclusion criteria 57

Data Collection Instruments 57

Validity and Reliability of the Instrument 62

Data Collection Procedure 63
Data Processing and Analysis 65
Research Question 1: What is the level of psychosocial risk factors for hypertension and obesity among adults in the CCM? 66
Research Question 2: What is the prevalence of hypertension, overweight, and obesity among adults in the CCM? 67
Research Question 3: What is the influence of socio-demographic characteristics on BP and BMI of adults in CCM? 67
Research Question 4: What is the extent to which neighbourhood walkability, food environment, stress, and social support predict BP and BMI levels among adults in CCM? 68
CHAPTER FOUR: RESULTS AND DISCUSSION 69
Research Question 1: What is the Level of Psychosocial Risk Factors for Hypertension and Obesity among Adults in the CCM? 70
Research Question 2: What are the BP and BMI Levels among Adults in the CCM? 73
Research Question 3: What is the Influence of Socio-Demographic Characteristics on BP and BMI of Adults in CCM? 77
Research Question 4: What is the Extent to which Neighbourhood Walkability, Food Environment, Stress, and Social Support Predict BP and BMI Levels among Adults in CCM? 85
CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS 92
Summary 92
Main Findings 93

Conclusions 95

Recommendations 96

Recommendation for practice 96

Recommendations for policy 96

Recommendations for future research 97

REFERENCES 98

APPENDICES 141

Appendix I: The Study's Questionnaire 141

Appendix II: Ethical clearance letter 150

Appendix III: Bivariate Analysis Tables 151

LIST OF TABLES

Table		Page
1	Level of psychosocial risk factors for hypertension and obesity among adults	71
2	Binary logistic regression for predictors of hypertension and overweight/obesity among participants	81
3	Influence of neighbourhood walkability, food environment, stress, and social support on hypertension and overweight/ obesity of participants	88
4	Chi square analysis of association between socio-demographic variables and BP level among participants	151
5	Chi square analysis for the association between BMI and independent variables	152
6	Chi square analysis of association between level of social support, food environment, neighbourhood stress and BP level	153
7	Chi-square analysis of the association between level of social support, food environment, neighbourhood stress, neighbourhood walkability and BMI level	153

LIST OF FIGURES

Figure		Page
1	Socio-ecological model	17
2	Conceptual framework for the built and psychosocial environment and risk of CVDs	47
3	Study map of CCM	52
4	BP and BMI levels among adults aged 30-79 years in the CCM	74

LIST OF ACRONYMS

ACC-	American College of Cardiology
AOR-	Adjusted Odds Ratio
BMI-	Body Mass Index
BP-	Blood Pressure
CDC-	Centres for Disease Control and Prevention
CCM-	Cape Coast Metropolis
CVDs-	Cardiovascular Diseases
CI-	Confidence Interval
DBP-	Diastolic Blood Pressure
DVs-	Dependent Variables
EPHA-	European Public Health Alliance
FAO-	Food and Agriculture Organisation of the United Nations
GIS-	Geographic Information System
GSS-	Ghana Statistical Service
IVs-	Independent Variables
M.Phil.-	Master of Philosophy
NCCOR-	National Collaborative on Childhood Obesity Research
NCDs-	Non-communicable diseases
NEMS-P-	Perceived Nutrition Environment Measures Survey
NSW-	New South Wales
ODK-	Open Data Kit
PA-	Physical Activity
PANES-N-	Nigeria version of Physical Activity Neighbourhood Environment Scale

Ph.D.-	Doctor of Philosophy
SBP-	Systolic Blood Pressure
SDG-	Sustainable Development Goal
SSA-	Sub-Saharan Africa
UK-	United Kingdom
US-	United States
USEPA-	United States Environmental Protection Agency
WC-	Waist Circumference
WHO-	World Health Organisation

CHAPTER ONE

INTRODUCTION

Background to the Study

Neighbourhood built environment can offer significant access to nourishing food sources, a sense of security, peace, as well as opportunities for engaging in physical activity. Neighbourhood built environment is the man-made or modified components of the environment designed for human activity (Kaklauskas & Gudauskas, 2016). It constitutes spaces for physical activity and recreation, including parks and sports facilities, gymnasiums, foot paths, walkways, buildings, road networks, available water supply systems, and sources of food supply (United States Environmental Protection Agency [USEPA], 2021). Thus, it includes both physical and psychosocial environments.

The psychosocial environment includes an individual's daily interaction with stressors within a community or a place of work and how an individual or the community responds to these stresses (Collaborative on Health and the Environment, 2019). The stressors in the environment range from war, crime, traffic jams, homelessness, and famine to workplace-related interactions including problems among others (Payne, 2020). Besides, an individual's relationship with people in the neighbourhood including parents, siblings, friends, neighbours, groups, and the availability of social support constitute an important part of the psychosocial environment (Lamb & Kwok, 2016). The argument is that these environments and their closely related factors predispose adults to health challenges like obesity, panic attacks, stress, and CVDs. The environment and its related factors may also serve as protective factors for CVDs and other chronic diseases.

The neighbourhood built and psychosocial environment is linked to CVDs among individuals (Albert et al., 2017). Besides, modifiable risk factors for CVDs including hypertension, diabetes, overweight/obesity, stress, and tobacco smoking are associated with the built and psychosocial environment of the local community (Brandão, Sa-Couto, Gomes, Beça & Reis, 2022). For instance, people who live in places where there are more spaces for physical activity are more likely to engage in physical activity which reduces their risk of hypertension, overweight, and obesity and vice versa (An, Shen, Yang & Yang, 2019). Again, living in environments with higher vehicular traffic and the associated noise exposes individuals to stress, which puts them at risk of CVDs (Münzel et al., 2020). Moreover, consistent or prolonged exposure to these stressors may elevate epinephrine levels in the blood, predisposing individuals to hypertension and CVDs (Ayada, Toru & Korkut, 2015). Consequently, CVDs and associated ailments pose a formidable obstacle to global healthcare.

Globally, CVDs are the primary cause of mortalities and pose a significant public health risk (American College of Cardiology [ACC], 2020). These conditions encompass a diverse array of maladies that affect the heart and circulatory system (WHO, 2021a). They consist of ailments such as heart attacks, rheumatic heart disease, strokes, peripheral arterial disease, coronary heart disease, cerebrovascular disease, pulmonary embolism, congenital heart disease, deep vein thrombosis and peripheral arterial disease (WHO, 2021a). Moreover, such conditions are costing huge number of economic challenges.

For instance, in 2019, around 17.9 million deaths globally were attributed to CVDs, which accounted for approximately 32% of the total global deaths in 2019 (WHO, 2021a). Unfortunately, approximately 9.6 million fatalities were observed among the male gender, whilst 8.9 million mortalities were recorded among the female population (ACC, 2020). The ACC further revealed that more than 6 million of these CVD-related deaths were recorded among adults aged 30-70 years. WHO (2021a) further reported that, the highest CVD fatalities in 2019 occurred in developing countries, surpassing three-quarters of the total CVD fatalities worldwide. In addition, a recent finding indicated that the role of CVDs in global mortality has grown from 12.1 million mortalities in 1990 to 18.6 million mortalities in 2019 (Collaborators & Rnlöv, 2020). Thus, the global incidence of CVD-related deaths is increasing steadily, but disproportionately affecting developing nations.

In Africa, CVDs are the primary cause of non-communicable diseases (NCDs) attributable to mortalities, killing about 2.6 million people contributing to about 13% of all fatalities and 37% of NCDs mortalities (Yuyun et al., 2020). Additionally, in 2019, CVDs were the second major cause of mortality in Africa following infectious diseases (WHO, 2021a). Moreover, CVD-related mortality has increased by more than 50% in Sub-Saharan Africa (SSA) between 1990 and 2019 (Yuyun, Sliwa, Kengne, Mocumbi & Bukhman, 2020). Besides, countries in Africa are experiencing increasing rates of CVDs resulting from increasing rates of hypertension and obesity (Hamid, Groot, & Pavlova, 2019). About 39% of all cases of heart failure in SSA are due to hypertension (Agbor et al., 2018). Current evidence suggests that hypertension accounts for about 20% of heart failure hospitalisations in Africa (Kataye et al., 2021). Thus, the prevalence of CVDs in African countries like Ghana burdens the healthcare system.

Ghana is experiencing a double burden of disease in recent times. For instance, epidemiological transition has resulted in increased mortality from both communicable and NCDs over the past two decades in the country (Agyemang et al., 2012). Research indicates that NCDs accounted for 43% of all mortalities reported in Ghana in 2016. Within this category, CVDs constituted 19%, while mental health disorders, diabetes, and cancers accounted for 13%, 3%, and 2%, respectively (WHO, 2018). Furthermore, in Ghana, hypertension is a significant CVD risk factor, it is ranked second in outpatient morbidity among adults aged over 45 years (Agyei-Baffour, Tetteh, Quansah & Boateng, 2018). Additionally, a population-based study conducted in Ghana found that urban areas tend to display higher rates of hypertension than their rural counterparts (Addo et al., 2012). Again, Setorglo et al. (2020) observed that taxi drivers in Cape Coast Metropolis (CCM) recorded 23%of hypertension and 52.5% of prehypertension. Unfortunately, over 30% of adults in fishing communities in urban CCM are obese, complicating the risk for CVDs (Pereko, Setorglo, Owusu, Tiweh & Achampong, 2013). However, various determinants play a key role in modulating the susceptibility of developing nations to CVDs.

In developing nations, the increasing burden of CVDs is due to population growth, physical inactivity, tobacco smoking, excessive alcohol consumption, and ageing (Ding et al., 2020; Ribeiro et al., 2020; Xu, & Wang, 2015). This may require proper planning of cities to create a conducive and exercise-friendly environment. However, urbanisation as the result of the fast-growing population in developing countries has influenced poor planning of cities, limiting people from engaging in physical activities (Kuddus, Tynan & McBryde, 2020). Furthermore, the influence of globalisation and urbanisation has shifted people's dietary preferences, replacing traditional fruit and vegetable-rich diets with unhealthy food choices such as saturated fats, and sugar sweetens and salty diets (Kuddus et al., 2020). Moreover, urbanisation has caused congestion in cities and influenced more people to engage in sedentary lifestyle and becoming less physically active (Kuddus et al., 2020; Lara, Liesbeth, Joachim & Sergio, 2019). Also, urbanisation as a result of rural-urban migration has contributed to heavy traffic, excessive noise, increased crime levels, and air pollution from vehicles in urban areas (Liesbeth et al., 2019). These phenomena have public health implications such as increased stress levels among individuals (Lara et al., 2019). Additionally, harmful social factors in the neighbourhood, such as loneliness and inadequate social support, elevate the probability of anxiety and depression in individuals, thereby making them more susceptible to CVDs (Donovan & Blazer, 2020).

It seems less attention has been given to the neighbourhood built and psychosocial environment and how they affect people's health in Ghana (Tannor et al., 2022). Moreover, the health system is already overwhelmed with the burden of infectious diseases (Asiamah, Petersen, Kouveliotis, & Eduafo, 2021). Therefore, it is crucial to highlight the importance of lowering the risk of CVDs among people in Ghana by conducting research and promoting public health education on the long-term effect of the neighbourhood environment on CVDs.

Statement of the Problem

The prevalence of CVD risk factors, including hypertension and obesity, is on the rise among individuals between the ages of 30 and 79 in CCM (Setorglo et al., 2020). This rise in CVDs risk factors can potentially lead to an increased economic burden on the residents of CCM (Bosu & Bosu, 2021; CDC, 2021). The neighbourhood environment (built and psychosocial environment) influences the health status of people (Malambo et al., 2016; Pedersen, Von Känel, Tully & Denollet, 2017). These environments affect lifestyle choices, access to healthy foods, alcoholic beverages, social support, and promote PA (Folta, 2014; Pradeilles et al., 2021). Some schools of thought contend that studying the socio-environmental factors linked to CVDs is more effective than altering people's behaviour or advocating healthy living on an individual basis to lower CVD risks (Bhatnagar, 2017; Sabzmakan et al., 2014). Unfortunately, the socio-environmental influence on CVD risks has received less attention in Ghana and the CCM (Ofori-Asenso, Agyeman, Laar & Boateng, 2016).

The available research that has linked CVDs risk factors to the neighbourhood environment is limited in scope. These studies tend to be discipline-specific, with a focus on medical or nutritional factors (Asare et al., 2014; Asare-Anane et al., 2015), or gender-specific (Asare et al., 2014). Some studies have centred on individual lifestyles (Sanuade et al., 2021; Asiamah et al., 2021). Thus, neglecting the potential influence of the neighbourhood's built and psychosocial environment. Also, these studies focused on mainly Accra and Kumasi, leaving other urban areas in Ghana, including the CCM (Asiamah et al., 2021; Dake, 2014; Dake, Thompson, Agyei-Mensah &

Codjoe, 2016). Meanwhile, the CCM recorded the third-highest CVDs mortalities in Ghana with Accra and Kumasi Metropolis being first and 2nd respectively in 2020 (Akakpo et al., 2020). The identified neighbourhood characteristics influencing CVDs risk in Accra and Kumasi in the literature may differ from the CCM due to the difference in the population size of these metropolitan areas.

The current understanding of the influence of the built and psychosocial environment of neighbourhood on the development of CVD risk factors in CCM remains unclear. Therefore, it is imperative to evaluate and measure the degree to which the neighbourhood built and psychosocial environment contribute to the susceptibility of individuals in CCM to CVD risk factors. Failure to comprehend the association between the built and psychosocial neighbourhood environment and CVD risk factors could lead to an increase in the prevalence and mortality of NCDs in CCM.

Purpose of the Study

This study investigated how the neighbourhood built and psychosocial environment impacts the risk of developing CVDs in adults residing in the CCM.

Research Questions

These research questions were addressed by this study.

1. What is the prevalence of psychosocial risk factors for high blood pressure and overweight/obesity among adults in the CCM?
2. What percentage of adults in the CCM are hypertensive, overweight, or obese?

3. What is the influence of socio-demographic characteristics on BP and BMI of adults in CCM?
4. What is the extent to which neighbourhood walkability, food environment, stress, and social support predict BP and BMI levels among adults in CCM?

Significance of the Study

Treatment of CVDs puts an economic burden on countries and families across the globe. Hence, identifying the modifiable factors such as neighbourhood walkability will inform town planners to consider the health implications of living in a congested environment. The Sustainable Development Goal 11 focuses on making cities and human settlements inclusive, safe, resilient, and sustainable. The study's insights into the relationship between neighbourhood built and psychosocial environments and CVD risk can guide urban planners in designing more walkable, health-conscious communities. This directly supports the creation of sustainable and liveable urban areas, reducing the environmental and health hazards associated with congestion and suboptimal urban planning. Also, the research findings can provide valuable guidance for policymakers, both within Cape Coast Metropolis and beyond. Policymakers can use the insights gained from the study to develop and implement policies that support healthier living environments and reduce the risk of CVDs. This includes spatial planning, traffic management, and security measures that can create safer and more health-conscious communities.

This study directly aligns with SDG 3, which aims to ensure healthy lives and promote well-being for all at all ages. By identifying modifiable factors contributing to CVD risk, the study can inform targeted interventions and policies to improve the cardiovascular health of the population, ultimately contributing to the achievement of SDG 3. Furthermore, this research illuminates the importance of social support networks and their beneficial influence on health. This information is valuable for health promoters when developing health education programs that aim to improve social support within communities in the context of CCM.

Delimitation

The study was delimited to adults aged 30-79 years who were residents of Cape Coast, Abura, Akotokyir, and Brofoyedur in the CCM. This study assessed neighbourhood environment characteristics: neighbourhood walkability; neighbourhood food environment; social support and neighbourhood stress. Additionally, this study employed a quantitative survey design in order to assess the risk factors for CVDs, including overweight, obesity, and blood pressure. Additionally, a questionnaire was utilised as a means of gathering data.

Limitations

It is imperative to admit that the conclusions and inferences drawn from this study may be subject to limitations influenced by certain factors, which should be taken into consideration. Firstly, the study measured the perceived neighbourhood built and psychosocial environment of participants. Perhaps, some participants' levels of awareness of their neighbourhood built and psychosocial environment do not align with the actual built and psychosocial environment measured. Hence, it is plausible that the outcomes derived from this study may not accurately depict the actual neighbourhood-built and psychosocial environment of such individuals. Nonetheless, the study tried to reduce this limitation by recruiting only participants who had stayed in the study community for six months or more. It was presumed that these people might have had a good idea about their neighbourhood. The study employed a cross-sectional survey methodology, which restricts its ability to establish a causal relationship between the variables. Furthermore, the neighbourhood stress instruments used in this study required participants to recall incidences in their neighbourhood in the past year, which may create recall bias. However, participants were given enough time to recall and respond to the study. Notwithstanding the acknowledged limitations, the study's findings are accurate and reflect the opinions of adults in CCM who are between the ages of 30 and 79.

Definition of Terms

Built environment: Man-made or altered components of the environment designed for human activity such as football parks, markets and walkways (USEPA, 2021).

Cardiovascular disease (CVDs) risk factors: These are behaviours, lifestyles, and conditions of individuals that put them at risk of CVDs (WHO, 2021).

Food environment: The types of food that are accessible, affordable, practical, and aesthetically pleasing in a particular location (Fellinger, 2015).

Neighbourhood: Neighbourhoods are dwellings where people live their daily lives (Sieroka, 2019).

Psychosocial environment: An individual's daily interaction with sources of stress in the community or workplace and how the individual or the community responds to these stresses (Collaborative on Health and the Environment, 2019).

Residential area: This refers to an area where people live (Law Inside, n.d).

Social support: People's perception of the amount of support (psychological and physical support) received from one's social network (Layous & Nelson-Coffey, 2021).

Walkability*:* The ability to safely walk a reasonable distance to amenities is referred to as walkability (Habibian & Hosseinzadeh, 2018).

Organisation of the Study

This study is divided into five chapters. The first chapter discusses the background of the study, the statement of the problem, the purpose of the study, research questions, and significance of the study, delimitation, limitations, and the definition of terms. The second chapter examines concepts, theories, and literature related to the built and psychosocial environments. The third chapter discusses the methods, including study design, study site description, population, sampling procedure, data collection instrument, data collection procedure, and data processing and analysis. The results and discussion are presented in chapter four while five contains a summary, main findings, conclusions, and recommendations.

CHAPTER TWO

LITERATURE REVIEW

The intention of this study was to ascertain how the neighbourhood built and psychosocial environment impacts the risk of developing CVDs in adults residing in the CCM. This section reviewed related literature, drawing on peer review articles and other grey literature such as the thesis, policy documents, conference proceedings, government documents, and urban plans. In conducting the literature search for the literature review, MeSH terms and keywords were used. The MeSH terms used were: Cardiovascular Diseases, Urban Health, Socioeconomic Factors, Environment Design, Residence Characteristics, Social Support, Health Behaviour, Ghana, Adults and risk factors. Also, the keywords used were: Neighbourhood environment, psychosocial factors, cardiovascular risk, adults, built environment, urban planning, social support networks, environmental stressors and congestion and health. The MeSH terms and keywords were combined to conduct a search through five main data bases: PubMed, Central, Scopus, Web of Science, JSTOR, Tailor and Francis and Dimensions AI. Further searches were conducted in Google Scholar and Google as well as reference list of retrieved articles. The literature review is done on:

1. Theoretical Base of the Study
2. Concept of Built Environment
3. Concept of Psychosocial Environment
4. Cardiovascular Disease Risk Factors
5. Residential Area and Risk of CVDs
6. Neighbourhood Walkability and Risk of CVDs

7. Food Environment and Risks of CVDs
8. Perceived Social Support and Risk of CVDs
9. Stress and Risk of CVDs
10. Neighbourhood Security/Fear and Risk of CVDs
11. Conceptual Framework
12. Summary

Theoretical Base of the Study

This study employed the socio-ecological model to provide the theoretical base for the study (Bronfenbrenner, 1977). The constructs of the model and its application to CVD risk factors are discussed in this section.

Socio-Ecological Model and risk of CVDs

Theories and models in public health offer supporting evidence regarding how the built and psychosocial environment affect the risk of CVDs. The socio-ecological model in psychology considers CVDs risks (such as obesity and hypertension) as personal factors influenced by determinants at the interpersonal, organisational, community, and policy levels. According to Richard et al. (2011), the socioecological model (SEM) underscores the importance of recognising that health outcomes are shaped by a multitude of factors, and these factors interrelate across various levels.

