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REGIONAL INSTITUTE FOR POPULATION STUDIES

AT THE

UNIVERSITY OF GHANA

THE BUILT ENVIRONMENT AND THE RISK OF OBESITY AMONG THE URBAN POOR IN ACCRA, GHANA

BY

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(10166270)

THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF PHD POPULATION STUDIES DEGREE

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ACCEPTANCE

Accepted by the College of Humanities, University of Ghana, Legon, in fulfillment of the requirement for the award of PhD Population Studies degree.

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DECLARATION

I FIDELIA AKPENE AMA DAKE hereby declare that, except for references to other people's work, which have been duly acknowledged, this is the result of my own research and it has neither in part nor in whole been presented for another degree.

_____ _____

FIDELIA AKPENE AMA DAKE DATE

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DEDICATION

This work is dedicated to world's best parents ever. Thank you mum and dad. May the good Lord richly bless you and may He cause you to continually sing His praises. May He restore unto you all that you have lost in taking care of me and may He give you long life, good health and prosperity to enjoy the fruits of you labour.

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ABSTRACT

BACKGROUND: Obesity has become a major public health problem globally. Once more common in developed countries, the prevalence of obesity has been observed to be increasing in developing countries as well. In the past, obesity was attributed to factors such as individual genetic make-up and lifestyle behaviours. These factors however, do not exclusively explain the global increase in the prevalence of obesity over the last three decades. Rather, a built environment that encourages excess calorie consumption and physical inactivity has been proposed as a more likely explanation.

OBJECTIVES: The influence of the built environment on obesity has been extensively documented in developed countries but continues to remain a grey area in developing countries, especially in the sub-Saharan Africa region. This study examines the built environment in an urban poor Ghanaian context and investigates how the built environment influences the risk of obesity for residents of these urban poor settings.

METHODOLOGY: This study was conducted in three urban poor communities (James Town, Ussher Town and Agbogbloshie) in Accra, Ghana. The study involved the collection of primary data at two levels: the individual and community levels. At the individual level, data were collected on socio-demographic characteristics, lifestyle behaviours and anthropometric measures including weight, height and waist circumference through a survey. At the community level, Geographic Positioning System (GPS) technology was used to gather data on the features of the built environment including the location and number of out-of-home cooked foods, convenience stores, fruit and vegetable sales points and physical activity spaces. Qualitative data on community norms and perceptions about ideal body size and dietary and physical activity behaviours were also collected through focus group discussions. A mix of spatial, qualitative and quantitative analysis tools were used to analyse the data. The dependent variable for the study was obesity which was measured using body mass index (BMI) and waist-to-height ratio while the features of the built environment were used as the main independent variables.

RESULTS: The built environment in the study area is suggestive of one that is "obesogenic". There were more options for out-of-home cooked foods and convenience stores but fewer options for fruits and vegetables and physical activity spaces. Each additional out-of-home cooked food place located in the community was associated with an approximate 0.1 kg/m^2 decrease in BMI while each additional convenience store was associated with a 0.2 kg/m^2 increase in BMI after controlling for population density, crime level, social cohesion, trust among community members, perception about community ideal body size and individual socio-demographic characteristics and lifestyle behaviours. Also, the presence of a physical activity space in the community was associated with a 0.4 kg/m^2 reduction in BMI although statistical significance was not achieved. The results of sex stratified models show a 0.1 kg/m^2 reduction in BMI for each additional out-of-home cooked food place among females (at $P<0.10$) but not among males. The features of the built environment did not show a significant influence on waist-to-height ratio in the general model and sex stratified models although contributing to the variance.

CONCLUSIONS: This study demonstrates the existence of a built environment that influences the risk of obesity in an urban poor Ghanaian context. The influence of the built environment on obesity differs depending on the measure of obesity and also differs for males and females. There is the need to expand the scope of obesity research in the sub-Saharan African region by examining the contribution of the built environment.

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CHAPTER ONE

INTRODUCTION

1.1 Background

1.1.1 The built environment and obesity

Population health research shows that the places people interact with directly or indirectly affects individual and population health outcomes (Stevenson et al., 2009). Consequently, researchers in the last two decades, have become increasingly interested in place-based influences on health and how context plays a role in shaping peoples' health experiences and health outcomes (Stevenson et al., 2009; Macintyre et al., 2002; Diez Roux, 2001). Obesity is among the several population health outcomes that has been found to be influenced by contextual factors including neighbourhood socio-environmental characteristics (Booth, 2005).