In the 1970s, Urie Bronfenbrenner established SEM as a theoretical framework for understanding the process of human development (Bronfenbrenner, 1977). Later in the 1980s, the model was formalised as a theory (Bronfenbrenner, 2000). The model provides a reliable framework to explain how an individual's behaviour and environment interact reciprocally. According to McLeroy, Bibeau, Steckler, and Glanz (1988), the Social

Ecological Model (SEM) encompasses five levels that influence behaviour. These tiers include:

1. Individual level: This level focuses on factors that influence behaviour at the individual level, such as personal values, educational attainment, beliefs, skills, and other individual characteristics.
2. Interpersonal level: This level considers the relationships and interactions between individuals and how they influence behaviour. This includes the influence of family, friends, peers, and other social connections.
3. Organisational level: The organisational level examines the influence of institutions and how they are structured and operated. This includes factors such as workplace policies, leadership, and organisational culture.
4. Community level: At community level the central emphasis lies on the influence that the physical and social surroundings, in which an individual dwells and participates in their pursuits, has on their well-being. This includes community resources, social norms, and community support systems.
5. Policy level: The policy level encompasses the laws, regulations, and rules that shape interventions, influence individuals, and impact the organisations in which they operate. This level considers the broader societal context and the policies that govern behaviour and interventions.

The SEM offers a comprehensive framework for comprehending the numerous factors that mould behaviour and the significance of tackling these factors at diverse levels to achieve effective interventions and behaviour alteration. This is achieved by taking into consideration the five tiers of influence proposed by the SEM.

The socio-ecological framework has become widely recognised and applied in the field of health promotion to analyse different health issues (Alghzawi, & Ghanem, 2021; Brogan, Rossiter, Duffield, & Denney-Wilson, 2021; Rand et al., 2017). Additionally, the built and psychosocial environment's impact on people's risk of developing CVDs has been extensively studied using the SEM (Tamura et al., 2019). According to SEM, interactions between personal, interpersonal, organisational, community, and policy factors lead to CVD risk factors like obesity and high blood pressure. Thus, a variety of individual factors, such as age, gender, sex, place of residence, as well as dietary preferences and physical activity, influence individuals' behaviours that predispose them to overweight, obesity, and hypertension. Moreover, energy intake and expenditure are influenced by interpersonal factors, like community support, family support, and support from friends for an active lifestyle and a healthy dietary choice (Ndejjo, Musinguzi, Nuwaha, Bastiaens, & Wanyenze, 2022). At the organisational level, elements of the local environment, such as socioeconomic status, have an effect on food availability, cost of fresh foods, and a physically friendly environment.

The built environment is the tangible features like parks, street connections, walkways as well as the availability of food resources, including both unhealthy fast food and nutritious options in stores. The food environment has an impact on both the energy intake and expenditure of individuals. Policies implemented at various levels of governance, namely municipal, national, and international have a profound effect on the allocation of food resources and the development of urban areas that foster physical activity like walking (Yang, Wang, Wang, & Song, 2022).

An advantage of the use of the SEM is that it helps to understand the combined effects of different factors that influence the health status of an individual (Ellison et al., 2021). However, the model fails to provide insight into how much impact each level of influence has on the individual. This limitation makes it difficult to determine which aspect of the model, when improved, will have much impact on people's risk of developing CVDs (Partelow, 2018). Nonetheless, the model is useful in guiding studies and interventions interested in determining risk factors of CVDs (Yang et al., 2022). For instance, the model was used to explore the drivers of BP control among patients with comorbidities in Egypt (Mohamed, Macharia, Asiki, & Gill, 2023). Moreover, other studies applied the model to determine the factors influencing obesity among school children (Jebeile, Kelly, O'Malley, & Baur, 2022; Noh, & Min, 2020; Pereira, Padez, & Nogueira, 2019), physical activities among adults (Donnelly et al., 2018; Korom et al., 2023) and dietary practices among children and adults (McCormick et al., 2021; Uchendu, Windle, & Blake, 2020; Upreti, Bastien, Bjønness, & Devkota, 2021).

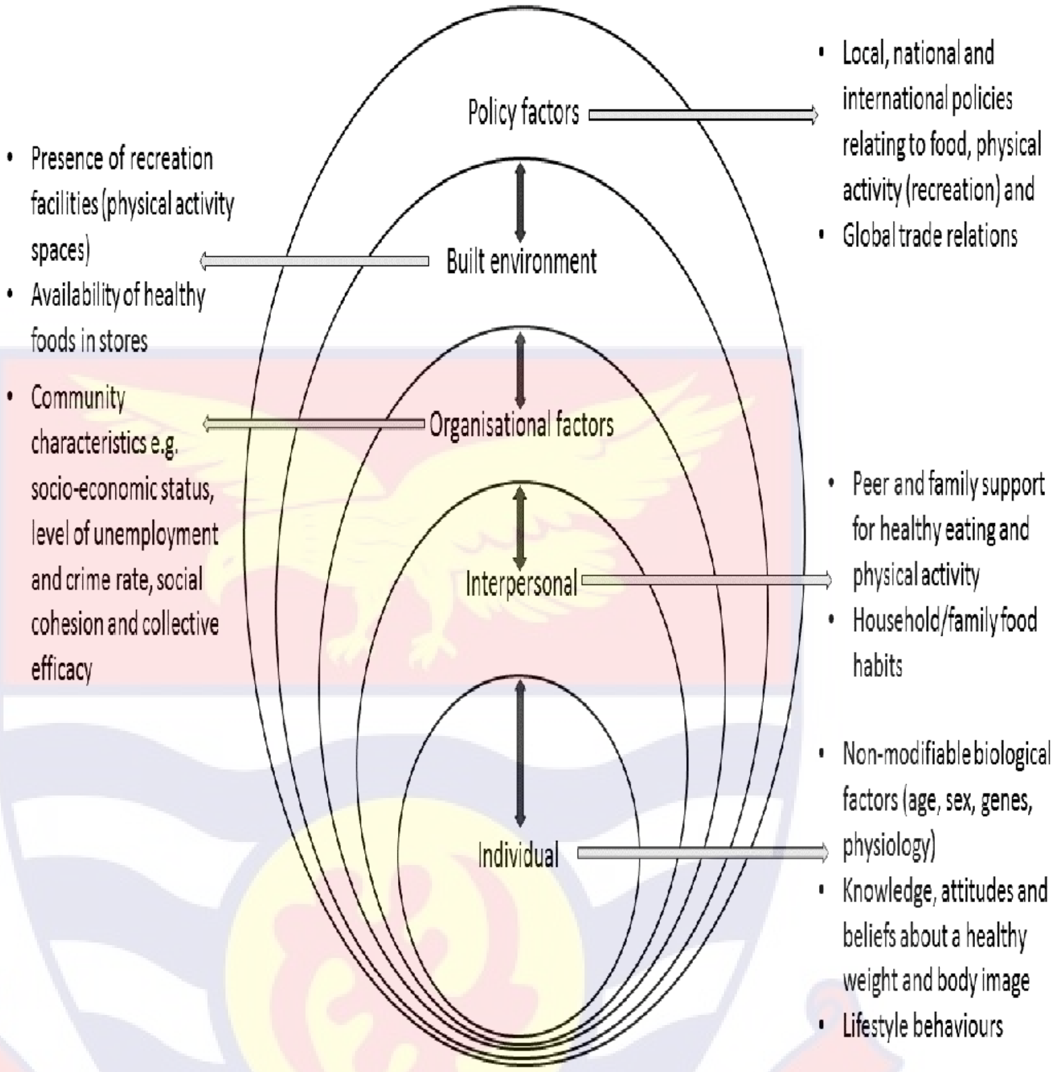

Figure 1: Socio-ecological model (Dake, 2014)

The Concept of Built Environment

The built environment comprises features of the environment assembled by individuals to enhance human activity (Booth, Pinkston & Poston, 2005). It is the altered natural settings in which people reside, work, and play (British Columbia CDC, n.d). Moreover, it consists of urban design, physical spaces for PA, drinking bars, food access (fruits and vegetable markets), grocery stores, restaurants, fast-food joints, sports facilities (parks), gymnasiums, buildings, road networks, traffic systems, available water supply systems, "walkability" and "bikeability" in the neighbourhood. According to CDC (2018), an ideal neighbourhood-built environment should encourage good health and well-being of individuals. Dovjak and Kukec (2019) classified the built environment into two components: healthy and unhealthy built environment.

A healthy built environment promotes the positive well-being of individuals and groups in a community (Gardener, & Lemes de Oliveira, 2020). Besides, it constitutes a planned environment that supports good health and promotes healthy behaviours for people in a particular community (BC Healthy Communities, 2022). A healthy built environment promotes PA, healthy eating, social connectedness, and safety, provide access to natural and green space, and also ensures opportunities for good health for all individuals in a community (UN-Habitat & WHO, 2020). The New South Wales (NSW) checklist for a healthy built environment proposes that such an environment should promote healthy eating habits by promoting access to fresh, nutritious, and affordable food and drinks, discouraging overconsumption of unhealthy foods and drinks including alcohol and also supporting local food production (New South Wales Ministry of Health, 2020). Thus, a healthy built environment exposes people to affordable healthy food outlets that are easy to reach and have safe walking routes. It also promotes PA by promoting access to spaces (green space and recreational amenities) that support walking and cycling (BC Healthy Communities, 2022; Folta, 2014). Moreover, a healthy built environment has separated and well-connected walkways and cycle ways, footpaths, and pedestrian crossings to reduce car dependency and encourage active transport, safety, and security in the community (New South Wales Ministry of Health, 2020).

Furthermore, a healthy neighbourhood-built environment promotes healthy behaviours and the health of children, adults, and the aged. Evidence shows that neighbourhoods with accessible parks increase park visits and PA among individuals (Folta, 2014). For instance, children and teenagers in China were shown to have higher PA levels, fewer sedentary habits, and/or more active commuting when green areas, parks, recreational facilities, and walkways were available (An, Shen, Yang & Yang, 2019). Also, the availability of cycle lanes and sidewalks promotes cycling and walking in the neighbourhood for the good health of individuals (An et al., 2019). A similar study in Brazil found a higher walkability index and cycling activities among adolescents who lived in communities with adequate sidewalks and cycling facilities (Giles-Corti et al., 2019). Meanwhile, evidence suggested that built environment characteristics such as road connectivity and low traffic increase walking and other PA among adults and the aged (Folta, 2014).

Furthermore, studies show that increasing the number of supermarkets and greengrocers can encourage individuals to purchase more fruits and vegetables (Gustafson et al., 2013; Duran, De Almeida, Latorre & Jaime, 2016). Besides, the types of nearby restaurants, the distance and location of both healthy and less-healthy restaurants have an impact on the types of foods people choose to eat. According to a US study, providing a wide choice of healthy food options within 500 metres of a residential area can improve fruit and vegetable consumption (Gustafson et al., 2013). Thus, in the US, every additional outlet serving healthy food within 800 metres of a home may assist to cut the incidence of obesity by 20% (Katare, Lynch & Savaiano, 2021). Katare et al. are therefore, of the view that making nutritious foods more noticeable in stores may encourage customers to purchase more fruits and vegetables.

An unhealthy built environment is associated with poor health outcomes. For instance, a web-based study among 8177 students at the University Institute of Milan, Italy found that students who resided in poor housing facilities were more likely to suffer depression (Amerio et al., 2020). Accordingly, students staying in flats with poor outdoor and indoor views were 1.368 and 2.253 times more likely to experience moderate-severe and severe symptoms of depression respectively. The study emphasises the need to ensure a more attractive neighbourhood. Furthermore, a Portuguese study reported that there was a significant correlation between the proximity of ready-to-eat meals establishments and increased prevalence of overweight and obesity in children who resided within walking distance of these outlets (Ribeiro et al., 2020).

Residential Area

A residential area is that part of the built environment where people live as their dwelling such as individuals' homes, school boarding, prisons, and nursing homes (Law Inside, n.d). Usually, researchers measure residential areas by classifying them into two main categories: Urban and rural areas (Kim & Kim, 2021; Lizana, Cisternas-Vallejos, Araya, Aguilera & Mora, 2016; Nurdiantami, Watanabe, Tanaka, Pradono & Anme, 2018). Nevertheless, the operationalisation of the term `Urban area" in a study may differ based on the country because there is no internationally acceptable definition for the term (Opoku-Asare & Siaw, 2015). Some schools of thought see an urban area to include towns and cities characterised by high population density (Meerow, Newell & Stults, 2016; Ofem, 2012). Others define it based on the functions of an area and the availability of certain basic facilities and amenities such as schools, hospitals, and sources of electricity as well as the type of occupation of the majority of the people (Weeks, 2010). For instance, settlements where citizens engaged in non-agricultural activities could be defined as urban areas and vice versa.

In the Ghanaian context, urban areas are localities with a population of 5,000 or more individuals (Ghana Statistical Service [GSS], 2014). A rural area on the other hand is defined as a settlement inhabiting a population of less than 5,000 people (GSS, 2014). Furthermore, some studies included living in "Slums" in measuring place of residence (Astiarani et al., 2022; Kazmi et al., 2022). An area is considered a slum if it lacks basic amenities, including power, drinkable water, a drainage system, schools, medical facilities, and recreational areas, as well as deteriorated surroundings (Oppong, Asomani-Boateng & Fricano, 2020).

Walkability

Walkability can be described as a complex concept that encompasses the extent to which the physical structures of an environment are conducive to pedestrians and support walking as a means of transportation (Habibian & Hosseinzadeh, 2018). Besides, a "walkable" environment facilitates active transportation modes like cycling, walking, and public transportation, allowing equal access to destinations and fostering social inclusion (Battista, &

Manaugh, 2019). According to Battista and Manaugh (2019), walkability also improves health outcomes by encouraging PA involvement.

The built environment is frequently evaluated in relation to physical activities such as walking, with emphasis placed on key components including street connectivity, household/population density, land use, and land use mix (Yin, Cao, Sun, & Liu, 2023). These factors are commonly aggregated to generate a walking index, as evidenced by the works of Frank, Schmid, Sallis, Chapman and Saelens (2005) and Mayne et al. (2013). A neighbourhood with a "high" level of walkability is characterised by a well-connected street, and convenient access to various destinations (New South Wales Ministry of Health, 2020). Conversely, a neighbourhood with "low" walkability typically exhibits urban sprawl, featuring low population densities, limited street intersections, and decentralised development (Yin, Cao, Sun, & Liu, 2023).

The Food Environment

The term food environment includes all the opportunities present in the surroundings that allow people to access food (Fellinger, 2015). It encompasses the physical, economic, policy, and sociological factors of the environment that impact people's food and beverage preferences, as well as their nutritional status (European Public Health Alliance [EPHA], 2019). Additionally, the food environment represents the assortment of "spaces" where decisions regarding food choices are made, and it determines the types of foods that are available, accessible, affordable, and appealing within those spaces (EPHA, 2019). The food environment is comprised of three fundamental components, namely the social environment, the person-centred environment and physical environment.

The physical dimension of the food environment encompasses various factors, including the density of food establishments within a specific locality, the different types of establishments (i.e., grocery stores, restaurants), and the multitude of options available in terms of both variety and quantity across these establishments (markets, stores, and restaurants). The physical food environment pertains specifically to the food items which are accessible to individuals residing in the surrounding vicinity (Drewnowski, Monterrosa, de Pee, Frongillo & Vandevijvere, 2020). Moreover, the concept of the food environment can be expanded to include other areas where individuals spend a considerable amount of time, such as workplaces and educational institutions, where food is commonly obtained from canteens, nearby supermarkets, and street vendors (Food and Agriculture Organisation of the United Nations [FAO], 2016). Furthermore, the physical food environment encompasses a wide range of locations where food can be accessed, including workplaces, homes, recreational centres, communal centres, funeral ceremonies, festivals, and wedding ceremonies (FAO, 2019). Moreover, this environment encompasses various factors that can influence people's food choices and health outcomes, such as the accessibility and availability of food in neighbourhoods, the presence of food-related information sources such as advertisements in restaurants and grocery stores, and nutritional labels (FAO, 2019).

The physical food environment of adult changes based on the work they do and the occasions they find themselves (Pradeilles et al., 2021). For instance, adults may be exposed to energy-dense foods during workshops, wedding ceremonies, and funeral ceremonies. Adults who find themselves in these situations may consume more energy-dense foods than their body's daily energy requirements exposing them to obesity and hypertension (Clohessy, Walasek, & Meyer, 2019).

The social food environment constitutes the social policies regarding food and dietary practices in an environment. It constitutes support received from family, friends, and workmates, social norms, and taboos to make healthy food choices regarding the consumption of foods. It may comprise rules and practices regarding eating behaviours, and rewards received for consuming certain types of food (National Collaborative on Childhood Obesity Research [NCCOR], 2016). Moreover, the person-centred food environment constitutes an individual's food taste preferences, motivation toward certain food consumption, and self-regulation toward purchasing and consumption of foods in the environment (NCCOR, 2016). Thus, the food environment influences the dietary practices of individuals.

In Pennsylvania, US, Lucan, and Mitra (2012) found that, people who find it difficult in locating fruits and vegetables in a neighbourhood, those who had to travel long distances to purchase fruits and vegetables, and get access to supermarkets and grocery stores rather resorted to consuming more fast foods available to them than consuming fruits and vegetables. They also reported that participants who had negative perceptions about their food environment were less likely to eat healthy foods. Similarly, a systematic review to examine how the food environment affects dietary consumption reported that the majority of participants consumed whatever food that was available to them in their neighbourhoods (Herforth & Ahmed, 2015). Therefore, Lucan and Mitra (2012) suggested that promoting healthy food choices, such as increased consumption of fruits and vegetables, could be facilitated by implementing public policies that restrict the availability of unhealthy options like energy-dense and fast-foods. The rationale behind this recommendation is the understanding that people tend to consume what is readily accessible.

Lamichhane et al. (2012) found that individuals who lived farther from food outlets tended to consume less meat and sweets, and more low-fat dairy products. Meanwhile, in Maine, Briggs et al. (2019) reported that the easy accessibility of fast-food outlets led to poor dietary patterns among 79.7% of residents, which can contribute to obesity and CVDs. However, Flint, Cummins and Matthews (2013) found no association between the food environment and healthy dietary practices in developing countries. In contrast, a study of 147 adults in Kentucky, US, by Gustafson et al. (2013) found that individuals who lived closer to grocery shops were more likely to consume vegetables, grains, and milk.

A study in Brazil stated that the availability of fruits and vegetables in neighbourhoods had a positive impact on the regular consumption of these items (Duran, De Almeida, Maria do Rosario & Jaime, 2016). The study also reported that individuals living in neighbourhoods with limited access to fresh food markets and supermarkets had a lower prevalence of regular fruit and vegetable consumption. The researchers further reported that when a wide range of sugar-sweetened beverages was readily available in the neighbourhood, there was a 15% increase in the regular consumption of such beverages.

Concept of Psychosocial Environment

The psychosocial environment includes an individual's daily interaction with sources of stress in the community or workplace and how the individual or the community responds to these stressors (Collaborative on Health and the Environment, 2019). The stressors in the environment may be war, crime, traffic jams, homelessness, famine, and workplace-related problems (Payne, 2020). Our relationships with people in our societies including parents, siblings, friends, neighbours, and group members, and the availability of social support constitute an important part of the psychosocial environment (Lamb & Kwok, 2016). Interaction with these groups may influence the way we deal with stressors in the community and our risk of diseases such as CVDs.

Social Support

Social support, according to Layous and Nelson-Coffey (2021), is the idea that one feels appreciated and respected by friends, family, and other people. It encompasses a sense of belonging to a supportive network that can be relied upon during challenging circumstances. Strong social networks and receiving high social support can motivate healthy behaviours like engaging in physical activities and practicing healthy dietary habits (Yang et al., 2018). The amount of social support in one's environment could be classified into structural and functional social support measures (Holt-Lunstad & Uchino, 2015). Holt-Lunstad and Uchino further argued that whereas functional measures take into account a person's view of the resources and support they receive from their network; structural measures are influenced by a person's position within a social network. Meanwhile, there are various sorts of assistance within functional support measures, including informational, emotional, belonging, and instrumental support (Layous & Nelson-Coffey, 2021).

The emotional support component of functional support is the perception or actual level of care, love, compassion, encouragement, and reassurance received from a social network (Yang et al., 2018). On the other hand, informational support involves the perception that an individual will receive adequate information such as advice from the social network an individual belongs. According to Yazawa et al. (2022), instrumental social support refers to the perception or direct assistance received from one's social network. In contrast, belonging support pertains to the sense of acceptance, inclusion, strong identity, and security felt by a group member within a particular group. The amount of perceived and actual social support received from a social network could influence the health behaviours of people (Yang, 2018). Moreover, perceived social support is essential in promoting good health and protecting people against obesity and hypertension (Yazawa et al., 2022).

Stress

Stress is the physiological and psychological response that the body exhibits in response to external pressures or demands (American Psychological Association [APA], 2019). However, different schools of thought have viewed stress differently. Lazarus and Folkman (1984) define stress to be a negative response to an excessive demand or pressure placed on a person. Also, the WHO (2023) describes stress as a condition characterised by feelings of worry or psychological tension arising from challenging circumstances. Moreover, stress frequently occurs when individuals encounter something novel, unexpected, or that endangers their sense of identity, or when they believe they have little control over a circumstance (United Kingdom [UK] Mental Health Foundation, 2021). Thus, stress occurs when there is external pressure from an individual's surroundings.

Residing and working in persistently stressful environments can lead to various negative health consequences. Although the body's stress response mechanisms (such as the "fight-or-flight" response) can be useful in responding to sudden environmental stimuli, significant life events, or trauma, the repeated activation of these systems might decrease a person's capacity to withstand stressors over time (Dhabhar, 2018). Chronic stress is associated with an increased likelihood of developing harmful health outcomes like type 2 diabetes and hypertension (Merabet et al., 2022).

Cardiovascular Disease Risk Factors

Cardiovascular diseases are a collection of ailments that impact both the heart and the blood vessels (WHO, 2021b). Acute forms of CVDs, namely stroke and heart attacks, occur when blood flow is obstructed due to fatty deposits accumulating within the inner walls of the blood vessels supplying the brain or heart (WHO, 2021b; Yu, Zhang, Zheng & Tang, 2019). According to the WHO (2021b), the main lifestyle risk factors for CVDs, such as heart attacks and strokes, include bad eating patterns, inactivity, excessive alcohol use, and cigarette use. The health implications of these lifestyle risk factors can be observed through the presentation of high BP, increased levels of blood lipids, heightened blood sugar, as well as overweight and obesity in an individual (CDC, 2019). However, it is possible to identify these risk factors early through routine health screenings (Bansilal, Castellano, & Fuster, 2015).

Overweight and Obesity

Being overweight and obese is a significant contributor to CVDs, making it a prominent global public health threat. Accumulation of abnormal or excessive fat due to unhealthy lifestyles is the primary cause of overweight and obesity (WHO, 2021, p. 2). In 1997, the WHO officially recognised obesity as a threat to public health, highlighting the necessity for its measurement and prioritisation in public health initiatives (Haththotuwa, Wijeyaratne & Senarath, 2020).

Overweight and obesity are now substantially more common than they were before they were identified as a global pandemic. Adults 18 years and above who were overweight or obese experienced a threefold increase in prevalence between 1975 and 2016 (Haththotuwa et al., 2020). Globally, approximately 1.9 billion persons were overweight in 2016, with 650 million adults classed as obese (WHO, 2021). Moreover, in the same year, more than 13% of the adult population worldwide was obese, with a higher prevalence among women compared to men (WHO, 2021). The rates of obesity among children and adolescents have reached alarming levels since the recognition of this issue as a global epidemic in 1975. For example, in 2016, approximately 340 million children and teenagers were classified as overweight or obese, which signifies a substantial rise from the prevalence of 4% recorded in 1975 to 18% (WHO, 2021). Furthermore, according to the WHO, in 2019, around 38.2 million under five children were either overweight or obese.

Overweight and obesity were once primarily seen as issues affecting developed countries, but now developing countries are also facing high prevalence rates, especially urban areas (Templin et al., 2019). In 2019, the African continent alone accounted for approximately 24% of global cases of overweight among children under five (WHO, 2022). A current report from the WHO (WHO, 2022) predicts that by December 2023, one in every five individuals and one in every ten children and teenagers in Africa will be obese unless substantial measures are taken to address this issue. In Ghana, a meta-analysis examining studies on overweight and obesity revealed that around 43% of adults in the country are either obese or overweight (Ofori-Asenso et al., 2016).

Obesity and overweight primarily occur due to imbalance caloric intake and caloric expenditure, as explained by the National Heart, Lung, and Blood Institute [NIH] (NIH, 2022). Furthermore, globally there is a rise in the consumption of energy-dense, high-fat foods, coupled with low physical activity, largely driven by the highly sedentary nature of various occupations, changes in transportation methods, and the growing urbanisation trend (Fox, Feng & Asal, 2019). These modifications in dietary patterns and physical activity levels often result from environmental and societal changes, including urbanisation, as well as the lack of supportive policies in sectors such as transportation, agriculture, healthcare, urban planning, education environment, food processing, distribution and marketing.

Having a higher BMI is one of the risk factors for NCDs (Fox et al., 2019). Among the health risks associated with obesity, type 2 diabetes, CVD conditions (specifically heart disease and stroke), and hypertension are the most prominent hazards (Gregg & Shaw, 2017). Overweight and obesity both contribute to about 2.8 million deaths worldwide each year. Even more severe repercussions result from childhood obesity (Neupane, Prakash & Doku, 2015). Being obese is in relation to elevated risk of premature death and impaired health in adulthood. Additionally, obese children are more likely to experience respiratory issues, early signs of CVD, insulin resistance, fractures, psychological challenges and hypertension (Gregg & Shaw, 2017). Additionally, they are more likely to face future health problems (Neupane et al., 2015). The occurrence of overweight, obesity, and the associated NCDs can largely be prevented (WHO, 2021). Creating supportive environments and communities plays a crucial role in influencing individuals' food choices by making healthier food options and routine physical activity more accessible, available, and affordable, thereby reducing the prevalence of overweight and obesity (Gregg & Shaw, 2017). Individuals can take several steps to improve their health, such as increasing their intake of legumes, fruits, nuts, whole grains, and vegetables, getting regular exercise (averagely, 150 minutes per week for adults, or 60 minutes per day for children) and cutting back on fats and sugars (Neupane et al., 2015).According to Gregg and Shaw (2017), while individual responsibility plays a role in maintaining a healthy lifestyle, it is only effective when people have access to the necessary resources. This emphasises the need for supportive policies and programmes at the societal level that facilitate healthy eating and regular physical activity. To achieve this, evidence-based and population-based policies need to be implemented and sustained to make healthier dietary choices and physical activity accessible, affordable, and easily available to everyone.

Measurement of Overweight/Obesity

The body mass index (BMI) is a widely utilised measure to assess overweight and obesity in individuals. It is calculated by dividing a person's weight in kilograms by the square of their height in metres (kg/m^2) (WHO, 2021). For adults18 years and above, BMI values falling below 18.5 kg/m^2 is categorised as underweight, between 18.5 and 24.9 kg/m^2 as healthy weight, 25 and 29.9 kg/m^2as overweight, 30 and 39.9 kg/m^2 as obese, and 40 kg/m^2 or higher are extremely obese (WHO, 2021).

Researchers recommend the use of BMI measures when working with a large population because it is more practical to use and could serve as a population-level indicator of overweight and obesity. Moreover, the use of BMI could be applied to both male and female adults (Haththotuwa, Wijeyaratne & Senarath, 2020). Besides, BMI may be measured anywhere, it is significantly less expensive and is simpler to use (Fellinger, 2015). However, BMI does not differentiate between lean body mass and excess fat, making it an imperfect measure of adiposity (Zhang et al., 2020). Nevertheless, BMI is more practical and convenient to use when dealing with a larger population in a study (WHO, 2021).

Hypertension

Blood pressure (BP) refers to the force exerted by circulating blood on the walls of arteries, which are the primary blood vessels transporting blood from the heart to other parts of the body (WHO, 2021). Hypertension, or high BP, is the result of an abnormal high pressure exerted on the artery walls by circulating blood (WHO, 2021). Over time, hypertension can lead to a range of health problems, including heart disease (Sundstrom et al., 2015). The volume of blood pumped by the heart and the degree of artery resistance both affect BP. Blood pressure increases when the heart pumps more volumes of blood and the arteries are narrower (Mayo Clinic, n.d).

Blood pressure is represented in two figures: systolic and diastolic. The systolic figure reflects the pressure (force) in the blood vessels when the heart contracts, whereas the diastolic figure indicates the pressure (force) in the blood vessels when the heart is at rest between beats (WHO, 2021). Hypertension, or high BP, can have detrimental effects on various aspects of the cardiovascular system. For example, it can negatively impact the structure and function of arteries, arterioles, and other blood vessels (Lee & Park, 2015). In addition, hypertension can cause harm to organs such as the eyes, kidneys, and brain (Modi & Arsiwalla, 2021). Long-term hypertension is associated with CVDs like coronary artery disease, heart failure, and stroke, as well as other conditions including dementia and chronic kidney disease (Fuchs & Whelton, 2020).

Various studies have reported diverse hypertension prevalence in adults globally. For instance, a Ghanaian study found a 30.3% hypertension prevalence in adults 18 years or above (Atibila, Hoor, Donkoh, Wahab, & Kok, 2021). Another study in the Kintampo South and Kintampo North Municipality in Ghana reported a hypertension prevalence of 28% among adults 18 years or above. The study also identified current and past tobacco use, prediabetes, high BMI, and high glucose levels as risk factors for hypertension among their participants (Dosoo et al., 2019). Similarly, a study among 12,151 people 18 years or above in Ghana found a 30.43% hypertension prevalence (Opoku et al., 2020). Also, males were at higher risk of developing hypertension than females in their study. The study further reported that advancing age, urban residency, and higher wealth index increased the likelihood of hypertension within their participants (Opoku et al., 2020).

A study conducted in the Ashanti Region involving 3,080 adults (≥18 years) reported a hypertension prevalence of 27.3% (Tannor et al., 2022). The study identified increasing age and high BMI as predictors. Furthermore, a study conducted among 2214 adults aged ≥25 years in Lebanon recorded a prevalence of 30.7% (Ghaddar et al., 2021). Moreover, astudy among 2620 adults aged 18-69 years in Mayotte, France found hypertension prevalence of 38.4% (Calas et al., 2022). Similarly, a study in Sralinka among the adult population was 28.2% (Rannan-Eliya et al., 2022).

Measurement and Diagnosis of Hypertension

The diagnosis of hypertension requires a consistently high resting BP measurement. The WHO proposes that, in diagnosing hypertension, the resting BP measurement of an individual should be measured on two different days using a sphygmomanometre (WHO, 2021). Likewise, to diagnose hypertension, the American Heart Association (AHA) recommends that patients' resting blood pressure be measured at least three times during at least two distinct trips to the medical facility (Xi et al., 2017). Besides, an adult is considered hypertensive if their systolic blood pressure (SBP) on both days record 140 mmHg and/or their diastolic blood pressure (DBP) records 90 mmHg (Nickey, Lenfant, Chobanian, & Roccella, 2003). Also, BP recordings for DBP less than 120mmHg and SBP Less than 80mmHg as normal; DBP

120–129 mmHg and SBD below 80 mmHg as elevated BP; DBD 130-139 mmHg and SBD 80-89 mmHg as HBP (hypertension) stage one.

Apart from the recommendations by WHO and AHA on the diagnosis of hypertension, another type of hypertension, “ambulatory hypertension”, which is about monitoring the BP of an individual for over 12 to 24 hours is the most accurate approach in diagnosing hypertension (Siu, & US Preventive Services Task Force, 2015). Using ambulatory BP measurement permits the BP of an individual to be checked at regular intervals. This approach helps reduce the undue rise in the BP of patients who suddenly experience an increase in BP at the site of a doctor or in the healthcare setting.

In determining the BP of an individual, the patient should be seated resting for at least three to five minutes before and after each BP measurement in a warm and quiet environment (Chen, Lei & Wang, 2018). The client should be made to sit up straight with his/her back against the chair, leg uncrossed, and feet flat against the ground. When taking the reading, the upper arm (often the right upper arm) should be resting on a table at a height that is roughly equal to the heart level with the palm visible (CDC, 2021). The client should be freed of any tight clothing that may interfere with the BP measurement. Moreover, the client should not be talking while the BP is being measured.

The Residential Area and Risk of CVDs

The residential area where people live may expose or protect them from obesity and hypertension. For example, a study revealed that people who lived in neighbourhoods with higher levels of air pollution and ambient heat were at higher risk of developing hypertension (Yang et al., 2018). Also, living in residential areas with higher levels of noise from residential road traffic was associated with hypertension (Dzhambov, & Dimitrova, 2018). Furthermore, a study among 313,714 women (≥18 years) in Indonesia showed that the residential area where the respondents lived significantly influenced their risk of developing hypertension (Nurdiantami et al., 2018).

Though they are lifestyle conditions, overweight and obesity are predominantly related to the environment people live. In Korea, Kim and Kim (2021) studied the changes in the prevalence of obesity among people (≥age 19 years) concerning their residential status. They found that obesity increased among rural area dwellers compared with those in metropolitan areas (Kim & Kim, 2021). Moreover, Kim and Kim found higher consumption of vegetables and cereals but low consumption of milk and fast-food among the rural folks than those in the metropolitan areas. Their findings show that living in rural areas may improve healthy eating but may not be sufficient to protect rural dwellers from hypertension and obesity.

Further research reported a significant relationship between overweight/obesity and residential areas. For instance, in Pakistan Asif, Aslam, Altaf Atif, and Majid (2020) analysed the 2010 Pakistan Population and Household Survey to evaluate the prevalence and associated demographic factors of overweight and obesity in 10,063 adults. They revealed that adults in urban localities were more likely to be overweight/obese than rural dwellers. Similarly, a study in Jordan reported a significant relationship between living in residential areas and overweight/obesity among adults (Ajlouni, Khader, Batieha, Jaddou & El-Khateeb, 2020).

Nonetheless, the influence of residential areas on health risk factors expands beyond adults to children and the elderly. For instance, in Chile, a study compared the BMI, PA, and body fat distribution of school-aged children in urban and rural settings (Lizana et al., 2016). Children in urban settings were found to have higher prevalence of obesity (30.88%) than those in rural settings (28.9%). However, more children from rural areas suffered from central obesity. However, a similar cross-sectional study in Ontario, Canada found more adults in rural areas who were overweight and obese (15.1%, 6.7%) than those in urban areas (14.6%, 6.3%) (Ismailov & Leatherdale, 2010).

Notwithstanding the negative impact the built environment has on developing CVD risks, some residential areas may encourage healthy behaviours of people. Besides, some residential characteristics such as residential green space and highly walkable residential environments are protective factors against CVD risks like obesity and hypertension. For instance, a descriptive cross-sectional study conducted among 555 adults in Austria revealed that adults who were residing in higher overall greenness residential areas had reduced their chance of developing hyper/hypotension by 30-40% (Dzhambov, Markevych, & Lercher, 2018). The researchers further found that having a backyard garden served as a protective factor against developing hyper/hypotension. Similarly, a study in Bangladesh found that the greenness of residential areas reduced people’s risk of becoming hyper/hypotensive (Khan, Biswas, Hossain & Archie, 2022).

Neighbourhood walkability and risk of CVDs

The built environment characteristics and their influence on health behaviours and outcomes are attaining recognition globally, especially in developed countries like the US (Xu & Wang, 2015), United Kingdom (UK) (Hawkesworth et al., 2018; Sarkar, Webster, & Gallacher, 2018) and Canada (Howell, Tu, Moineddin, Chu & Booth, 2019). Besides, studies have investigated the influence of neighbourhood walkability and PA (Howell et al., 2019; Malambo et al., 2016; Sarkar et al., 2018). Moreover, these studies have linked neighbourhood walkability and the risk of developing CVDs. The following assessment of the literature shows a linkage between neighbourhood walkability and the risk of acquiring CVDs.

Neighbourhood walkability is associated with an increased global likelihood of obesity and hypertension. For instance, a cross-sectional study among 44,448 adults in urban centres in Ontario, Canada aimed at determiningthe association between neighbourhood walkability and predicted 10-year CVD risk. The researchers found that participants residing in less walkable communities had a higher predicted 10-year CVD risk compared with those who stayed in a highly walkable neighbourhood. The study further reported that adults who lived in less walkable neighbourhoods were at higher risk of experiencing higher SBP, and diabetes mellitus (Howell et al., 2019). However, their study focused on built environment characteristics neglecting the impact of psychosocial factors such as stress and social support. Yazawa et al. (2022), argue that in measuring neighbourhood characteristics and their influence on health, psychosocial factors should be considered.

According to Yazawa et al. poor psychosocial factors like social support and stress can impact the health of people.

Furthermore, a 2005 to 2015 systematic review to determine the relationship between the built environment and the risk of CVDs using eighteen studies reported that neighbourhood environment attributes significantly predicted CVD risks and outcomes (Malambo et al., 2016). Malambo et al. further revealed that built environment features such as a high walkable environment, living closer to supermarkets, fast-food outlets, high-density traffic areas, and living closer to a bus stop were associated with BMI, BP, metabolic syndrome and diabetes mellitus. However, their study failed to measure the association between psychosocial factors such as social support and neighbourhood stress and the risk of CVDs.

Additionally, Creatore et al. (2016) used a time series analysis for adults 30-64 years to determine whether walkable urban neighbourhood had a slower rate of increasing overweight, obesity, and diabetes as compared with less walkable environments. They reported a rise in the prevalence of obesity and overweight among adults living in less walkable neighbourhoods while the prevalence of overweight and obesity showed no significant change in higher walkability environments. Moreover, a recent cross-sectional study (Koh et al., 2021) among adults in rural Japan found a lower mean BMI in adults who resided in highly walkable neighbourhoods. Further, using generalised linear models, Adhikari et al. (2021) studied the relationship between neighbourhood walkability, park availability and hypertension in two separate demographic cohorts (My Health My Community cohort, 22,418 adults, and BC Generations Project, 11,972 adults) in British Columbia (BC) and Canada. They used walkability measures from the municipal database on neighbourhood characteristics. The study reported that participants who had easy access to community parks and those who lived in a high walkable environment had reduced their chances of getting hypertension as compared to those who lived in a low walkable environment and also lived far from community parks.

Furthermore, Müller-Riemenschneider et al. (2013) studied 5970 adults (25+ years) in Western Australia. They found that people who lived in walkable neighbourhoods had reduced their likelihood of becoming obese and also were at decreased chances of type 2 diabetes mellitus. Similarly, Sarkar et al. (2018) studied 429,334 UK residents (38–73 years) to establish the relationship between the built environment and BP scores of their participants. They measured neighbourhood walkability using UK detailed building footprint-level data. They reported that DBP, SBP, and hypertension were all positively related to neighbourhood walkability within a one-kilometre street catchment and that each quartile increases in walkability was linked to lower DBP, SBP, and hypertension risk.

The relationship between residency and CVD risk is evident. For instance, in France, de Courrèges et al. (2021) determined the association between neighbourhood walkability and people's risk of CVD midst3218 respondents aged40-65 years. They used GIS to generate the neighbourhood walkability index for each residential address. They reported lower SBP, BMI, increased levels of PA and lower prevalence of hypertension among participants living in high walkable neighbourhoods. Furthermore, De Bourdeaudhuij et al. (2015), conducted a multi-country study using 12 culturally and environmentally different countries (Mexico, New Zealand, Spain, the Czech Republic, Denmark, Australia, Belgium, Brazil, China, Colombia, the United Kingdom, and the United States of America). They employed a multi-site cross-sectional design with 14,222 people (aged 18-66 years) in 17 cities to determine the association between the built environment features and their participants' nutritional status. They discovered that BMI was related to traffic safety, closeness to local destinations, and safety from crime across all 12 countries.

Hypertension is further linked to neighbourhood factors. For example, Malambo et al. (2018) conducted a study in South Africa to determine the association between the perceived built environment and hypertension among 671 respondents (5–70 years). They used the Neighbourhood Environment Walkability Scale (NEWS) to measure the perceived built environment. They reported a significant relationship between perceived neighbourhood walkability and hypertension. Another cross-sectional study conducted in South Africa among 341 adults (aged ≥35) used GIS to measure built environment characteristics to establish the association between the built environment and CVD risks (Malambo et al., 2018). It was found that those who were staying within easy walking distance of community centres had lower BMI and BP scores.