Obesity occurs when energy intake exceeds energy expenditure over time; leading to a positive energy balance (Hill and Peters, 1998). A complex interplay of genetic, biologic, physiologic, behavioural, environmental and social factors impact the rather simple energy balance equation that leads to obesity (Cheng, 2012; Huang et al., 2009). While factors such as genetics, physiology and metabolism are non-modifiable, behaviours such as poor dietary practices and physical inactivity are modifiable (Huang et al., 2009). These modifiable factors are, however, often shaped and affected by factors in the environment (Cheng, 2012; Lopez, 2007).

Papas et al. (2007) define the environment as "everything external to the individual" while the "built environment" constitutes aspects of the environment that are man-made or

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modified as opposed to the natural aspects of the environment. The built environment encompasses physical infrastructure (such as buildings, roads and street network), social processes (norms, practices, beliefs and perceptions), organisational and political process (structures, policies and regulations) which operate together to influence peoples' behaviour.

In the case of obesity, the built environment increases or decreases the risk of obesity by discouraging or encouraging healthy lifestyle behaviours. The built environment can structure access to certain foods and also determine the ease of engaging in physical activity. "Food deserts", defined as areas that lack access to affordable fruits, vegetables, whole grains, low fat milk and other foods that make up a full range of a healthy diet (Centers for Disease Control and Prevention, 2010), or areas that provide an imbalance of food choices by offering less healthy foods (Mari Gallagher Research and Consulting Group, 2010) restricts the choices individuals can make with regards to food. In socio-economically deprived areas, poor diets, obesity, diabetes and hypertension are often associated with food deserts (Cummins and Macintyre, 2006).

Changes in the built environment that promotes obesogenic behaviours has been reported to be the driving force behind the obesity epidemic being currently experienced the world over (Stern et al., 2010; Cohen-Cole and Fletcher, 2008). Some researchers argue that investigating socio-environmental conditions that breed obesity is a more effective approach to reducing obesity than changing individual behaviours or promoting healthy living at the individual level (Freudenberg, 2007). There is thus a growing consensus towards using a multi-systems, multi-level and multi-disciplinary approach to conducting obesity research (Cheng, 2012).

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1.1.2 Global obesity epidemic

Globally, the prevalence of obesity has seen a dramatic increase in all regions of the world in the last three decades (Pearce and Witten, 2010). There has been a three-fold increase in the rates of obesity in regions such as North America, the United Kingdom, Eastern Europe, the Middle East, the Pacific Islands, Australia and China since the 1980s (World Health Organisation (WHO), 2003). The increasing prevalence of obesity globally has been termed as the "obesity epidemic" (Hill and Peters, 1998).

The increasing prevalence of obesity has not been limited to advanced countries alone but has also been observed in developing countries where the increase is even more profound than in advanced countries (Pearce and Witten, 2010). Aside the increasing prevalence of obesity in both advanced and developing countries, there are geographic and socio-economic disparities in the distribution of obesity among different population sub-groups (McLaren, 2007). In most developed countries, obesity tends to be higher in socio-economically deprived areas and among the poor (McLaren, 2007; Gordon-Larsen et al., 2006) while in developing countries, the reverse generally pertains with obesity rates being higher among the rich and in urban areas (Ellulu et al., 2014; Neuman et al., 2013; Monteiro et al., 2004).

In spite of the afore mentioned socio-economic disparities in the distribution of obesity between developed and developing countries, a closer look at developing countries reveals rising prevalence among the poor (Monteiro et al., 2004; Sobal and Stunkard, 1989). These changes have been reported in countries such as Brazil where the rates of obesity and overweight are higher among the lower-income and the less educated populace compared to the higher income and highly educated group (Monteiro et al., 2004, 2001).

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Another source of marked variation in the global obesity epidemic is the gendered differences in the prevalence of obesity and overweight. The prevalence of obesity among males and females varies among the various regions of the world, between countries and even within countries (Kanter and Caballero, 2012). Globally, obesity is more prevalent among females than among males except in some parts of Europe were the prevalence is almost equal for both sexes in some Western European countries (Case and Menendez, 2009; Berghofer et al., 2008).