Food Environment and CVDs Risk Factors

The association between diet and CVDs risk is evident in the literature (Dake, 2014; Pradeilles et al., 2021; Walker et al., 2020). Literature in Western nations and Africa show that obesity among people is partly blamed on the obesogenic environment (Chen et al., 2019; Dake et al., 2016; Mattes &

Foster, 2014). Nevertheless, some literature has also reported that some features of the food environment serve as protective factors against CVDs risk factors like obesity and hypertension (Zhang et al., 2020). For instance, in Canada, Walker et al. (2020) studied 8076 adults (aged 35-70 years) to evaluate the impact of the local food environment on people's risk of obesity. They recruited participants from 42 rural, suburban, and urban communities and measured the BMI and waist circumference (WC) of the participants, proximity to full-service restaurants, fast-food outlets, markets, pubs, bars, and liquor stores within 500 metres and determined the relationship between these built environment characteristics, BMI and WC. They found a positive relationship between the ratio of ready-to-eat food outlets, proximity to fast-food outlets, living closer to liquor stores, bars/pubs, and obesity. Moreover, abdominal obesity was linked to living closer to bars/pubs and liquor stores.

Furthermore, Patel et al. (2018) studied the relationship between full-service and fast-food outlets density, dietary practices and overweight/obesity among adults in India. They used GIS to measure the food environment characteristics. They revealed that participants with high fast-food outlet density were at increased risk of overweight/obesity. Also, a Chinese study among older persons (aged 65-80 years) reported that, easy access to greengrocers, sit-down restaurants, living closer to more supermarkets, and easy access to fast-food outlets were linked with higher BMI. However, convenience stores that are accessible and easy access to ready-to-eat food outlets were protective against overweight and obesity. For instance, accessible convenience stores and western ready-to- eat food restaurants was linked with normal BMI (Zhang et al., 2020). Recent evidence from the US

(Katare, Lynch, & Savaiano, 2021) examined 1743 adults for the association between perceived neighbourhood food environment and obesity using a descriptive cross-sectional design. The study revealed that after controlling for demographic variables like residential area, age, and level of education, respondents who perceived that there is a variety of vegetables and fruits that were available and accessible were at 22% reduced risk of becoming overweight/obese. Also, respondents who believed they had to travel more than five miles to get to the grocery shop to shop were 1.36 times at risk of becoming overweight or obese as compared to those who only had to travel lesser distances. However, this study used self-reported measures for height and BMI of which respondents may have over or underestimated their BMI scores. Similarly, a study in the US reported a significant relationship between the food environment and risk of obesity. These researchers found an increased risk of overweight/obesity among respondents who lived closer to fast-food outlets (Chen et al., 2019).

Aside the impact of the food environment on the likelihood of obesity among US citizens, the food environment has also been connected to the risk of hypertension. According to a study from six sites in the US, the food environment significantly predicted the risk of hypertension among their participants. The study discovered that increasing the availability of healthful foods was connected to reducing the chances of getting hypertension by 12% (Kaiser et al., 2016). In Mexico, a study looked at the association between food retail environment and BMI in people and discovered that residents in high-density food outlet concentrations had a greater chance of being overweight/obese (Pineda, Brunner, Llewellyn & Mindell, 2021). Again, they found that when the store density was increased by 10%, adults were at risk of gaining an extra 1 kg of weight. Also, a similar study in Australia reported a significant relationship between abdominal obesity and the unhealthful food environment index, but no correlation between the food environment and the risk of hypertension was recorded (Paquet et al., 2014). In Ghana, Dake et al. (2016) found an association between the neighbourhood food environment and the risk of overweight/obesity. They found that those who had easy access to readily available out-of- home food was at increased risk of becoming obese than those who did not have access to readily available out-of-home foods.

Social Support and High blood Pressure

Social support is key to encouraging healthy behaviour which may protect against some chronic diseases. For instance, in China, Yazawa et al. (2022) studied 765 adults to establish the association between loneliness and hypertension and whether social support reduces the risk of developing hypertension. The findings indicated that those who mostly felt lonely were at increased risk of developing hypertension. They further reported that the odds of hypertension were high among participants who received a low level of social support than those who had a higher level of social support. Similarly, there was a significant relationship between social support and hypertension among adults in a Chinese study. The study found that particularly middle-aged and older males who were not living with their spouses were at risk of becoming hypertensive. Moreover, being part of a community-based organisation and having more children could serve as a protective factor against hypertension (Wu, Lei, Ye, Sunil, & Zhou, 2019).

Social support may further affect the level of BP of individuals. For instance, Piferi and Lawler (2006) measured ambulatory BP to assess the link between "giving social support" and ambulatory hypertension in adults. The results indicated "giving social support" to others was associated with lower levels of SBP, DBP, and mean arterial pressure. Similarly, a cohort study of African American adults found that having high levels of functional social support was linked with a reduced chance of acquiring hypertension and that having less functional support could put people at risk of developing hypertension (Harding et al., 2022). Likewise, a longitudinal study that looked at the association between social support, social integration, and changes in hypertension risk in adults reported that low social support was substantially connected with high SBP, but low social integration was associated with the risk of hypertension (Yang, Boen & Mullan Harris, 2015).

The relation between social support and BP can also be influenced by gender. For example, in Canada, Hosseini, Safari, Khan, Veenstra and Conklin (2021) conducted a cross-sectional study to explore gender differences in social support for hypertension among 28,779 adults (aged 45-85 years). They found that higher perceptions about the availability of informational, emotional, belonging, and emotional support were associated with lower SBP. Also, the study found that low levels of informational and emotional support were related to an increased risk of high BP among women than men.

Social Support and Overweight/Obesity

The amount of social support an individual receives may influence their risk of becoming overweight/obese. For instance, a Canadian longitudinal study among 28,779 adults showed that people who lacked tangible, emotional, and informational support were at increased risk of developing central obesity in than other who received higher social support (Hosseini et al., 2021). Similarly, a longitudinal study in Sweden examined the relationship between social relationships and obesity. The study found a higher risk of obesity among men who lacked emotional support and those who recorded a lower social relationship index. Moreover, divorced women were at a reduced risk of obesity compared to married women. However, they found no significant association between a lower social relationship index and obesity among women (Oliveira, Rostila, De Leon & Lopes, 2013).

Furthermore, Lee, Yusof, Pillai, Yap, and Jahan (2022) reviewed the literature on the relationship between social networks and obesity in adults. They revealed that residents of neighbourhood with a higher level of social trust and social support were at a decreased risk of obesity than those who have low level of social trust and social support. Another study among African Americans reported an increased risk of developing obesity among people who received lower levels of social support than those who received adequate social support (Primack et al., 2017).

Conceptual Framework

Figure 2 is a conceptual framework showing the impact of the neighbourhood built and psychosocial environment on the risk of CVDs. The researcher designed the conceptual framework with the research questions and the influence of built environment framework designed by Dake (2014) serving as the basis and guide for the current conceptual framework. The conceptual framework demonstrates the relationship between neighbourhood walkability, neighbourhood social support, neighbourhood stress, neighbourhood food environment, socio-demographic characteristics, and the risk of CVDs. From Figure 2, neighbourhood walkability would influence the CVDs risk such as obesity and hypertension.

Studies have linked higher walkable environments to higher levels of PA, lower BMI levels, and lower prevalence of hypertension among individuals (Colom et al., 2021; de Courrèges et al., 2021). Also, neighbourhood social support and stress would influence an individual's risk of becoming overweight/obese and/or hypertensive (Kim, Hawes & Smith, 2014). Moreover, the food environment predicts CVD risk factors like overweight/obesity and/or hypertension (Mattes & Foster, 2014; Walker et al., 2020). In addition, socio-demographic factors such as marital status, residential area, educational level, age, religion, occupation and income level, would predict an individual's risk of becoming overweight/obese and/or hypertensive (Kim & Kim, 2021), by influencing the level of social support an individual receives (Shang, 2020), which in turn affects the level of stress.

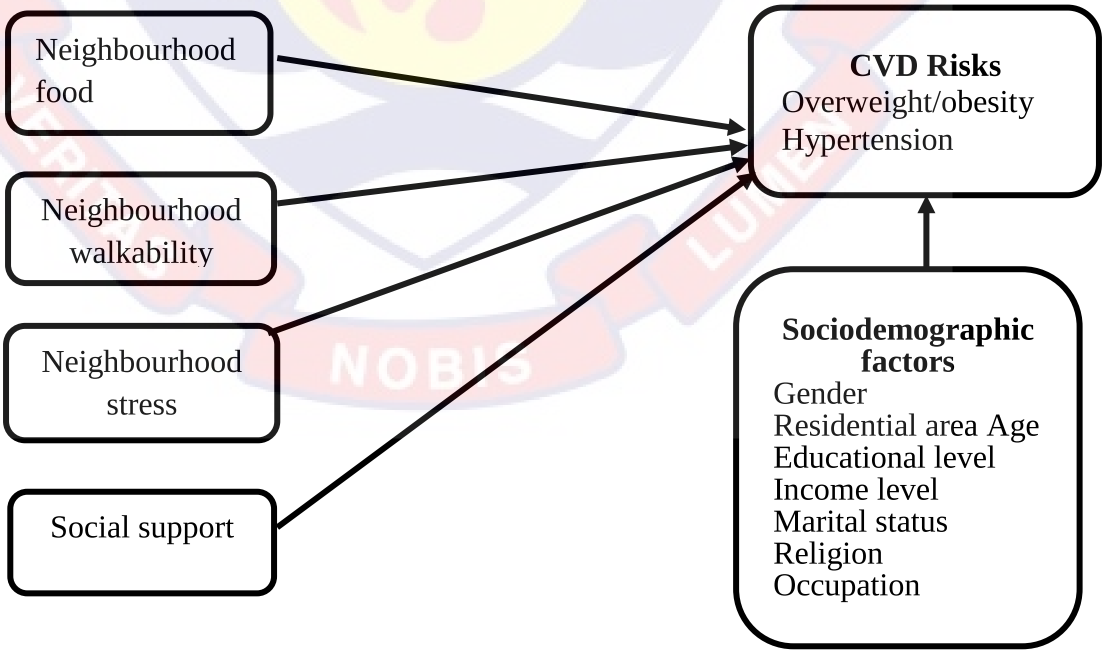

Figure 2: Conceptual framework for the built and psychosocial environment and risk of CVDs (Dake, 2014).

Summary

The purpose of this study was to determine the influence of the neighbourhood environment on the risk of CVDs among adults in the CCM. The SEM was used to guide the study. Also, a review of the empirical literature is done on a residential area, food environment, social support, stress and neighbourhood security, and risk of CVDs. The review noted some gaps in the literature that directed the focus of the current study.

It was noted that most of the studies on the relationship between neighbourhood-built and psychosocial environments and the risk of CVDs were conducted in Europe, and South Asia with few studies in Africa including Ghana. Moreover, most of the studies on neighbourhood factors influencing CVDs were mostly focused on the neighbourhood-built environment with less attention given to the psychosocial factors influencing CVDs. Also, studies that measured neighbourhood-built environment characteristics such as walkability and the food environment measured the environment objectively neglecting the perception of inhabitants on their neighbourhood environment. These limitations necessitate additional research on the influence of the built and psychosocial environment on CVDs risks throughout Africa, particularly Ghana.

CHAPTER THREE

RESEARCH METHODS

This study determined the influence of the neighbourhood built and psychosocial environment on the risk of CVDs among adults in the CCM. This section explains the methodologies, which include the study design, study site, population, sampling procedure, data collection instrument, instrument validation and reliability, data collection processes, and data processing and analysis.

Study Design

The current study used a quantitative cross-sectional survey to examine the relationship between the built and psychosocial environment and the risk of CVDs among adults in CCM. Cross-sectional surveys are an effective means of collecting data from a representative sample of a target population, allowing researchers to obtain information about participants' beliefs, opinions, attitudes, motivations, and behaviour (Babbie, 2007). The study focuses on describing participants' perceptions of the built and psychosocial environment, making a cross-sectional survey design the most appropriate method. Cross-sectional surveys are flexible, allowing for the collection of data on many variables and questions at one point in time (Nayak, & Narayan, 2019). The current study collected data on multiple variables making cross-sectional surveys the most appropriate design for this study. Also, cross-sectional surveys allow the measure of more than one outcome and predictors. This study measured the point prevalence of hypertension and overweight/obesity, hence, making cross-sectional surveys the best study design for the study. Similar studies that assessed the association between the built and psychosocial environment and CVD risk have also employed the same methodology (Chum & O'Campo, 2015; Dake et al., 2016; Harding et al., 2022; Malambo et al., 2018).

However, there are certain limitations associated with employing descriptive cross-sectional surveys. Descriptive cross-sectional survey research is not suitable for studying diverse or heterogeneous groups (Mathiyazhagan & Nandan, 2010), but the group in the current study seems more homogeneous. The use of cross-sectional survey is susceptible to sample selection bias, which has the potential to distort the collected data (Babbie, 2007; Creswell, 2009). To minimise this bias, it is recommended to utilise robust statistical tools during data analysis (Hair, Ringle & Sarstedt, 2011; Henseler, Ringle & Sarstedt, 2015). Furthermore, Babbie (2007) contended that quantitative cross-sectional surveys are not suitable for exploratory research and studying rare diseases. Additionally, establishing cause-and-effect relationships in cross-sectional survey studies presents a challenge. However, notwithstanding these limitations, this study provides a comprehensive understanding of the built and psychosocial environment variables. It should be noted that the purpose of this study is not to investigate or establish cause-and-effect correlations among the variables. Moreover, built and psychosocial environment research is quite mature that exploratory research is not needed (Chandrabose et al., 2019; Den Braver et al., 2018).

Study Area

The CCM holds a place of prominence as one of Ghana's earliest districts and is distinguished as the sole metropolis among the 22 Metropolitan, Municipal, and District Assemblies in the Central Region. With an area of 122 square kilometres, the CCM stands out as the smallest metropolis in Ghana. Its geographical coordinates are situated at latitudes 1° 15'W and 5°06'N, with Cape Coast serving as its administrative capital. The Metropolis is bordered by the Gulf of Guinea to the south, Komenda Edina Eguafo Abrem Municipal to the west, Abura Asebu Kwamankese District to the east, and Twifo Hemang Lower Denkyira District to the north (GSS, 2021). As of the year 2021, the Metropolis has a populace of 189,925, comprising 92,790 males and 97,135 females. Amongst this populace, 113,955 individuals are aged between 15 and 64, while 7,699 are 65 years and above. Of those aged 15-64, 55,873 are males and 58,082 are females, while in the 65 years and above group, males and females are about 3,065 and 4,634 respectively.

The Metropolis is predominantly characterised as an urban centre with approximately 130,348 individuals residing in urban communities. With regards to households, the Metropolis encompasses 40,386 households, of which roughly 30,354 (three-quarters) are located in urban areas. The urban areas exhibit an average of three households per house, while in rural areas, the average is two households per house. Approximately one-third, that is 32.5%, of the populace, aged 15 years or more, within the region are gainfully employed in the service and sales sector, while 23.6% are occupied in craft and related trading positions. Professionals contribute to 13.2% of the total population whereas about 10.3% of the overall households engage in agricultural pursuits.

Compound residences serve as the primary residential unit in the CCM, where a notable 58.2% of households reside within such structures. Improvised residences exhibit a higher frequency in urban communities (1.6%) than rural communities (0.3%). Huts are more commonplace in the rural sectors of the Metropolis (3.2%), while inferior quality homes can be observed in urban areas. Furthermore, typical construction materials in the area encompass mud-brick or earth (16.2%), wood (2.7%), and burnt brick (1.3%) (GSS, 2021).

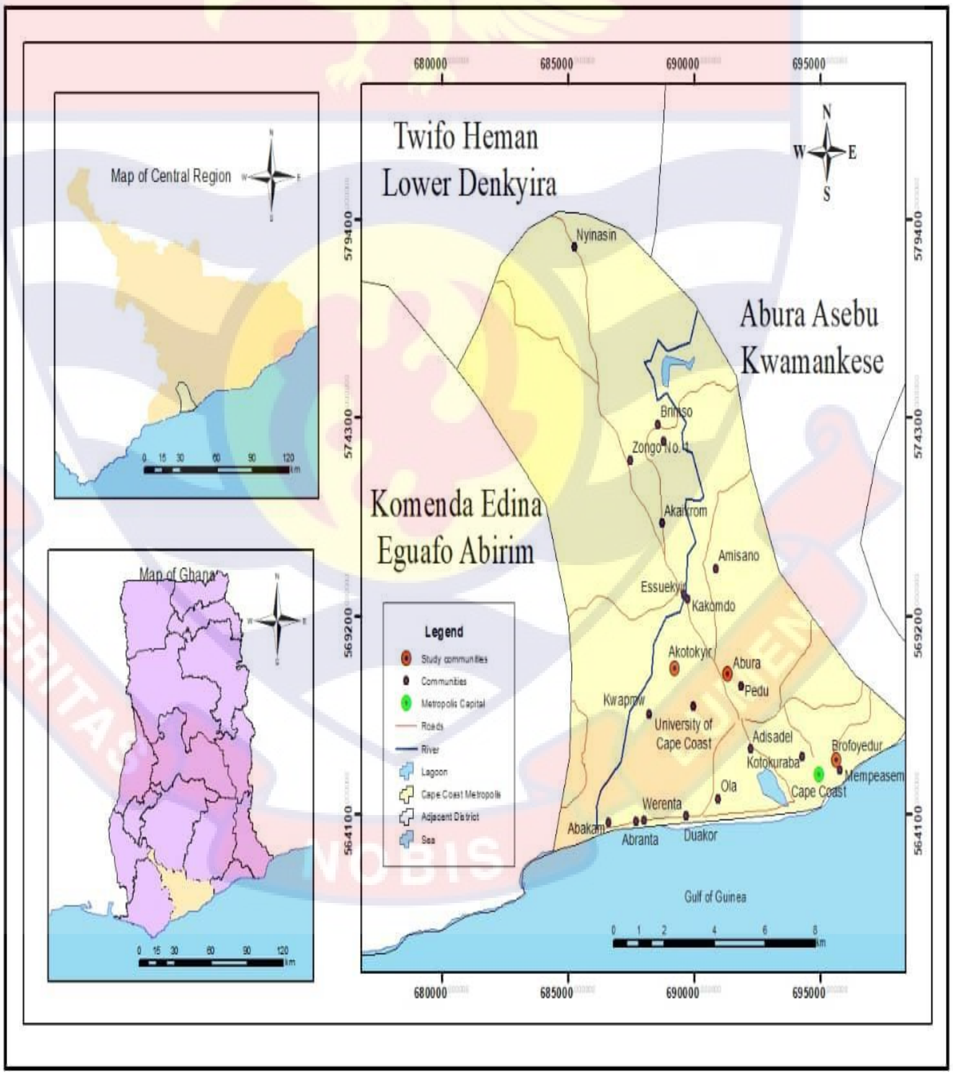

Figure 3: Study map of CCM (Kudom, 2015)

Population

The cohort under investigation were people aged 30-79 years in CCM. This was predicated on current data showing increased prevalence of CVDs risk factors, such as hypertension and obesity, among Ghanaian adults aged 30-79 (Bosu & Bosu, 2021; CDC, 2021).

The population of individuals aged 30-59 years comprises the working demographic who typically participate in demanding daily work routines. As outlined by Agyemang, Banstola, Pokhrel, and Anokye (2022), this group frequently exemplifies sedentary behaviour and adopts unhealthy dietary habits that heighten their susceptibility to CVD risks, like obesity and hypertension. Additionally, those aged 60 years and above constitute the elderly and non-working population in Ghana (GSS, 2021) and often adopt sedentary lifestyles while spending more time at home (Issahaku, 2022). The CCM comprises approximately 69,341 individuals aged 30-79 years who are distributed among 84 communities within the CCM (GSS, 2021).

Sampling Procedure

This study comprised of 2329adults aged 30-79 years, who were selected from the sample communities within the CCM. The sample size was not determined through any calculations or utilisation of sample size determination formulas that account for statistical power and/or effect size calculations. Instead, the selection of the sample size was based on the proportion of the population used in previous studies that explored the influence of the neighbourhood environment on health outcomes (de Courrèges et al., 2021; Katare et al., 2021). This methodology was adopted since determining the effect size beforehand assumes a normal distribution of the sample, which could not be determined before data collection (Selya, Rose, Dierker, Hedeker & Mermelstein, 2012). Moreover, the sample size adhered to the recommendation by Mills and Gay (2019) that a sample size of 400 is adequate for a quantitative survey when the target population exceeds 5000. Furthermore, the sample size of 2329 effectively represented the population, thereby enhancing the reliability of the study's findings (Araujo & Froyland, 2007).

The selection of participants in this study employed a multistage sampling procedure. According to Sharma (2017), the multistage sampling technique provides a flexible way of breaking the target population into smaller groups for easy sampling. However, the sampling errors associated with each of the sampling techniques employed at different stages can potentially impact the overall sampling process (Sharma, 2017). In applying the multistage sampling technique, the CCM was stratified into urban, rural, slum, and fishing communities. The stratified sampling technique provides a more homogenous sample and it is also useful in ensuring adequate representativeness of each type of residential area in the study (Sharma, 2017). A community in this study was conceptualised as an urban area if its population is 5000 or more, while a population below 5000 was classified as a rural area (GSS, 2014). Also, slum in this study was operationalised as a densely populated community where housing units are tightly packed, constructed with low-quality materials, and inhabitants are poor (Wasdani, & Prasad, 2020). Fishing communities were also conceptual as communities located in coastal areas where fishing is the main commercial activity of the majority of its inhabitants (CCMA, 2022).

Secondly, the selection of communities was performed using a simple random sampling technique wherein one community was selected from each stratum, namely Urban=Cape Coast, Rural= Akotokyir, Slum= Abura, and fishing community= Brofoyedur. This technique was chosen due to its ability to provide equal opportunities for all communities in each stratum to be selected, thereby reducing sampling biases (Sarfo, Debrah, Gbordzoe, & Obeng, 2022). To carry out the sampling process, the communities' names from each of the four strata were enlisted on separate pieces of paper. These pieces of paper were then uniformly folded and mixed before being placed in four distinct baskets. Afterward, a person was selected to draw a community from each stratum with the precaution of using a blindfold. This measure guarantees that every community has an equal opportunity to be selected. Eventually, the communities that were drawn were chosen to be a part of the study.

In the sampled communities, the sample size was determined in accordance with the community's population size. The formula devised by Babbie (2005) was applied to compute the sample size proportionate with the size of every selected community.

The formula is given as K/N x n

Where: K = Population of Adults 30-79 in a community, N= Total population of adults 30-79 in all four communities (N=27,977), n = Sample size (2400).

Akotokyere =2373/27,977*2329=198

Abura= 7240/27,977*2329=603

Brofoyedur=2162/27,977*2329=180

Cape Coast=16,202/27,977*2329=1,348

To recruit participants for the study, households were targeted. The WHO -2005 extended programme on immunisation (EPI) cluster sampling of household procedures were employed in selecting the households (Bostoen & Chalabi, 2006). The implementation of EPI cluster sampling of household procedures is recommended by WHO in cases where accurate quantification of households within a given cluster proves challenging. This procedure reduces the need for a detailed number of households within a sampled cluster (Bostoen & Chalabi, 2006). In selecting households in each selected community, a location closer to the centre of each community was first identified. A random direction was determined by spinning a bottle on even ground. The researcher followed and counted all the houses in the direction of the bottle to the edge of each selected community. A random number was selected between one and the total number of houses along the directional line. The selected house was visited and checked for eligible households for the study. After the first house, the K^{th} number of houses was selected for the study. In every domicile, one household was selected and the household head who satisfy the established criteria for inclusion was chosen to partake in the study. In instances where there was no eligible member in the structure, the closest structure was visited for eligible participants for the study. The process of surveying households continued iteratively until the desired number of households had been reached.

Inclusion criteria

1. Adults aged 30-79 years
2. Residents of six months or more in the Metropolis

Exclusion criteria

1. Pregnant women.
2. Postpartum mothers.

Data Collection Instruments

A survey instrument was utilised to gather data from the participants. As noted by Codó (2008), the questionnaire is the most appropriate tool to employ when dealing with a larger population that is dispersed over a wider area. Given that this study involved several sample populations in distinct communities within the CCM, the questionnaire was deemed the most fitting data collection instrument. Furthermore, the utilization of questionnaires can mitigate any personal biases that the researcher may have regarding the participants' responses (Codó, 2008). Nevertheless, questionnaires may not be suitable when the researcher aims to obtain in-depth information about the participants (Babbie, 2007). This study, however, is not concerned with obtaining detailed information about the built and psychosocial environment. Rather, it aims to quantify the built and psychosocial factors that expose adults in the CCM to CVD risk factors.

The survey instrument comprised 69 items categorised into five sections, namely A, B, C, D, and E (refer to appendix I). The questionnaire's items measured the walkability of the neighbourhood, which was adapted from the Nigerian version of the PA neighbourhood environment scale [PANES-N] (Oyeyemi et al., 2013). Also, the study measured the food environment using the adapted version of the perceived nutrition environment measures survey (NEMS-P) scale (Green & Glanz, 2015). Again, the social support section was developed from the perceived social support scale (Zimet et al., 1988), and the stress aspect was formulated from the perceived neighbourhood stress index (Ewart & Suchday, 2002).

Section "A" comprises 13 distinct items (1-13, on the background characteristics of participants, including sex, level of education, age, marital status, religion, occupation, and type of residential area. The participants were required to respond to the form of a tick or a written notation in the designated spaces provided for this purpose.

Section “B” measured the BMI and the BP of participants using “Height (m)”, “weight (Kg)”, “SBP (mmHg)”, and “Diastolic blood pressure”. The participants' body weight was evaluated with the use of an electronic body composition monitor scale (Omron Karada Scan body composition monitor). Height, on the other hand, was measured with a wall-mounted stadiometre that has a precision of 0.1 cm. The data gathered from these measurements were utilized in the computation of the study participants' BMI. Body Mass Index scores<18.5 kg/$m^2$was categorised as being underweight, scores ranging from 18.5-24.9 kg/m2 were classified as normal weight, scores ranging from 25-29.9 kg/m2 were designated as overweight, and scores of 30 kg/m2 or more were characterised as being obese. The systolic and diastolic BP readings were obtained using a calibrated electronic sphygmomanometre (Omron HEM-907-E, Omron Healthcare Co. Ltd, Kyoto, Japan). Blood pressure measurements with systolic BP (SBP) below 140 mmHg and diastolic BP (DBP) below 90 mmHg were considered non-hypertensive. Conversely, individuals with SBP of 140 mmHg or higher and DBP of 90 mmHg or higher were classified as having hypertension (Nickey et al., 2003).

Section "C" measured the perceived neighbourhood walkability of participants with 15 items (questions 15-29). These items were adapted from the validated version of the PA neighbourhood environment scale in Nigeria (PANES-N) (Oyeyemi et al., 2013). PANES-N is a 16-item scale (Oyeyemi et al., 2013), that assesses the environmental factors that foster walking and bicycling in the neighbourhood. The PANES-N is a validated version of the International PA Prevalence Study's 17-item PA neighbourhood environment scale (PANES) (International PA Questionnaire., 2016). However, the study excluded the item on residential density (*What is the main type of housing in your neighbourhood?*). This item was removed because, during the pretesting of the study, the researcher realised that participants found it difficult to understand the item. The majority of the participants refused to answer the item, hence, there was the need to exclude it from the study.

PANES-N is a four-point Likert scale ranging from strongly disagree (1) to strongly agree (4). Sample items are: "*Many shops, stores, markets or other places to buy things I need are within easy walking distance of my home",* and "*It is within easy walking distance from my home to access public taxis and buses in my neighbourhood"* (Oyeyemi et al., 2013). PANES has a good Cronbach's Alpha value of 0.80 (International PA Questionnaire., 2016). Moreover, PANES is proven to have good test-retest reliability in many countries including China [0.66 to 0.95] (Zhao et al., 2018) and Nigeria (0.63 to 0.98) (Oyeyemi et al., 2013). In scoring PANES, item 24, 25 and 26 were reversed scored. The mean of the item 13-27 was computed to create an overall mean score ranging from 1-4 with 2 or above categorised as high walkable neighbhourhood environment and below 2 categorised as low walkable neighbourhood environment (Protocol-Physical Activity Neighbourhood Environment, 2023; Sallis et al., 2010).). The PANES has been used by other studies to determine the neighbourhood environment support for physical activity and health outcomes (Godsday et al., 2023; McCormack, Frehlich, Blackstaffe, Turin & Doyle-Baker, 2020).

Section D (43 items, 30-47) measures the neighbourhood food environment with items adapted from the perceived nutrition environment measures survey [NEMS-P] (Green & Glanz, 2015). The NEMS-P aims at measuring individuals' perceptions of their food environment. The original NEMS-P consists of 118 items, 53 of which are core items on three categories of perceived food environments (household food environment, consumer nutrition environment, and community nutrition environment). The current study adapted and utilized 43 items from the NEMS-P core items. This study excluded the five items from the home food environment and the five items from individual thoughts on their food environment. The questions on NEMS-P in this study were grouped into: Food shopping and restaurant/eating out. Some questions on food shopping were measured on a five-point Likert scale ranging from strongly disagree (0) to strongly agree (4). Sample questions included: "*It is easy to buy fresh fruits and vegetables in my neighbourhood*", "*The fresh produce in my neighbourhood is of high quality*", and *"There is a large selection of fresh fruits and vegetables in my neighbourhood"*.

Also, on restaurant/eating out, questions were asked on the number of times individuals eat at either fast-food restaurants, sit-down restaurants, or other types of restaurants (participants were to specify). The NEMS-P has a good internal reliability value of 0.83 (Green & Glanz, 2015), and an acceptable reliability value of 0.6 to 0.9 in the Mediterranean Spanish context (Martínez-García et al., 2020). The NEMS-P has been used in several contexts to establish the relationship between the nutrition environment and health behaviours. For instance, a study in Utah used the MEMS-P scale to measure the influence of a healthy nutrition environment on good dietary practices (Atoloye, & Durward, 2019). Another study also adapted the NEMS-P scale and established the link between the neighbourhood environment and diabetes (Love et al., 2019).

Section "E" encompasses elements that relate to social support, which were derived from the multidimensional scale of perceived social support (MSPSS) formulated by Zimet et al. (1988). The MSPSS is a scale composed of 12 items that assess the perceived sufficiency of social support from family, friends, and significant others. For this research, all 12 items were employed to gauge perceived social support, which was evaluated using a four-point Likert scale ranging from strongly disagree (1) to strongly agree (4). Sample items from the scale include "*There is a special person who is around when I am in need*", "*There is a special person with whom I can share my joys and sorrows*", and "*My family tries to help me*". Again, the social support scale has a very good Cronbach's alpha reliability coefficient of 0.88 (Zimet et al., 1990).

Furthermore, section "F" covers neighbourhood stress, measured from an adapted validated neighbourhood stress scale, known as "The City Stress Inventory" (Ewart & Suchday, 2002). The city stress index is originally an 18-item instrument designed to measure neighbourhood stress, which measuresstressful events participants experienced in their neighbourhoods over the past year. However, the current study adapted 14 items. Items such as: "*Number of houses or buildings in one's neighbourhood that were vacant or unoccupied?*", "*Number of neighbours who received food stamps in the past year?*", "*gang fights near one's home*" and "*sight of a "shooting gallery" near one's home*" on the original scale were excluded from the current study because such questions did not apply to the residents in CCM. Participants selected each item on a four-level (1=Never, 2=once, 3=a few times, and 4=often) scale. Sample items include: "*A family member or friend was robbed or mugged in the past year*", "*I heard neighbours complaining about crime in our neighbourhood in the past year", "A family member, friend or acquaintance was stabbed or shot in the past year" and "I saw strangers who were drunk or high hanging out near my home in the past year".*

The internal consistency of the City Stress Inventory in urban adolescents is good (Cronbach's α=.85) (LaFont, 2019). For instance, the inventory has been used to investigate the impact of neighbourhood stress on the activity of the autonomic nervous system during sleep (Mellman, Bell, Abu-Bader, & Kobayashi, 2018), and the relationship between neighbourhood stress and life satisfaction (Valois et al., 2020). These studies recorded a good internal reliability of 0.84 (Valois et al., 2020) and 0.82 (Mellman et al., 2018).

Validity and Reliability of the Instrument

This study ensured the validity of the instruments before the actual data collection took place. This was necessary because some of the items of this study were adapted from other standardised instruments and also used in a different environment. Thirty adults, 30-79 years, from Kwaprow, were purposely and conveniently selected to take part in pretesting the instrument. In the process of conducting pretesting for a quantitative research instrument, a sample size ranging from 20 to 30 is deemed sufficient for attaining the requisite level of instrument reliability (Radhakrishna, 2007). Also, the study used the open data kit (ODK) application in the data collection, therefore, it was imperative to conduct pretesting to evaluate the applicability of the tool prior to the start of the actual data collection.

The anthropometric measurements of the participants were obtained by the research assistants whilst the individuals were presented with a questionnaire to complete, a task that required approximately 25 minutes. However, for those unable to read or comprehend English, the research assistants administered the questionnaire. The participants were encouraged to report any ambiguities or difficulties they encountered whilst responding to the questionnaire. The retrieved questionnaires were meticulously examined, coded, and analysed using Statistical Package for the Social Sciences (SPSS) software. The pre-testing data's internal consistency reliability was calculated and reported utilising the Cronbach alpha reliability coefficient. The study revealed an overall internal consistency reliability (Cronbach's alpha) of 0.823, with 0.709, 0.933, 0.908, and 0.733 for PANES-N, Social support scale, Neighbourhood stress scale, and the food environment scale, respectively.

Data Collection Procedure

An introductory letter from the Department of Health, Physical Education and Recreation (HPER), University of Cape Coast (UCC) was used to seek ethical clearance from the Cape Coast Teaching Hospital Ethical Review Committee (REF: CCTHERC/EC/2022/163). This was after the research protocols were approved by my supervisors and a committee from the department of HPER. Also, the introductory letter and ethical clearance were used to seek and obtain permission from the Cape Coast Metropolitan Assembly and the community heads (Chief/s) of the study areas. Again, an informed consent document was presented to each participant, either verbally or in writing, which furnished information pertaining to the study's objectives, prospective benefits and risks, confidentiality, and the anticipated duration of time necessary for completing the instrument. The individuals who provided their consent to participate in the study duly signed the consent form before their involvement. Furthermore, the participants were informed of their right to partake in the study and were granted the opportunity to withdraw at any juncture without facing any consequences. Again, the researcher provided reassurance to the participants concerning the privacy of their personal data and identity.

Data was collected from four communities within the CCM with the assistance of ten research assistants. These research assistants comprised of individuals with diverse academic backgrounds, including M.Phil. nursing and health education students, a dietitian, and diploma nursing students. Prior to data collection, these assistants underwent a comprehensive two-day training program to familiarise themselves with the data collection instruments, as well as the proper measurement and calibration of various medical equipment, such as the weighing scale, BP apparatus, and stadiometre. In addition, they were trained on how to accurately record anthropometric measurements, establish rapport with participants, and adhere to all ethical requirements mandated by the study.

The anthropometric measurements of the participants were taken using an electronic body composition monitor scale (the Omron Karada Scan body composition monitor) and a wall-mounted stadiometre to measure weight and height, respectively. The electronic body composition monitor scale was selected for this study due to its portability, which allowed for easy data collection. Additionally, the scale was able to calculate the BMI of the participants during data collection. The weight and height of each participant were measured twice by two different research assistants, and the average value was recorded. Participants were weighed barefoot and in light clothing with empty pockets, and were asked to stand erect with their head facing forward. Prior to each weighing, the digital weighing scales were checked to ensure that the reading was at zero kilograms. Further, two different research assistants measured the BP of participants thrice at least 3-5 minutes apart and recorded each of the readings. The questionnaire was interviewer-administered. Approximately, it took about 45 minutes for participants to finish responding to the questionnaire. The entire data collection process lasted for three months.

Data Processing and Analysis

Following the collection of data, every questionnaire underwent a manual screening process to guarantee its comprehensiveness. I used SPSS software version 27.0 for Windows to manage the data and compute the statistical analysis. Subsequently, data cleaning was conducted by replacing missing values, merging values, transforming values, and also scoring the PANES, social support, and neighbourhood stress scale. Also, descriptive analyses like frequencies and percentages were carried out for all the variables. In accordance with Babbie (2007)'s recommendation, missing values of categorical data like gender and educational level, PANES, NEMS-P, social support scale, and the neighbourhood stress scale were replaced with a median of nearby points, whereas values in interval and/or ratio like SBP, DBP, age and years of stay in the CCM were replaced using the serial mean for all missing values (Babbie, 2007). The data analysis was done based on the research questions.

Research Question 1: What is the level of psychosocial risk factors for hypertension and obesity among adults in the CCM?

The purpose of this research question was to estimate the level of psychosocial environment features (social support and neighbourhood stress) that are putting adults in CCM at risk of developing CVDs. The level of social support was categorised as having high, medium, or low social support, and neighbourhood stress was categorised into high and low levels of stress.

In analysing this research question, neighbourhood social support items responses were summed up across all 12 items on the social support scale. A score of 12-24 was categorised as "Low social support", 25-37 as "moderate social support" and 38-48 categorised as "high social support" (Zimet et al., 1988). Frequencies and percentages were used to analyse the responses on social support. The results were presented using a table with frequencies and percentage counts.

Also, neighbourhood stress responses were analysed by calculating the mean response of all the 14 items on the scale. A mean score of two or above was categorised as high stress whereas a mean score below two was categorised as low stress (Ewart & Suchday, 2002). Descriptive statistics of frequency and percentage were used to analyse the responses to the neighbourhood stress. The results are presented using frequency tables.

Research Question 2: What is the prevalence of hypertension, overweight, and obesity among adults in the CCM?

Research question two estimated the prevalence of hypertension, overweight, and obesity among adults in the CCM. In analysing this research question, the BP measurement was classified into non-hypertensive and hypertensive using SBP below 140 mmHg and DBP below 90 mmHg as non-hypertensive, and SBP of 140 or above and DBP of 90 or above as hypertensive (Nickey et al., 2003). This research question was analysed using frequency and percentage counts and resultswere presented in a pie chart.

Furthermore, the BMI scores were generated by dividing the weight (kg) values of participants by a square of their height in metres. The computed BMI scores were categorised as underweight, normal weight, overweight and obese; 18.5kg/m^2, 18.5-24.9 kg/m^2, 25-29 kg/m^2, and 30 kg/m^{2}and above as obese, respectively (WHO, 2021). Frequency and percentage analysis were calculated.

Research Question 3: What is the influence of socio-demographic characteristics on BP and BMI of adults in CCM?

Research question three estimated the level at which socio-demographic characteristics such as age, income, level of education, marital status, residential area, and religion influence BP and BMI levels among adults in the CCM. The dependent variables (DVs) are the BP and BMI levels categorised into two levels (non-hypertensive and hypertensive) and normal weight and overweight/obese respectively. The independent variables for this research question were sex, age, years of stay in the CCM, marital status, monthly income, level of education, smoking habits, living arrangement (whether participant lives alone or lives with others), occupation, residential area, family history of hypertension and religion. Therefore, binomial logistic regression analysis was conducted to establish the level at which socio-demographic characteristics influence BP and BMI levels. The results were reported with their corresponding odds ratios at a 95% confidence interval ($p<0.05$).

Research Question 4: What is the extent to which neighbourhood walkability, food environment, stress, and social support predict BP and BMI levels among adults in CCM?

This research question measured the level at which neighbourhood walkability, food environment, stress, and social support influence the BP and BMI level of participants. The DVs were BP (non-hypertensive and hypertensive) and BMI level (normal weight and overweight/obese). The IVs were neighbourhood walkability, food environment, stress, and social support. Thus, binomial logistic regression analysis was conducted and reported with their corresponding odds ratios at a 95% confidence interval ($p<0.05$).

CHAPTER FOUR

RESULTS AND DISCUSSION

The purpose of this study was to determine the influence of the neighbourhood built and psychosocial environment on the risk of CVDs among adults in the CCM. This chapter presents the results and the discussion based on the research questions.

The respondents comprised 624(26.8%) adults from Abura, 201(8.6%) from Akotokyir, 146 (6.3%) from Brofoyedur, and 1358(58.3%) from Cape Coast. Also, 1233(52.9%) of the respondents were females, while 1096 (47.1%) were males. Again, 951 (40.8%) of the respondents were of age 30-39 years, 601(25.8%) 40-49 years, 410(17.6%) 50-59 years, and 367(15.8%) 60 years or above. The respondents comprised 624(26.8%) adults from Abura, 201(8.6%) from Akotokyir, 146 (6.3%) from Brofoyedur, and 1358(58.3%) from Cape Coast. Also, 1233(52.9%) of the respondents were females while 1096 (47.1%) were males. Again, 951 (40.8%) of the respondents were aged 30-39, 601(25.8%) aged 40-49 years, 410(17.6%) aged 50-59 years and 367(15.8%) aged 60 years and above. Further, 200(8.6%) of the respondents were residents of the CCM for five years or less, 330(14.2%) for six to 10 years, 222(9.5%) for 11-15 years and 1577 (67.7%) for 16 years or above.