The rising prevalence of obesity in all regions of the world, among the old and the young and among rich as well as poor nations has raised several questions about the factors that could be fuelling the global obesity epidemic. Some scholars have attributed the possible cause to genes. However, these scholars are careful to add that, while genes increase individual susceptibility to obesity, genes don't necessarily make one fat as there are very few, rare and single gene defects that cause obesity (Popkin, 2010; Hill and Peters, 1998). Other researchers argue that rather than genes alone, it is the complex interaction between genes and the environment that results in obesity (Qi and Cho, 2008).

Going by the gene-environment interaction argument, some researchers further argue that there has not been major changes in the genetic make-up of the human population over the last three decades that can explain the dramatic rise in obesity prevalence (Tremblay et al., 2004; Hill and Peters, 1998; Institute of Medicine, 1995). The cause of this rise is therefore an environment that promotes behaviours (excess calorie intake and physical inactivity) that result in obesity (Hill and Peters, 1998). Hill and Peters (1998) therefore emphasize that in order to "stop and ultimately reverse the obesity epidemic we must "cure" the environment.

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1.1.3 Obesity research in Ghana

The prevalence of obesity has been observed to be increasing in developing countries including those in sub-Saharan Africa. In Ghana, the prevalence of obesity has increased from less than 1 percent in the late 1980s to about 14 percent in 2003 (Berios, et al., 1997; Amoah, 2003). In 2008, the adult female prevalence of obesity in Ghana was about 10 percent (Ghana Statistical Service, 2009).

Over the last two decades, several studies have been conducted on obesity in Ghana (Amoah, 2003; Biritwum et al., 2005; Duda et al., 2007; Dake et al., 2011) and although these studies have contributed to the literature on obesity in Ghana and Africa at large, these studies are still limited in a number of ways. They are either data driven (using secondary data from the demographic and health survey which is limited to females within the ages of 15-49 years), discipline specific (with a medical, nutritional or geographic focus), approached from limited perspectives (focussing on a rural-urban or rich-poor divide) or focusing on individual lifestyle behaviours.

Considering the global discourse and debate among researchers and scholars working on obesity, studies on obesity in Ghana and the broader developing country context reveal three fundamental research gaps. Firstly, the findings of these studies exhibit obesity as an urban and or an affluence problem, masking the emerging pattern of high levels of obesity among the urban poor in developing countries (Steyn and Damasceno, 2006; Sobal and Stunkard, 1989). Secondly, these studies are limited to individual lifestyle behaviours without addressing the influence of socio-environmental factors. Thirdly, studies using secondary data such as the demographic and health survey focus only on

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women. Due to this data constraint, the problem of obesity among men in the developing country context remains under researched.

This current study addresses these research gaps by investigating the influence of socio-environmental factors on obesity in an urban poor developing country context with a focus on both females and males using a multidisciplinary approach and analysis of primary data. Given the dearth of research exploring the evolving link between the built environment and the risk of obesity in sub-Saharan Africa and in developing countries at large (Scott et al., 2012), this study will contribute to the literature on the built environment obesity relationship in a developing country context. The research focus and methodological approach employed in this study will provide empirical evidence on the relationship between the built environment and obesity in an urban poor developing country context. The study will also contribute to our understanding of the complexity of the obesity problem in an urban poor setting in a number of ways:

Firstly, this research is timely in studying the problem of obesity among a vulnerable but under studied population in the midst of observed rising obesity prevalence among the poor (Ziraba et al., 2009). Unlike most other studies on obesity in Ghana that explored the rural-urban, rich-poor dichotomy, this study focuses solely on the urban poor context and its implications for obesity among this under studied section of the Ghanaian population.

Secondly, unlike prior studies, this study goes beyond the conventional individual centred approach of studying health behaviours associated with obesity. Drawing on theories such as the social determinants of health, the socio-ecological and health behaviour models, this study investigates the influence of community characteristics on obesity in an

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urban poor context. Furthermore, the study examines different aspects of the urban poor environment that are pertinent to understanding the problem of obesity among the urban poor.

Thirdly, this study uses primary data which was purposely collected for this study. By using primary data, the study addresses the limitations of using secondary data sources such as the demographic and health survey which does not contain data on the built environment and which is also limited to only females. The data for this study includes information from both men and women and thus allows for the examination of obesity among both females and males and not only females. The collection of primary data on the features of the built environment provides objective measures of the built environment and allows the influence of the built environment to be examined quantitatively by combining community level data with individual survey and anthropometric data.

1.1.4 Research Questions

This study focuses on examining the built environment in an urban poor setting and investigates how the built environment constitutes a potential source of risk for obesity among residents of this urban poor setting. The study seeks to answer the following research questions;

1. What is the nature of the built environment among the urban poor?
2. Through what mechanism(s) does the built environment influence the risk of obesity among the urban poor?
3. What are the salient differences in the influence of the built environment on obesity for females and males living in the same built environment?

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1.1.5 Study Objectives

The main objective of this study is to investigate the built environment in an urban poor setting and how it relates to the risk of obesity. Specifically the study seeks to;

1) Examine different aspects of the built environment among the urban poor.
2) Investigate the mechanism(s) through which the built environment influences the risk of obesity among the urban poor.
3) Investigate gender differences in the risk of obesity for females and males living in the same built environment.

1.2 Theories and Conceptualisation

The influence of the built environment on obesity is demonstrated by theories and models in fields such as public health, psychology and statistics. Several models including the social determinants of health model in public health, the socio-ecological model in psychology and multilevel modelling in statistics; illustrate obesity as an individual level outcome which is influenced by factors at higher levels including factors operating at the interpersonal (households, friends, social networks), organisational (community, school, work place), governmental (national and international) and policy levels. The core principles of these models are that multiple factors affect health outcomes and the influences of these factors interact across different levels (Richard et al., 2011).

1.2.1 The socio-ecological model and obesity

In line with the growing recognition of the importance of considering the joint influence of social, environmental and biological factors on individual and population health outcomes such as obesity, socio-ecological models conceptualise and integrate the

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built environment as a mediator of obesogenic behaviours (Richard et al., 2011; Huang et al., 2009; Swinburn et al., 1999). The socio-ecological model shows obesity at the individual level as an outcome of the interaction between individual and interpersonal factors, organisational factors (including the community, work or school), conditions in the built environment and policies at the local, national and global levels (Figure 1.1).

Individual factors including non-modifiable factors such as age, sex, genetics and modifiable behaviours such as dietary practices, physical activity, smoking and alcohol consumption influence behaviours that impact energy balance. Interpersonal factors including family, peer and social support for active living and healthy eating also influence energy intake and expenditure. At the organisational level, factors in the community environment e.g. socio-economic status influence the availability and prices of fresh foods.

The features of the built environment including the physical structures (such as recreational facilities, street connectivity and walkability) and food resources e.g. fast foods and availability of healthy foods in stores (Willows et al., 2012)[1], influence energy

[1] Willows et al. (2012) applied the socioecological model to understanding weight-related issues among Aboriginal children in Canada. In their application of the socioecological framework, Willows et al. considers the high prevalence of obesity among Aboriginal children in Canada to be a result of several factors operating at different levels including individual level factors (e.g. non-modifiable biological factors such as age and sex, early life events such as birth weight and knowledge, attitudes and beliefs about healthy weight), interpersonal – family and peer factors (e.g. family feeding and parenting practices; and family/peer support for active living and healthy foods), community, home and sociocultural environment (e.g. household socio-economic status, school food and physical activity environments and community self-government and determination), built environment factors (e.g. availability of healthy foods in stores, fast food restaurants and safe playgrounds), societal factors (e.g. local, provincial and federal policies relating to food, recreation and environmental protection and media influence about food advertising and portrayals of beauty and weight) and historical factors (e.g. colonization by Europeans, dispossession of traditional lands and assimilation policies).