Furthermore, 191(8.2%) of the respondents were divorced, 1349(57.9%) married or living with their partners and 789(33.9%) singles. Also, as high as 350(15.0%) had no formal education, 164 (7.0%) had tertiary education, 401(17.2%) had primary education, 964 (41.4%) had JSS/JHS education, and 450 (19.3%) had secondary education. Again, 2142 (92.0%) had never smoked a cigarette 95(4.1%) were former smokers and unfortunately, 92(4.0%) currently smoke. Moreover, 410 (17.6%) of the respondents live alone, while 1919 (82.4%) live with others. The employment status the respondents: 183 (7.9%) unemployed, 56 (2.4%) students, 1692 (72.6%) self-employed, 157(6.7%) private employees, 155 (6.7%) government employees, 39 (1.7%) daily labourer, 15 (0.6%) retired government workers and 32 (1.4%) retired private workers. Also, 1036(44.5%) received below 500.00 Ghana cedis monthly, while 1081 (46.4%) received 500-1000.00 cedis monthly. Unfortunately, 266 (11.4%) were hypertensive, while 2063 were non-hypertensives. Again, 1892 (81.2%) of the participants were Christian, 407 (81.2%) were Muslim, 16 (0.7%) did not belong to any religion and 14(0.6%) belonged to the African traditional religion.

Research Question 1: What is the Level of Psychosocial Risk Factors for Hypertension and Obesity among Adults in the CCM?

The purpose of this analysis was to estimate the level of psychosocial environment characteristics (social support and neighbourhood stress) as perceived by the adults in CCM. In line with Zimet et al. (1988) recommendation for scoring the social support scale, the 12 items on social support were aggregated to create a composite score of social support. A score of 12-24 was categorised as "Low social support", 25-37 as "moderate social support" and 38-48 as "high social support" (Zimet et al., 1988). Also, neighbourhood stress responses were analysed by calculating the mean response of the 14 items on the scale. A mean score of ≥ 2 was categorised as high stress whereas <2was categorised as low stress (Ewart & Suchday, 2002). Frequencies and percentages analysis were performed to analyse the levels of social support and neighbourhood stress among the adults.

The results show that the majority (53.9%) of the respondents received moderate social support, whilst about a quarter (25.8%) received low social support. Also, the majority (54.0%) of the respondents were highly stressed by their neighbourhood environment (see Table 1).

Table 1: Level of psychosocial risk factors for hypertension and obesity among adults

Variable	Frequency (2,329)	Percentage (%)	Mean	SD	Risk
Social support			30.52	±8.88	**Moderate**
Low social support	601	25.8			
Moderate social support	1256	53.9			
High social support	472	20.3			
Neighbourhood stress			2.48	±2.48	**High**
Low stress	1071	46.0			
High stress	1258	54.0			

Note: SD= Standard deviation

The level of perceived social support among most adults in this study was moderate. This means that most adults in the CCM are receiving some amount of social support from their family, friends, churches, and other organisations in their society. However, many others are also receiving less social support than they needed for their optimal health and well-being. This low social support exposes adults to poor health conditions such as hypertension and other CVDs (Yazawa et al., 2022). Moreover, moderate social support tends to increase poor mental health conditions such as depression, stress, and anxiety which could further put people at risk of hypertension and obesity (Yazawa et al., 2022).

Many recent studies reported similar findings. For instance, Berhe et al. (2022) recorded moderate levels of social support among the majority of adults in the Gamo zone of Southern Ethiopia. Moreover, in Greece (Sarla, Lambrinou, Galanis, Kalokairinou, & Sourtzi, 2020) and Nigeria (Ejikeme,

Ejikeme, Badru, & Akwash, 2014) researchers reported moderate to low social support among adults in their urban metropolis. However, an Egyptian study reported contrary finding (El-Zoghby, Soltan, & Salama, 2020). El-Zoghby et al. reported high social support among their participants. Perhaps, the context and time of the study accounted for these differences. El-Zoghby et al. (2020) conducted their study during the COVID-19 period when the pandemic brought families together due to the closures of many workplaces and restrictions on movement, and the attendant increase in social media usage to reach relatives (Long et al., 2022).

Furthermore, the current study found that more than half (54%) of adults in CCM reported living in highly stressful neighbourhoods. This means that more adults in the Metropolis are experiencing stress from their neighbourhood beyond their control. These stressful events could come from frequent robbery cases, other crimes, speeding vehicles, and noise in neighbourhoods. Perhaps these neighbourhood incidences are putting the people in CCM in fear, and sleeplessness, hence, increasing their stress levels. Such neighbourhoodsmay be common in many localities or communities. For instance, a US study recorded a high level of stress among 62% of their participants, which was attributed to the high incidence of crime in the neighbourhoods (Kwarteng, Schulz, Mentz, & Israel, 2019). Also, from South Africa (Burns, Esterhuizen, & Seedat, 2011), Nigeria (Gureje et al., 2015), Ethiopia (Tadesse, & Mekonnen, 2019), and Kenya (Ndetei, Khasakhala & Mutiso, 2016), high levels of neighbourhood stress among adults in metropolitan communities were recorded. The common reasons include urbanisation, high levels of crime, traffic congestion, and noise pollution.

Unfortunately, high neighbourhood stress among participants would have detrimental effects on their health. For instance, constant or chronic stress leads to high levels of BP, heart attack, obesity, and diabetes (Albert et al., 2017). Moreover, if adequate measures are not put in place to prevent or reduce neighbourhood stressors in CCM, the prevalence of hypertension, diabetes, and obesity could increase, which may increase personal, and institutional healthcare costs, and lay an increased burden on healthcare professionals and already burdened healthcare system in the metropolis.

Research Question 2: What are the BP and BMI Levels among Adults in the CCM?

This analysis aimed to estimate the levels of BP and BMI among adults aged 30-79 years in the CCM. The BP levels were categorised into two: hypertensive and non-hypertensive (CDC, 2021), while BMI was categorised into four: underweight, normal weight, overweight and obese (WHO, 2021). Frequency and percentages were used to analyse this research question. The results indicated that the participants' mean SBP was 131.34 (SD = ±20.90), mean DBP was 83.72 (SD = ±12.85), and 466(20%) were hypertensive, and had a mean BMI score of 25.66 (SD=±6.23). The study found that 233(10%) of the participants were underweight, 940(40.0%) had normal weight, whereas 645(28%) and 511(22%) were overweight and obese, respectively.

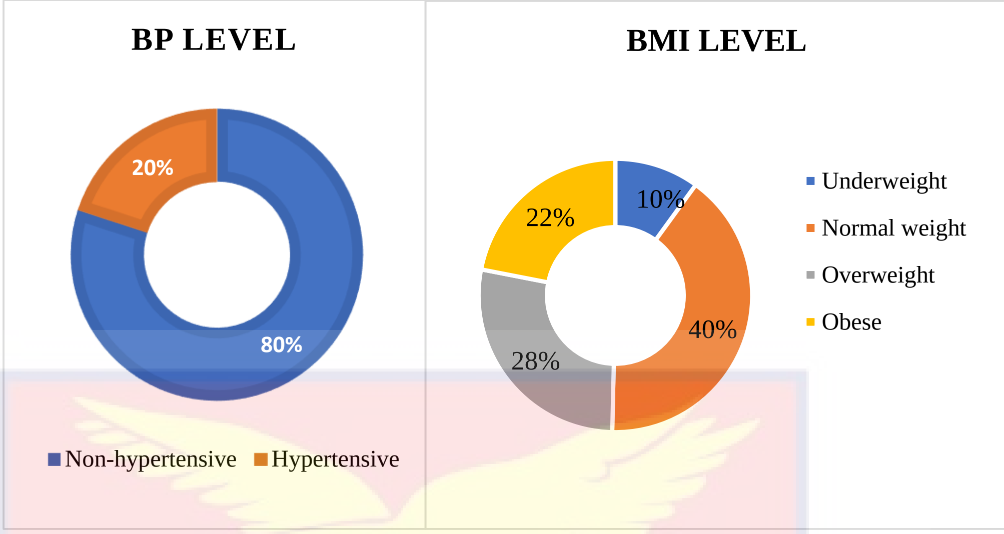

Figure 4: BP and BMI levels among adults aged 30-79 years in the CCM

The prevalence of hypertension among adults aged 30-79 years in the CCM was 20%. Thus, close to a quarter of adults in the CCM is at risk of developing CVDs, which could increase NCD mortalities in Ghana (Opoku et al., 2020). Moreover, this may predispose such persons to other NCDs like diabetes, cancers, and strokes (Cohen et al., 2023). Also, this may hinder the world's target of reducing mortality associated with NCDs like CVDs, diabetes, and cancers (United Nations, 2022). Unfortunately, the current findings are in contrast with other studies from Europe, Asia, other African countries and other parts of Ghana. For instance, a cross-sectional study among Sralinkan adults reported a hypertension prevalence of 28% (Rannan-Eliya et al., 2022). The possible reason for the difference in the finding is that Sralinka's study was a nationwide survey whereas the current study focused on only one metropolitan area. A nation-wide study might have a heterogenous population with diverse geographic and demographic variations which might have increased their hypertension status than the metropolitan area in this study. Also, a community-based study in Kintampo North Municipality in

Ghana recorded a relatively higher (28%) prevalence of hypertension (Dosoo et al., 2019). The Kintampo study recruited adults 18 years and above, and also used a community-based screening approach in selecting their participants. Perhaps, the difference in the findings is because their study employed screening and a convenient sampling technique where many persons who responded might be looking for answers to their perceived health challenges. Persons who perceived themselves to have such conditions would likely respond actively by attending such health screening activities. Also, other similar studies have recorded a comparatively higher prevalence of hypertension among adults (Atibila et al., 2021; Calas et al., 2022; Ghaddar et al., 2021; Opoku et al., 2020; Tannor et al., 2022). Notwithstanding the comparatively lower prevalence of hypertension recorded among adults 30-79 years in this study, there is a need to pay critical attention to issues of hypertension among this group in CCM.

The hypertension recorded in this study implies that there could be an increase in poverty among adults in CCM due to reduced productivity and healthcare costs associated with regular medical monitoring, medication, and management of hypertension. This financial burden further threatens the world's effort to eradicate extreme poverty by the year 2030 (United Nations, 2023). Moreover, such a prevalence could strain healthcare resources and potentially lead to longer waiting times and reduce access to care for other patients (United Nations, 2022). Also, the government's attention could be diverted to investing more resources into hypertension management and other CVDs to the detriment of other developmental projects. Hence, there is a need to prioritise interventions that reduce the risk of hypertension in CCM among adults early enough.

Furthermore, this study found that 28% and 22% of adults in the CCM were overweight and obese, respectively. These findings mean that over one-quarter of the adults in the CCM have an unhealthy weight that potentially negatively affects their health. This high prevalence of obesity in the current study is attributable to increased levels of sedentary lifestyles in most people due to an increase in transport availability, lack of community space, and aged-friendly recreation facilities in the CCM (Tuoyire, McNair, Debrah, & Duda, 2018). Similarly, a study in Ashanti Region in Ghana recorded 49.3% and 20.7% overweight and obese, respectively, among their adult participants (Aryeetey, Ansong, Gyamfi, Boateng, & Agyemang, 2016). Also, another Ghanaian study recorded 39.4% and 15.6% overweight and obese adults (Ofori-Asenso et al., 2016). These findings imply that more adults in metropolitan areas in Ghana are gaining unhealthy weight. This is worrying because these adults could be at risk for CVDS, diabetes, cancers, and other NCDs (Ofori-Asenso et al., 2016). Hence, there is a need for overweight and obesity prevention interventionsinmetropolitan areas in Ghana.

It is also worth noting that the current study found that 10% of the adults in the CCM were underweight. Perhaps, partly because of the low level of monthly income (GH₵<500.00) of participants. This might have affected their ability to purchase a healthy diet for consumption. Similarly, a study in Myanmar recorded a high (14.1%) prevalence of underweight among adults (Hong, Peltzer, Lwin, & Aung, 2018). The similarity in the findings could be partly explained by the cross-sectional survey design and household survey approach used by both studies. Moreover, these countries (Ghana and Myanmar) are developing nations (World Data, 2023), thus, the purchasing power of their citizens may be very low (World Bank, 2022). However, a study in Nepal recorded a relatively higher prevalence of underweight among adults, than the current study, which they attributed to a higher rate of food insecurity (Al Kibria, 2019). This finding implies that there could be increased morbidities among adults in CCM due to possible weakened immune systems, infections, and reduced muscle mass associated with being underweight (Ferreira, & Cunha, 2018). This could put pressure on the Ghanaian health system, and families and reduce the quality of life of adults in the CCM.

Research Question 3: What is the Influence of Socio-Demographic Characteristics on BP and BMI of Adults in CCM?

This analysis aimed at identifying the influence of the socio-demographic characteristics of participants on their BP and BMI. Two different analyses, bivariate and multivariate analysis, were done separately for BP and BMI levels. Firstly, a preliminary bivariate analysis was conducted to determine the association between socio-demographic characteristics and hypertension or overweight/obesity. This was done to understand the strength and significance of these relationships before proceeding to more complex analyses like logistic regression (Elamin, 2023). The bivariate analysis shows that there is a significant association among gender, age, marital status, monthly income, level of education, smoking habits, occupation, religion, family history of hypertension, living arrangement, and hypertension. Also, age, monthly income, and having a close relative who is hypertensive were significantly associated with overweight/obesity (see Appendix III, table 4).

Furthermore, a binary logistic regression analysis was conducted separately for BP and BMI levels, based on the bivariate results, to determine the extent to which the IVs predict the risk of hypertension and overweight/obesity. The results show that, significantly, males were 38% less likely to become hypertensive than females (AOR=.62, 95%CI=.491-.793). Again, adults aged 40-49 years were 1.89 times more likely to be hypertensive than those aged 30-39 years (AOR=1.89, 95%CI=1.391-2.570). Also, participants aged 50-59 years and those aged 60 years or above were 1.54 [AOR=1.54, 95 %CI=1.083-2.182] and 4.17 (AOR=4.17, 95 %CI=2.914-5.954] respectively, more likely to become hypertensive than those aged 30-39 years. Further, adults who were married/cohabiting and those who had never married were 38% [AOR=0.62, 95%CI=0.430-0.880] and 43% [AOR=0.57, 95%CI=.381-.857] respectively, less likely to develop hypertension than those who had never married. Also, adults who attended school up to Junior High School (JHS) were 45% less likely to become hypertensive than those who had no level of education [AOR=.55, 95%CI=.384-.856]. Further, participants who earned between 1001-2000.00 Ghana cedis monthly were 2.81 times more likely to be hypertensive than those receiving below 500.00 Ghana cedis monthly [AOR=2.81, 95%CI =1.925-4.105]. Also, participants who were former smokers were 49% less likely to become hypertensive than those who had never smoked [AOR=.51, 95%CI=.260-.992], and current smokers were 1.85 times more likely to become hypertensive than those who had never smoked [AOR=1.85, 95%CI=1.099-3.096]. Moreover, the odds of becoming hypertensive were low among participants who had no close relative(s) as hypertensive than those who had a family history of hypertension [AOR=.63, 95%CI=.467-.860]. Additionally, the odds of becoming overweight/obese were low among participants aged 60 years or above [AOR=.68, 95%CI =.508-.912], and high among those who earn 1001-2000.00 Ghana cedis monthly [AOR=2.23, 95%CI=1.562-3.173]. Moreover, the odds of hypertension were low among participants with no family history of hypertension than those with family history of hypertension [AOR=.70, 95%CI =.537-.904] (see table 2).

The finding indicates that the males have a lower risk of hypertension than the females. According to Setorglo et al. (2020), more males in CCM are more physically active than females, hence, protecting them against CVDs. Setorglo et al.'s finding could partly explain the lower risk of hypertension in this study. This finding is also consistent with a finding from Nigeria of a higher risk of hypertension among females than males (Adedoyin, Mbada, Balogun, Martins, & Adebayo, 2018), where the attribution was to a high sedentary lifestyle among the females. According to Adedoyin et al., females are less active and usually engage in low-intensity activities which expose them to obesity and associated hypertension. Also, in line with the current findings, Amoah, Owusu, Adjei, and Acheampong (2019) found Ghanaian males to be at a lower risk of hypertension than females, attributing it to a lower level of obesity among males than females. However, Isara and Okundia (2015) found a higher risk of hypertension among men than women. They attributed their findings to higher levels of stress and poor dietary habits among men than women. The differences in the findings could be that the current study included more female than male participants, unlike Isara and Okundia's study.

Also, the current finding agrees with the proposition of the socioecological model that individuals' characteristics like sex could protect or expose them to health conditions like hypertension and obesity (Bronfenbrenner, 1977). The implication is that males are at reduced risk of developing CVDs and or dying from NCDs in CCM, while females may have higher levels of risk. This finding calls for attention to hypertension prevention among this group of females in the CCM. Moreover, health education on risk factors of hypertension should focus more on females, though it is important to target all persons in the Metropolis.

Furthermore, the finding revealed that the risk of developing hypertension is higher among adults aged 40 or above than those aged 30-39 years. This finding means thatthese individuals are at higher risk of developing hypertension as they age. Similarly, other studies reported an increased risk of hypertension among the aged than the youth (Aryeetey et al., 2016; Darebo et al., 2019; Mkuu et al., 2021). According to Aryeetey et al. (2016), one's health begins to decline with age, probably, the blood vessels narrow or harden with age or the effects of youthful risky behaviours begin to manifest with age. The implication is that CVDs-related mortalities and complications such as stroke may rise, increasing healthcare costs for individuals, families, and the healthcare system as a whole (Hoshide, Mogi, & Kario, 2023). Also, this could increase caregiving demands for family members which can reduce the time available for other activities, work, and school, complicating the dependency ratio.

Table 2: Binary logistic regression for predictors of hypertension and overweight/obesity among participants

		Hypertension			Overweight/obesity		
Variable		**B**	**AOR**	**95% CI**	**B**	**AOR**	**95% CI**
Sex	Female	Ref	Ref	Ref	Ref	Ref	Ref
	Male	-.472	.62***	.491-.793	-.132	.877	.732-1.049
Age	30-39	Ref	Ref	Ref	Ref	Ref	Ref
	40-49	.637	1.89***	1.391-2.570	.191	1.211	.960-1.527
	50-59	.430	1.54*	1.083-2.182	-.069	.933	.719-1.211
	≤60 years	1.427	4.166***	2.914-5.954	-.385	.681*	.508-.912
Marital status	Divorced	Ref	Ref	Ref	Ref	Ref	Ref
	Married/cohabiting	-.486	.62**	.430-.880	.012	1.012	.735-1.391
	Never married	-.559	.57**	.381-.857	.142	1.153	.814-1.631
Education	None	Ref	Ref	Ref	Ref	Ref	Ref
	Primary	.241	1.27	.865-1.872	.270	1.310	.966-1.776
	JHS	-.437	.55*	.384-.856	.196	1.217	.931-1.590
	Secondary	-.037	.96	.633-1.468	.083	1.087	.799-1.477
	Tertiary	-.283	.75	.416-1.364	.183	1.200	.794-1.814
Monthly income	<500	Ref	Ref	Ref	Ref	Ref	Ref
	500-1000	-.185	.83	.647-1.066	-.124	.883	.732-1.066
	1001-2000	1.034	2.81***	1.925-4.105	.800	2.227***	1.562-3.173
	>2000	.549	1.73	.751-3.992	.717	2.048	.966-4.339
Smoking habit	Never	Ref	Ref	Ref	Ref	Ref	Ref
	Former smoker	-.679	.51*	.260-.992	.053	1.054	.680-1.634
	Current smoker	.613	1.85*	1.099-3.096	-.078	.925	.594-1.440

Table 2 continued

Variables	Categories	Hypertensions			Overweight/Obesity		
		B	AOR	95% CI	B	AOR	95% CI
Living arrangement	Living alone	Ref	Ref	Ref	Ref	Ref	Ref
	Living with others.	.066	1.07	.777-1.467	.094	1.098	.871-1.385
Occupation	Unemployed	Ref	Ref	Ref	Ref	Ref	Ref
	Student	-.053	.95	.263-3.420	-.396	.673	.356-1.274
	Employed	1.206	3.34**	1.412-7.906	.285	1.330	.641-2.761
	Daily labourer	-.828	.44	.173-1.099	-.301	.740	.372-1.475
	Retired	.486	1.63*	1.019-2.595	-.182	.834	.599-1.159
Family history of hypertension	Yes	Ref	Ref	Ref			
	No	-.456	.63**	.467-.860	-.362	.697**	.537-.904
	Don't know	-.204	.82	.581-1.145	-.179	.836	.627-1.115
Religion	Pagan	Ref	Ref	Ref	Ref	Ref	Ref
	Muslim	-1.006	.37	.105-1.274	.270	1.310	.459-3.738
	Christian	-1.040	.35	.103-1.208	.098	1.103	.393-3.099
	Traditional	.138	1.15	.223-5.913	-.283	.754	.169-3.352
Years of staying in a community	<5years	Ref	Ref	Ref	Ref	Ref	Ref
	5-10	.141	1.15	.685-1.936	-.111	.895	.620-1.293
	≥11	-.015	.99	.621-1.560	-.120	.887	.643-1.225
Nagelkerke R Square			0.148			0.044	
Hosmer and Lemeshow test (goodness of fit)			$\chi2$ (8) =8.693, p=0.370			$\chi2$ (8) =14.06, p=0.080	

Note. ∗p < 0.05, ∗∗p < 0.01, ∗∗∗p<0.001

The current study also found married/cohabiting participants and those who had never married to be at a lower risk of developing hypertension than those who had divorced. This could be because, married/cohabiting participants receive social support from their partners, which is likely to reduce their level of stress and improve their emotional well-being (Merabet et al., 2022). Also, divorce can cause people to lose their source of social support leading to feelings of loneliness and social isolation, a situation that can expose adults to hypertension. Moreover, the burden of single parenting and financial strains associated with such status possibly increases the stress level of divorced couples, exposing them to hypertension. Unfortunately, the process of divorce and its associated challenges can lead to heightened levels of anxiety, stress, and depression among couples, particularly women, which can in turn result in increased BP level (Hald, Ciprić, Sander, & Strizzi, 2022).