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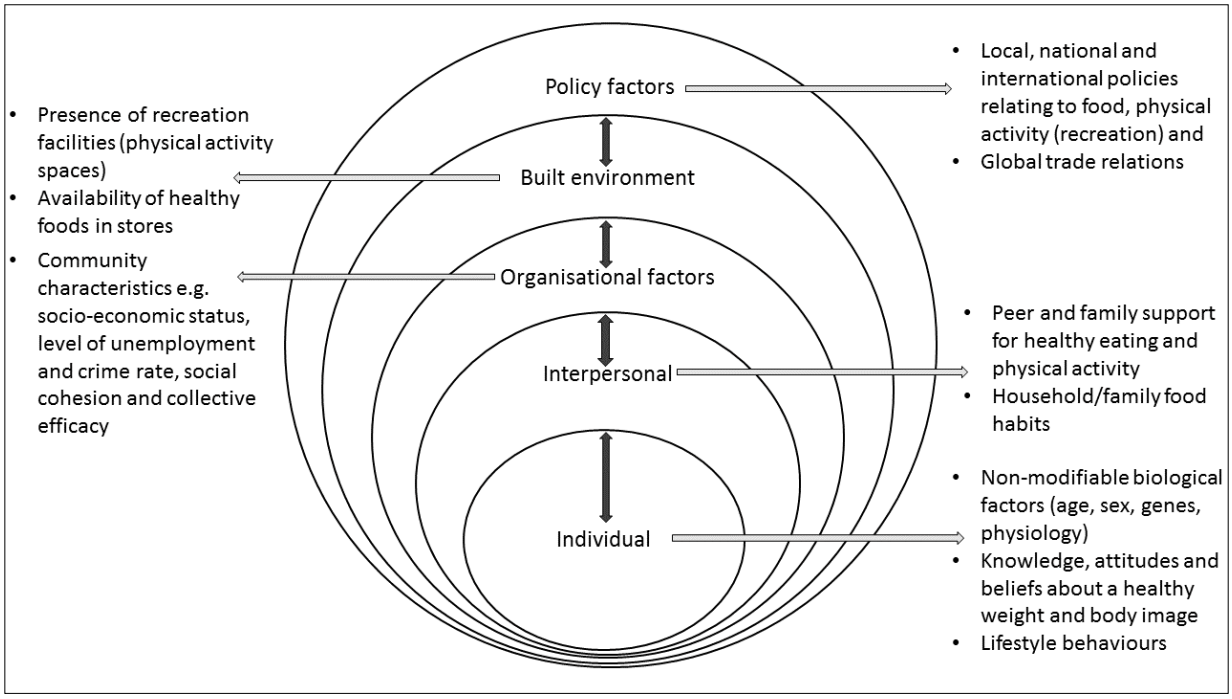
expenditure and energy intake respectively. Policies at the local, national and global levels also influence the distribution of food resources. For example, as a result of globalisation, urban residents have increased access to imported energy dense high fat western food choices which has been implicated for the high prevalence of obesity in developing countries (Puoane et al., 2005a; Popkin, 2001).

Figure 1.1: Socio-ecological model depicting the interaction between factors at different levels and their influence on obesity



Source: Adapted from Willows et al., 2012

The socio-ecological model illustrates the complex interaction between factors at different levels acting together to influence energy balance at the individual level. Applying the socio-ecological model to the conceptualisation of obesity research emphasises the need to examine factors beyond the individual level that influences obesity.