Other studies found single and married/cohabiting adults to be less at risk of hypertension than divorced couples (Pareek et al., 2021; Tuoyire, & Ayetey, 2019), attributing it to high social support and low level of stress. However, Ramezankhani, Azizi and Hadaegh (2019) found a higher risk of hypertension among never-married men than divorced men. Also, they found a lower risk of hypertension among widowed/divorced women than married women. They attributed their findings to the high rate of cigarette smoking among single men. Also, they observed low stress among widowed/separated women which could have accounted for their low risk for hypertension. Thus, it is important to prevent divorce as a way of preventing BP, while trying to understand the mechanism by which divorce influences BP.

The finding further showed that adults with JHS/SSS as their highest level of education have a lower risk of hypertension compared with those who had no education. In essence, attaining a secondary level of education reduced adults' risk of becoming hypertensive. Unhealthy lifestyles (smoking, eating an unbalanced diet, and alcohol consumption) and poor health-seeking behaviours among less educated adults might explain this finding (Sun et al., 2022). However, the current finding contrasts previous studies in Nepal (Hasan et al., 2018) and Bangladesh (Chowdhury, Uddin, Haque, & Ibrahimou, 2016) which reported a higher risk of hypertension among highly educated adults. Perhaps, there is a high-calorie diet intake and sedentary lifestyles among adults with higher education. The majority of the participants in the current study had a lower level of education, this could have accounted for the difference in the findings.

Additionally, the risk of becoming overweight/obese was low among adults aged 60 years or above than those aged 30-39 years in the current study. This means that more adults aged 60 years or above are less prone to developing unhealthy weight than those aged 30-59 years. Unlike older adults 60 years or above, adults aged 30-59 years are in the midst of their careers and may have less time to focus on healthy habits such as regular exercise and cooking nutritious meals. Moreover, they may also experience more stress, which can lead to emotional eating and a higher intake of calorie-dense foods. Similarly, the risk of overweight/obesity was lower among adults aged 60 years or above than those aged 40-54 years in Ethiopia (Darebo, Mesfin, & Gebremedhin, 2019). However, a Kenyan study found otherwise, they recorded a higher risk of overweight/obesity among older adults than younger ones (Mkuu et al., 2021), because of low PA among the aged due to aging and its related complications. Meanwhile, the majority of the participants in Mkuu et al.'s study were older adults, this could have affected their findings.

Furthermore, participants who received a monthly income of 1001-2000 Ghana cedis were at an increased risk of becoming overweight/obese than those who received below 500 Ghana cedis monthly. Perhaps, adults who receive higher monthly income have more access to and consume high-calorie, high-fat, and high-sugar foods, which possibly put them at risk of overweight/obesity. Also, typically in the Akan community where the study was conducted, larger body sizes may be viewed as a sign of wealth, which can contribute to higher rates of obesity among wealthier individuals (Agyapong, Annan, Apprey, & Aduku, 2020). Other studies have also reported an increased risk of overweight/obesity among adults with higher socioeconomic status (Aryeetey et al., 2016, Darebo et al., 2019; Mkuu et al., 2021). The implications are that there is a likelihood of an increase in NCD morbidity and mortality with associated dependency ratio in these communities.

Research Question 4: What is the Extent to which Neighbourhood Walkability, Food Environment, Stress, and Social Support Predict BP and BMI Levels among Adults in CCM?

This research question intended to determine the extent to which neighbourhood walkability, social support, food environment, and neighbourhood stress predict BP and BMI levels among adults in CCM. The study conducted a preliminary bivariate analysis to determine the association between neighbourhood environment variables and BP or BMI level. The bivariate analysis results showed that neighbourhood walkability ($\chi 2$=17.24, p<0.001), social support ($\chi2$=17.24, p<0.001), neighbourhood food environment ($\chi2$=17.24, p<0.001) and neighbourhood stress ($\chi2$=17.24, p<0.001), were significantly associated with hypertension (see Table 6). However, there was no significant association between neighbourhood environment characteristics and overweight/obesity (see Appendix 1, Table 7).

Furthermore, a multivariate analysis was conducted to determine the extent to which neighbourhood environment characteristics (walkability, food environment, social support, and neighbourhood stress) predict the risk of hypertension and obesity among participants using logistic regression analysis. The finding indicated that participants living in a highly-walkable neighbourhood environment were 37% [AOR=.63, 95%CI=.506-.772] less likely, those living in a healthy food environment were 1.42 [AOR=1.42, 95%CI=1.150-1.748] times more likely, and living in a highly stressful neighbourhood environment were 1.42 [AOR=1.42, 95%CI=1.145-1.749] times more likely, to develop hypertension. Moreover, participants who received moderate social support were 31% less likely to develop hypertension than those who received low social support [AOR=.69, 95%CI=.537-.874].

The finding is that adults living in a high-walkable neighbourhood environment were less likely to develop hypertension than those in a less-walkable neighbourhood. This means that staying in neighbourhoods where there is less traffic and more space for walking and exercising protects adults against hypertension, hence, lowering their risk of CVDs. Similarly, studies in Canada found an increased risk of hypertension and CVDs among adults living in a less walkable environment (Adhikari et al., 2021; Howell et al., 2019). Also, in line with the current findings, the risk of hypertension was lower among people living in high-walkable environments in Australia (Müller-Riemenschneider et al., 2013), reducing the risk of developing hypertension (de Courrèges et al., 2021; Malambo et al., 2018; Sarkar et al., 2018). Thus, a highly walkable neighbourhood environment promotes a healthy lifestyle like PA which protects adults against hypertension (Briggs et al., 2019). Therefore, efforts toward reducing people's risk of hypertension and CVDs need to focus on creating exercise-friendly neighbourhoods.

The finding again indicated that living in a healthy neighbourhood food environment in the CCM increased adults' risk of hypertension. This finding means that it is not enough to simply have access to healthy foods, individuals must also make healthy choices and engage in other healthy lifestyles like regular PA to reduce their risk of hypertension (Hu et al., 2022). The reason behind this finding is that increased salt intake, and overconsumption of processed foods (Ali, & Ali, 2020). Moreover, the genetic predisposition of participants could have influenced their risk of hypertension more than the physical presence of healthy foods (Hu et al., 2022). Paquet et al. (2014) agree with the findings of this study where they found more adults living in healthy food environments in Canada experiencing hypertension. They attributed their findings to the high cost of healthy foods that hindered participants from consuming healthy foods, just found in the current study that many of the participants earned less monthly income. The similarity in findings could partly be explained by the increase in prices of foods and other goods and services in Ghana (Jonathan, Sylvester, Diego, Collins, & Felix, 2022).

Table 3: Influence of neighbourhood walkability, food environment, stress, and social support on hypertension and overweight/obesity of participants

Variable	Hypertension			Overweight/obesity		
	B	AOR	95% CI	B	AOR	95% CI
Neighbourhood walkability						
Low	Ref	Ref	Ref	Ref	Ref	Ref
High	-.470	.63***	.506-.772	-.076	.927	.783-1.097
Neighbourhood food environment						
Unhealthy	Ref	Ref	Ref	Ref	Ref	Ref
Healthy	.349	1.42**	1.150-1.748	.039	1.040	.882-1.227
Neighbourhood stress						
Low	Ref	Ref	Ref	Ref	Ref	Ref
High	.347	1.42**	1.145-1.749	.074	1.077	.912-1.271
Social support						
Low	Ref	Ref	Ref	Ref	Ref	Ref
Medium	-.378	.69**	.537-.874	-.174	.840	.688-1.025
High	-.225	.80	.587-1.085	.018	1.018	.793-1.306
Nagelkerke R Square	.004			0.034		
Hosmer and Lemeshow test (goodness of fit)	$\chi2$ (7) =18.703, p=0.099			$\chi2$ (7) =9.473, p=0.220		

Note. $*p < 0.05$, $**p < 0.01$, $***p<0.001$

This might have prevented adults in healthy food environments from patronising healthy foods. Nevertheless, further studies are needed to understand why people living in a healthy food environment in CCM are at increased risk of hypertension. Again, the current findings contrast studies in the US (Kaiser et al., 2016) and Canada (Oakley et al., 2022), which found that more adults who stay in a healthy food environment were less likely to develop hypertension than those in an unhealthy food environment. Perhaps, the studies from US and Canada were conducted in urban areas rather than the current study that included rural, slum, coastal, and urban dwellers. Moreover, the economic conditions in US and Canada may provide the population with higher purchasing power compared with those in Ghana. Thus, whereas the population in US and Canada can afford healthy foods in the neighborhood and engage in PA regularly because of the availability of an exercise-friendly environment, those in Ghana lack such conditions for healthy living (Adjei-Boadi et al., 2022).

The current study further found that living in highly stressed neighbourhoods increased the participants' risk of developing hypertension. In line with the findings of this study, Jones (2012) and other researchers (Dhabhar, 2018; Merabet et al., 2022) found an increased risk of developing hypertension among people living in highly stressed neighbourhoods. However, Mayne et al. (2018) and Coulon et al. (2016) found no such significant association between increased neighbourhood stress and the risk of developing hypertension. Perhaps, the variations are attributable to the differences in the study settings. The current study included both urban and rural communities, unlike the previous studies that selected participants from only rural communities. Nonetheless, hypertension and CVDs morbidities and mortalities could rise should the neighbourhoods remain stressful. Moreover, such a situation could increase the burden on health facilities and also reduce productivity in the Metropolis. Hence, efforts towards reducing neighbourhood stressors such as crime rate and high traffic are important to reduce hypertension prevalence and CVDs risks in the CCM.

Furthermore, participants in the current study who received moderate social support were less likely to develop hypertension. The current study confirms that from China (Yazawa et al., 2022) and Canada (Hosseini et al., 2021). which had a lower risk of hypertension among participants who received moderate social support from family and friends. Contrary to the current findings, Yoon et al. (2017) found no significant association between social support and the risk of hypertension among their participants. While Yoon et al. studied older adults 60 years or above, the current study selected adults 30-79 years. Perhaps, other factors like old age and its complications exposed the previous participants more than social support.

It is also worth noting that the current study found no significant association between social support, food environment, neighbourhood stress, neighbourhood walkability, and risk of overweight/obesity among adults in CCM. This finding may imply that the risk of adults becoming overweight/obese may not depend on adults' perception of their neighbourhood built and psychosocial environment, which was also found in Sweden (Oliveira et al, 2013). However, findings from Canada (Hosseini et al., 2021) and Asia (Lee et al., 2022) reported higher risk of overweight/obesity among adults who received low social support. These studies attributed their findings to low PA among adults who received low social support. Perhaps, other factors like dietary habits, unhealthy lifestyles, and socioeconomic status exposed these adults to overweight/obesity rather than social support. Furthermore, Malambo et al. (2016) found a significant association between neighbourhood walkability and increased risk of overweight/obesity. Contraryly, other studies found a significant association between neighbourhood walkability and risk of overweight/obesity (Creatore et al., 2016; Koh et al., 2021; Müller-Riemenschneider et al., 2013; de Courrèges et al., 2021; De Bourdeaudhuij et al., 2015). Moreover, the current findings oppose the socioecological model which proposes that other community factors such as neighbourhood walkability could expose people to obesity (Bronfenbrenner, 1977). The reason behind these inconsistencies isthat adults no longer or minimally depend on the neighbourhood environment for their PA. Possibly, due to technological advancement, adults rely on indoor PAs such as rope skipping and other indoor games. Maybe the COVID-19 pandemic and its associates locked down have also influenced the adult’s perception of utilising the neighbourhood environment for PA.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This study assessed the influence of neighbourhood-built and psychosocial environments on the risk of CVDs among adults in the CCM. This chapter presents the summary, main findings, conclusion, and recommendations.

Summary

Cardiovascular diseases are killing more adults worldwide with low- and middle-income countries disproportionately affected. Some schools of thought argue that the neighbourhood and psychosocial environment could expose or protect adults from hypertension and obesity (risk factors for CVDs). Besides, CVDs risk factors like hypertension, diabetes, overweight/obesity, stress, alcohol and tobacco smoking are modifiable risk factors linked to the neighbourhood built and psychosocial environment. Studies show that the built environment can encourage PA and healthy eating and vice versa which protect or expose adults to obesity and hypertension. For instance, living in high-traffic and crime zone could increase adults' stress. Hence, efforts towards reducing CVDs risk factors need to focus on ensuring a healthy built and psychosocial environment.

This study investigated the influence of the neighbourhood-built environment on the risk of developing CVD risks like hypertension and obesity. Adapting the socioecological model, the study conceptualised that the risk of developing CVD risks (hypertension and overweight/obesity) is linked to individual factors (age, sex), intrapersonal (social support), and institutional and community factors (neighbourhood-built environment).

The study was conducted among adults (aged 30-79 years) who were residents of sampled communities (Abura, Akotokyir, Cape Coast, and Brofoyedur) in the CCM. Also, the study employed a cross-sectional survey design and used a multistage sampling technique using stratified and simple random techniques to select 2400 adult participants who lived in communities for at least six months. However, the study excluded pregnant women and postpartum mothers. Furthermore, the study used structured closed, and open-ended 69 questionnaires (in five sections) to collect data from participants. Section "A" contained 13 items on background characteristics of participants, "B" on anthropometric measurements (weight, height, and BP measures), and "C" on perceived neighbourhood walkability with 15 items from the PANES-N scale. Section "D" contained 43 items on food environment using the NEMS-P scale, and E and F contained 12 and 14 items on social support (adopted MSPSS) and neighbourhood stress (adapted the city stress index) items, respectively. The instrument recorded overall internal consistency reliability (Cronbach's alpha) of 0.823 with 0.709, 0.933, 0.908, and 0.733 for PANES-N, social support scale, neighbourhood stress scale, and the food environment scale, respectively. With four research questions, frequencies, percentages and binary regression were used to analyse the data.

Main Findings

1. The level of social support among adults in CCM was moderate whereas neighbourhood stress was high.
2. A quarter of the adults in CCM were hypertensive while close to a third and a little above a quarter were overweight and obese, respectively.

3. The risk of hypertension was low among males than females, married/cohabiting adults, and divorced participants. Also, the risk of hypertension was high among adults aged 40 or above than those aged 30-39 years. Again, the risk was low among participants who had JHS as their highest level of education than those who had never attended school. Further, the risk of hypertension was low among former smokers but high among current smokers compared with those who never smoked cigarettes. Also, the risk was high among employed and retired participants than among those unemployed, and low among those who had no family history of hypertension.
4. The risk of overweight/obesity was low among participants aged 60 years or above than those aged 30-39 years, but those who earned 1001-2000 monthly were at an increased risk of overweight/obesity than those who received below 500.
5. Participants who lived in high-walkable neighbourhoods were at reduced risk of hypertension than those in less-walkable neighbourhoods. Also, those who lived closer to healthy food environments were at an increased risk of hypertension than those in unhealthy food environments. Again, participants who lived in highly stressful neighbourhoods were at increased risk of developing hypertension.
6. There was no association between the level of social support, food environment, neighbourhood stress, neighbourhood walkability, and the risk of becoming overweight/obese.

Conclusions

The following conclusions are drawn from the findings:

1. There is a high level of neighbourhood stress in the CCM, a situation that is increasing the risk of developing hypertension or obesity among these adults. This may hinder Ghana's effort to ensure good health and well-being for all by the year 2030 (Sustainable Development Goal [SDG] 3).
2. The high prevalence of hypertension and overweight/obesity among the adults in the CCM exposes them to CVDs and other NCDs such as type 2 diabetes and some cancers.
3. Being a male, married/cohabiting, a JHS graduate, a former smoker, and having no family history of hypertension could be a protective factor against hypertension, but not those age 40 years or above, and employed or retirees.
4. The working population of the CCM has higher chances of becoming overweight or obese than the aged or retired population. Also, those who receive a higher monthly income have a higher chance of becoming overweight or obese than those who receive a lower monthly income. This shows that more of the working population are likely to develop chronic diseases which could affect productivity and increase poverty in the CCM. Also, the high-income earning population in the CCM is at risk of CVDs and other NCDs, a situation that could hinder the attainment of Ghana's 2022 NCDs policy goal of reducing NCDs prevalence to the barest minimum.
5. Further receiving moderate social support could protect people against hypertension. However, living in a stressful neighbourhood environment

and living closer to a health food environment is a risk factor for hypertension.

Recommendations

Based on the conclusions, the following recommendations are made:

Recommendation for practice

1. Healthcare professionals are encouraged to emphasise hypertension prevention and management, particularly among females, divorced individuals, and those aged 40 years or above.
2. There is a need for the Health Promotion Unit of Ghana Health Service to increase its interventions targeting smoking cessation to reduce the risk of hypertension.
3. Health professionals and Non-Governmental Organisations are encouraged to develop interventions that target adults living in high-stress neighbourhoods to reduce their risk of hypertension.
4. Health professionals, church leaders, imams, and community leaders are encouraged to promote social support networks as a means of reducing the risk of hypertension.

Recommendations for policy

1. The Ghana Ministry of Health (MoH) is encouraged to strengthen the implementation of policies aimed at reducing smoking prevalence, such as tobacco control policies to reduce the risk of hypertensionamong adults in CCM.
2. Managements of various organisations are encouraged to implement policies and programmes that support workplace wellness to reduce the risk of hypertension among their worker in CCM.

3. The Ghana Ministry of Works and Housing is encouraged to implement urban planning policies, prioritising the creation of walkable neighbourhoods to reduce the risk of hypertension.
4. The local government agencies are encouraged to enforce policies aimed at reducing neighbourhood stressors, such as noise pollution and crime to reduce the risk of hypertension among adults in CCM.

Recommendations for future research

1. Further research is needed to explore why people living closer to healthy food environments are at higher risk of hypertension compared with those living in unhealthy food environment.
2. This study needs to be replicated elsewhere, to determine the impact of social support, food environment, neighbourhood stress, and walkability on overweight and obesity, given the lack of significant associations found in this study.

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APPENDICES

Appendix I: The Study's Questionnaire

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
DEPARTMENT OF HEALTH, PHYSICAL EDUCATION AND RECREATION

QUESTIONNAIRE FOR HOUSEHOLD SURVEY

Good morning/afternoon/evening Mr/Mrs/Miss/Dr./Prof
I am a candidate pursuing M.Phil. in Health Education from the Department of HPER, UCC. My current research pertains to conducting a survey on the "Psychosocial Environment and Risk of Cardiovascular Diseases Among Adults in CCM, Ghana." The underlying reason for undertaking this study is to ascertain if the surroundings or locality where one resides, the level of social backing that one receives, and the degree of stress experienced in one's neighbourhoods are factors that predispose individuals to hypertension and/or obesity. It is imperative to acknowledge that all answers provided in the survey are exclusively confidential and intended solely for the purpose of research. The extent of this survey may necessitate approximately 20 to 30 minutes of your esteemed time. I would like to emphasise that involvement in this examination is absolutely voluntary, and you have the liberty to terminate the survey if you deem it necessary. I am appreciative of your cooperation and eagerness to participate in this scholarly inquiry.

Name of town/city................................. **Name of locality ....**
Date of interview............/........./........... **Questionnaire number: ....**

SECTION A: Background Information
Instruction: Indicate by marking [X] the relevant box corresponding to your preference for each statement presented below, or specify where applicable.

1. What is your sex? Male [ ] Female [ ] others [ ]
2. How old are you? ___________years
3. Marital status
   a) Married or living with a partner [ ]
   b) Divorced [ ]
   c) Single [ ]
4. What is your highest level of education?
   a) None [ ]
   b) Primary [ ]
   c) JSS/JHS [ ]
   d) GCE O Level/SSSC/WASSCE/GCE "A" LEVEL [ ]

e) Tertiary ☐

5. Religious affiliation
   a) Christian ☐
   b) Muslim ☐
   c) African Traditional Religion ☐
   d) Others (specify): ______________________________
6. Occupation (Specify)______________________
7. Smoking cigarette
   a. Former smoker ☐
   b. current smoker ☐
   c. Never smoked ☐
8. Living arrangement
   a. Living alone ☐
   b. live with others ☐
9. What is your monthly income in Ghana Cedis?____________
10. Type of residential area
   a. Rural ☐
   b. Urban ☐
   c. Slum ☐
   d. Coastal dweller ☐
11. Are you a hypertensive patient?
   a. Yes
   b. No

11. Do you have any of your parents, relatives or siblings who is/are hypertensive?
   a. Yes
   b. No
   C. I don't know

12. How many drive-able motor vehicles (cars, trucks, and motorcycles) are there in your household? …………………………………………(Specify)

13. How long have you lived in your current address?.......................................(specify)

11. How would you describe your current employment status?
   a. Full-time employment
   b. Part-time employment
   c. Contract worker
   d. Unemployed

12. B: Anthropometric measurements

	1st reading	**2nd reading**	**3rd reading**
Height (m)			
Weight (Kg)			
Systolic BP (mmHg)			
Diastolic BP (mmHg)			

Section C: Neighbourhood walkability

Consider the diverse amenities present in the vicinity of your locality. By this, we are referring to the entirety of the area encircling your abode that can be traversed on foot within a span of 10-15 minutes.

		Strongly Disagree (SD)	Disagree (D)	Agree (A)	Strongly Agree (SA)
13.	Many shops, stores, markets or other places to buy things I need are within easy walking distance of my home.				
14.	There are many non-residential places like schools, hospitals, etc to go within easy walking distance of my home.				
15.	It is within easy walking distance from my home to access public taxis and buses in my neighbourhood.				
	Neighbourhood infrastructure				
16.	My neighbourhood has several places to exercise.				
17.	There are separate pedestrian pathways on most of the streets near my home.				
18.	The pathways in my area are unobstructed and good for walking				
	Aesthetic qualities				
19.	There are many beautiful things to look at while walking in my area.				
20.	My neighbourhood is generally free from unattended domestic animals.				
21.	My neighbourhood is generally free from garbage and offensive odour.				
	Social environment				
22.	I see many people in my neighbourhood walking, playing sports, etc.				
	Street connectivity				
23.	There are many cross junctions in my neighbourhood.				
	Neighbourhood safety				
24.	Walking is dangerous during the day because of inadequate security from crime and harassment.				
25.	Walking is dangerous because of the speed of traffic and driving in my area.				
26.	Walking is dangerous during the night because of inadequate security from molestation, crime and harassment				
27.	It could be safe to ride on a bicycle in my neighbourhood because of little traffic				

Section D: Neighbourhood food environment
Questions on food shopping

28. Please consider the food establishments in the vicinity of your residence and provide responses to the ensuing inquiries. For the purposes of this exercise, we are defining your community as the region within a 20-minute walking distance or a 10–15-minute automobile commute from your abode. Kindly indicate your level of agreement or disagreement with the subsequent statements.

		Strongly Disagree (SD)	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
a.	It is easy to buy fresh fruits and vegetables in my neighbourhood					
b.	The fresh produce in my neighbourhood is of high quality.					
c.	There is a large selection of fresh fruits and vegetables in my neighbourhood					
d.	It is easy to buy low-fat products, such as low-fat milk or lean meats, in my neighbourhood					
e.	The low-fat products in my neighbourhood are of high quality					
f.	There is a large selection of low-fat products available in my neighbourhood.					

29. Thinking about the store where you buy most of your food, how do you usually travel to this store? (Check all that apply)
    a. Walk
    b. Bicycle
    c. Bus or other public transportation
    d. Drive your own car
    e. Get a ride
    f. Other (please specify):………………………………………
30. How long would it take to get from your home to the store where you buy most of your food, if you walked there?
    a. 10 minutes or less
    b. 11 to 20 minutes
    c. 21 to 30 minutes
    d. More than 30 minutes

31. How important are each of the following factors in your decision to shop at the store where you buy most of your food?

		Not at all important	A little important	Somewhat important	Very important
a.	Near your home				
b.	Near or on the way to other places where you spend time				
c.	Your friend/relatives shop at this store				
d.	Selection of foods				
e.	Quality of foods				
f.	Prices of foods				
g.	Access to public transportation				

32. At the store where you buy most of your food, how hard or easy is it to get each of these types of foods?

		Very easy	Somewhat easy	Somewhat hard	Very hard
a.	Fresh fruits				
b.	Canned or frozen fruits and vegetables				
c.	Lean meats				
d.	Low fat produce				
e.	Sugary drinks (Malt, coke, fanta etc)				

33. At the store where you buy most of your food, how would you rate the price of fresh fruits and vegetables?

a. Very inexpensive
b. Not expensive
c. Somewhat expensive
d. Very expensive

34. Please mark whether you agree or disagree with the following statements for the store where you buy most of your food and your shopping habits at that store. Questions about unhealthy foods mean those foods often considered to be high in sugar, salt, fat and calories, sugary cereals, bakery desserts, and so on.

		Strongly Disagree (SD)	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
a.	I notice signs that encourage me to purchase healthy foods.					
b.	I often buy food items that are located near the Cash register.					
c.	The unhealthy foods are usually located near the end of the aisles.					
d.	I often buy items that are eye-level on the shelves.					
e.	There are a lot of signs and displays encouraging me to buy unhealthy foods.					
f.	I see nutrition labels or nutrition information for most packaged foods at the store.					
g.	The foods near the cash register are mostly unhealthy choices.					

Restaurant/Eating out question

35. In an average week, how many times do you eat a meal away from home, or get take-out food, at a...
   a. Fast-food restaurant [ ] times a week
   b. Sit-down restaurant [ ] times a week
   c. Other types of "restaurant" Please specify type:……………………………………

36. How long would it take to get from your home to the fast-food restaurant where you go most often, if you walked there?
   a. 10 minutes or less
   b. 11 to 20 minutes
   c. 21 to 30 minutes
   d. More than 30 minutes
   e. I do not eat at fast-food restaurants

37. How long would it take to get from your home to the sit-down restaurant where you go most often, if you walked there?
    a. 10 minutes or less
    b. 11 to 20 minutes
    c. 21 to 30 minutes
    d. More than 30 minutes
    e. I do not eat at sit-down restaurants

Please select the response that most accurately characterizes the restaurant which you frequent most frequently, including instances of take-out if applicable, as well as your personal assessment of said establishment. When referencing healthy options, we are referring to those choices which exhibit a low-fat content, promote heart health, are served in small portions, and contain a variety of fruits and vegetables. Conversely, when referencing unhealthy foods, we are alluding to those options which are high in fat, sugar, salt, and caloric content, such as deep-fried foods, sugary desserts, and similar items.

38. Is the restaurant where you go most often a...
    a. Fast-food restaurant
    b. Sit-down restaurant
    c. Other (please specify):……………………….

39. Please mark whether you agree or disagree with the following statements about the restaurant where you go most often:

		Strongly Disagree (SD)	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Strongly agree
a.	There are many healthy menu options at the Restaurant					
b.	It is hard to find a healthy option when eating out at the restaurant.					
c.	It is easy to find healthy fruit and vegetable choices at the restaurant.					
d.	It is important to me to be able to make a healthy food choice when eating out					
e.	The restaurant provides nutrition information (suchas calorie content) on a menu board or on the menu					
f.	Signs and displays encourage overeating or choosing unhealthy foods from the menu.					
g.	It costs more to buy the healthy options					
h.	The menu or menu board highlights and promotes the healthy options at the restaurant.					

Section E: Social support

Instructions: This scale is made up of a list of statements each of which you may agree or disagree. For each statement tick whether you "strongly disagree", "Disagree", "Agree" and "Strongly Agree".

		Strongly Disagree (SD)	Disagree (D)	Agree (A)	Strongly Agree (SA)
40.	There is a special person who is around when I am in need.	[1]	[2]	[3]	[4]
41.	There is a special person with whom I can share my joys and sorrows.	[1]	[2]	[3]	[4]
42.	My family really tries to help me.	[1]	[2]	[3]	[4]
43.	I get the emotional help and support I need from my family.	[1]	[2]	[3]	[4]
44.	I have a special person who is a real source of comfort to me.	[1]	[2]	[3]	[4]
45.	My friends really try to help me.	[1]	[2]	[3]	[4]
46.	I can count on my friends when things go wrong.	[1]	[2]	[3]	[4]
47.	I can talk about my problems with my family.	[1]	[2]	[3]	[4]
48.	I have friends with whom I can share my joys and sorrows.	[1]	[2]	[3]	[4]
49.	There is a special person in my life who cares about my feelings.	[1]	[2]	[3]	[4]
50.	My family is willing to help me make decisions.	[1]	[2]	[3]	[4]
51.	I can talk about my problems with my friends.	[1]	[2]	[3]	[4]

Section F: Neighbourhood Stress

Life in a city can be stressful. We want to know about stress you have experienced in your neighbourhood during the PAST YEAR. For each stressful event, please indicate if this event, or something like it, happened in the neighbourhood(s) where you lived during the PAST YEAR. Indicate if you strongly disagree, disagree, agree or strongly agree with the statement provided, by selecting one response.

		Never	Once	A few times	Often
	Neighbourhood disorder				
52	I saw people dealing drugs near my home in the past year.	[1]	[2]	[3]	[4]
53	I saw strangers who were drunk or high hanging out near my home in the past year.	[1]	[2]	[3]	[4]
54	I heard adults arguing loudly on my street in the past year.	[1]	[2]	[3]	[4]
55	I heard neighbours complaining about crime in our neighbourhood in the past year.	[1]	[2]	[3]	[4]
56	Someone I knew was arrested or went to jail in the past year	[1]	[2]	[3]	[4]
57	People in the neighbourhood complained about being harassed by police in the past year.	[1]	[2]	[3]	[4]
58	I saw cars speeding or driving dangerously on my street in the past year.	[1]	[2]	[3]	[4]
	Exposure to violence				
59	A family member was attacked or beaten in my neighbourhood in the past year.	[1]	[2]	[3]	[4]
60	A family member was stabbed or shot in the past year.	[1]	[2]	[3]	[4]
61	A friend was stabbed or shot in the past year.	[1]	[2]	[3]	[4]
62	A family member was stopped and questioned by the police in the past year.	[1]	[2]	[3]	[4]
63	A friend was robbed or mugged in the past year.	[1]	[2]	[3]	[4]
64	Someone threatened to hurt a member of my family in the past year.	[1]	[2]	[3]	[4]
65	A family member was robbed or mugged in the past year.	[1]	[2]	[3]	[4]

Thank You for participating in the study

Appendix II: Ethical clearance letter

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

Our Ref.: CCTH

Your Ref.:

P. O. Box CT.1363
Cape Coast
CC-071-9967
Tel: 03321-34010-14
Fax: 03321-34016
Website: www.ccthghana.org
email: info@ccthghana.com

2nd November, 2022

Paul Obeng
Dept. of Health, Physical Education & Recreation
University of Cape Coast
Cape Coast

Dear Sir,

ETHICAL CLEARANCE – REF: CCTHERC/EC/2022/163

The Cape Coast Teaching Hospital Ethical Review Committee (CCTHERC) has reviewed your research protocol titled, **'Neighbourhood Environment and Risk of Cardiovascular Diseases among Adults in Cape Coast Metropolis, Ghana'** which was submitted for ethical clearance. The ERC is glad to inform you that you have been granted provisional approval for implementation of your research protocol.

The CCTHERC requires that you submit periodic review of the protocol and a final full review to the ERC on completion of the research. The CCTHERC may observe or cause to be observed procedures and records of the research during and after implementation.

Please note that any modification of the project must be submitted to the CCTHERC for review and approval before its implementation.

You are required to report all serious adverse events related to this study to the CCTHERC within ten (10) days in writing. Also note that you are to submit a copy of your final report to the CCTHERC office.

Always quote the protocol identification number in all future correspondence with us in relation to this protocol.

Yours sincerely,

Prof. Ganiyu Rahman
Chairman, ERC

Appendix III: Bivariate Analysis Tables

Table 4: Chi square analysis of association between socio-demographic variables and BP level among participants

Variables		Blood pressure level: Non-hypertensive	Hypertensive	Chi-square (χ2)	*phi*
Gender	Female	945(40.6%)	288(12.4%)	18.36***	-.089
	Male	918(39.4%)	178(7.6%)		
Age	30-39	838(36.0%)	113(4.9%)	93.83***	.201
	40-49	462(19.8%)	139(6.0%)		
	50-59	324(13.9%)	86(3.7%)		
	≤60 years	239(10.3%)	128(5.5%)		
Years of stay	<5years	171(7.3%)	29(1.2%)	5.86	.050
	6-10	271(11.6%)	59(2.5%)		
	≤11	1421(61.0%)	378(16.2%)		
Marital status	Divorced	124(5.3%)	67(2.9%)	41.78***	.134
	Married/cohabiting	1066(45.8%)	283(12.2%)		
	Never married	673(28.9%)	116(5.0%)		
Monthly income	<500	828(35.6%)	208(8.9%)	53.32**	.151
	500-1000	903(38.8%)	178(7.6%)		
	1001-2000	107(4.6%)	71(3.0%)		
	>2000	25(1.1%)	9(0.4%)		
Level of education	Tertiary	143(6.1%)	21(0.9%)	26.71***	.107
	Primary	313(13.4%)	88(3.8%)		
	None	271(11.6%)	79(3.4%)		
	JSS/JHS	744(31.9%)	220(9.4%)		
	Secondary	392(16.8%)	58(2.5%)		
Smoking habits	Never	1716(73.7%)	426(18.3%)	11.86**	.071
	Former smoker	84(3.6%)	11(0.5%)		
	Current smoker	63(2.7%)	29(1.2%)		
Living arrangement	Living alone	344(14.8%)	66(2.8%)	4.76*	.045
	Living with others.	1519(65.2%)	400(17.2%)		
Occupation	Unemployed	153(6.6%)	30(1.3%)	12.54*	.073
	Student	53(2.3%)	3(0.1%)		
	Employed	27(1.2%)	12(0.5%)		
	Daily labourer	39(1.7%)	8(0.3%)		
	Retired	1591(68.3%)	413(17.7%)		
Residential area	Urban	580(24.9%)	178(7.6%)	26.19***	.106
	Slum	318(13.7%)	72(3.1%)		
	Rural	635(27.3%)	175(7.5%)		
	Coastal area	330(14.2%)	41(1.8%)		
Family history of HYPERTENSION	Yes	213(9.1%)	93(4.0%)	28.57***	.111
	No	1190(51.1%)	247(10.6%)		
	Don't know	460(19.8%)	126(5.4%)		
Religion	Pagan	12(0.5%)	4(0.2%)	8.14*	.059
	Muslim	313(13.4%)	94(4.0%)		
	Christian	1530(65.7%)	362(15.5%)		
	Traditional	8(0.3%)	6(0.3%)		

Note. $*p < 0.05$, $**p < 0.01$, $***p<0.001$

Table 5: Chi square analysis for the association between BMI and independent variables

Variables	Category	BMI level		Chi-square (χ2)	*Φc*
		Normal	Overweight/obese		
Gender	Female	604(25.9%)	629(27.0%)	1.99	-.029
	Male	569(24.4%)	527(22.6%)		
Age	30-39	477(20.5%)	474(20.4%)	17.24**	.081
	40-49	270(11.6%)	331(14.2%)		
	50-59	211(9.1%)	199(8.5%)		
	≤60 years	477(20.5%)	474(20.4%)		
Years of stay	<5years	94(4.0%)	106(4.6%)	1.14	.022
	6-10	164(7.0%)	166(7.1%)		
	≤11	915(39.3%)	884(38.0%)		
Marital status	Divorced	97(4.2%)	94(4.0%)	1.19	.023
	Married/cohabiting	691(29.7%)	658(28.3%)		
	Never married	385(16.5%)	404(17.3%)		
Monthly income	<500	526(22.6%)	510(21.9%)	.122***	
	500-1000	580(24.9%)	501(21.5%)		
	1001-2000	56(2.4%)	122(5.2%)		
	>2000	11(0.5%)	122(5.2%)		
Level of education	Tertiary	79(3.4%)	85(3.6%)	4.99	.046
	Primary	192(8.2%)	209(9.0%)		
	None	192(8.2%)	158(6.8%)		
	JSS/JHS	476(20.4%)	488(21.0%)		
	Secondary	234(10.0%)	216(9.3%)		
Smoking habits	Never	1080(46.4%)	1062(45.6%)	.038	.004
	Former smoker	47(2.0%)	48(2.1%)		
	Current smoker	46(2.0%)	46(2.0%)		
Living arrangement	Living alone	214(9.2%)	196(8.4%)	.667	.017
	Living with others.	959(41.2%)	960(41.2%)		
Occupation	Unemployed	89(3.8%)	94(4.0%)	3.73	0.040
	Student	31(1.3%)	25(1.1%)		
	Employed	16(0.7%)	23(1.0%)		
	Daily labourer	28(1.2%)	19(0.8%)		
	Retired	1009(43.3%)	995(42.7%)		
Residential area	Urban	360(15.5%)	398(17.1%)	4.47	.044
	Slum	204(8.8%)	186(8.0%)		
	Rural	411(17.6%)	399(17.1%)		
	Coastal area	198(8.5%)	173(7.4%)		
Family history of Hypertension	Yes	132(5.7%)	174(7.5%)	9.68**	.064
	No	755(32.4%)	682(29.3%)		
	Do not know	286(12.3%)	300(12.9%)		
Religion	Pagan	9(0.4%)	7(0.3%)	3.05	.036
	Muslim	190(8.2%)	217(9.3%)		
	Christian	966(41.5%)	926(39.8%)		
	Traditional	8(0.3%)	6(0.3%)		

Note. ∗p < 0.05, ∗∗p < 0.01, ∗∗∗p<0.001

Table 6: Chi square analysis of association between level of social support, food environment, neighbourhood stress and BP level

Variables	Categories	Blood pressure level		χ2	*Φc*
		Non-hypertensive	Hypertensive		
Neighbourhood walkability	Less walkable	749(32.2%)	242(10.4%)	20.97***	**-.095**
	Walkable	1114(47.8%)	224(9.6%)		
Social support	Low	454(19.5%)	147(6.3%)	10.65**	.068
	Moderate	1030(44.2%)	226(9.7%)		
	High	379(16.3%)	93(4.0%)		
Food environment	Unhealthy	985(42.3%)	208(8.9%)	10.12**	.066
	Healthy	878(37.7%)	258(11.1%)		
Neighbourhood stress	Low stress	883(37.9%)	188(8.1%)	7.47**	.057
	High stress	980(42.1%)	278(11.9%)		

Note. ∗p < 0.05, ∗∗p < 0.01, ∗∗∗p< 0.001

Table 7: Chi-square analysis of the association between level of social support, food environment, neighbourhood stress, neighbourhood walkability and BMI level

Variables		BMI		Chi-square (χ2)	*φc*
		Normal weight	Overweight/obese		
Level of social support	Low	289(12.4%)	312(13.4%)	4.47	0.044
	Moderate	658(28.3%)	598(25.7%)		
	High	226(9.7%)	246(10.6%)		
Food environment	Unhealthy	609(26.1%)	584(25.1%)	.46	.014
	Healthy	564(24.2%)	572(24.6%)		
Neighbourhood stress	Low stress	546(23.4%)	525(22.5%)	.30	.011
	High stress	627(26.9%)	631(27.1%)		
Neighbourhood walkability	Less walkable	489(21.0%)	502(21.6%)	0.72	-.018
	Walkable	684(29.4%)	654(28.1%)		

Note. ∗p < 0.05, ∗∗p < 0.01, ∗∗∗p<0.001