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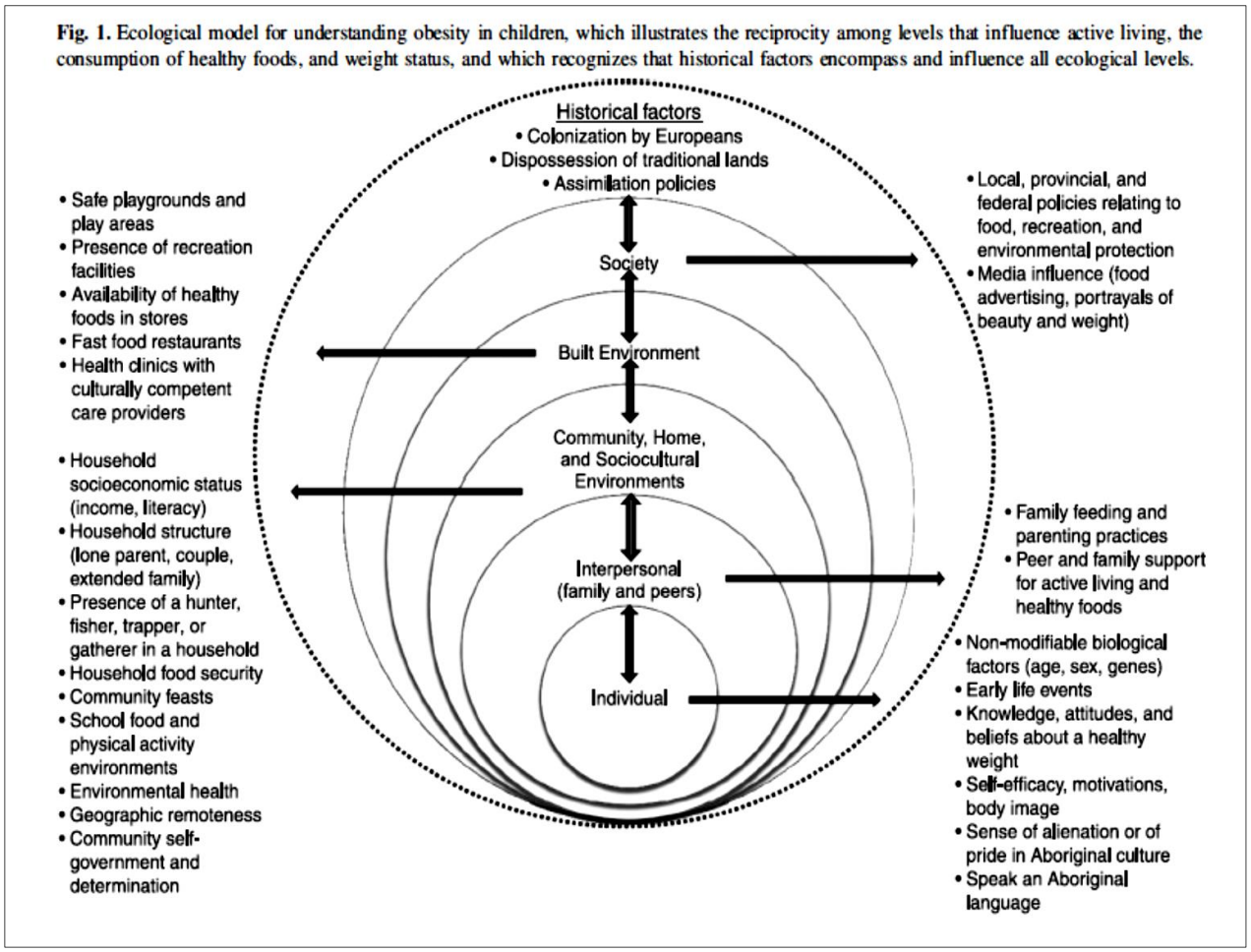
The conceptual model shown in Figure 1.1 is a modification of the application of the socio-ecological model to the study of obesity among Aboriginal children in Canada by Willows et al. (2012). In this current study, the historical factors included in the Willows et al. model (Figure 1.2) were not applicable and were thus not included (see Figure 1.1). Also, the community, home and socio-cultural environmental factors are collectively referred to as organisational factors in the model for this current study.

Figure 1.2: Application of the socio-ecological model to the study of obesity among Aboriginal children in Canada



Source: Willows et al., 2012

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1.2.2 Social determinants of health and obesity

The social determinants of health defined as the economic, environmental, political and social conditions in which people are born, live, work and age (Cheng, 2012; WHO, 2006) significantly influences obesity by impacting energy consumption and expenditure. The social determinants of health model highlights the social and income inequalities among communities that predispose people to health outcomes such as obesity and other chronic disease conditions. In socio-economically deprived communities, healthy foods such as fruits and vegetables tend to be less common and more expensive (Drewnowski, 2010). In contrast, high calorie high fat foods tend to be more common in deprived communities at affordable prices and the poor tend to substitute cheap and unhealthy foods for fresh foods (Scott et al., 2012; Wilkinson and Marmot, 2003).

Social support and good social relations are important factors that influence the health of people (Wilkinson and Marmot, 2003). Social support operates at both the community and interpersonal levels. Communities with high income inequalities tend to have weaker social support systems and higher crime rates. Residents of such communities are more likely to be overweight or obese and or have chronic disease conditions such as coronary heart disease as a result of living under stressful conditions (Wilkinson and Marmot, 2003).

The social determinants of health model shows that, inequalities among communities, stemming from disparities in socio-economic status structure the distribution of food and physical activity resources. The socio-economic status disparities also dictates social support systems which in tend impact the differences in the risk of obesity for individuals in poor and rich communities.

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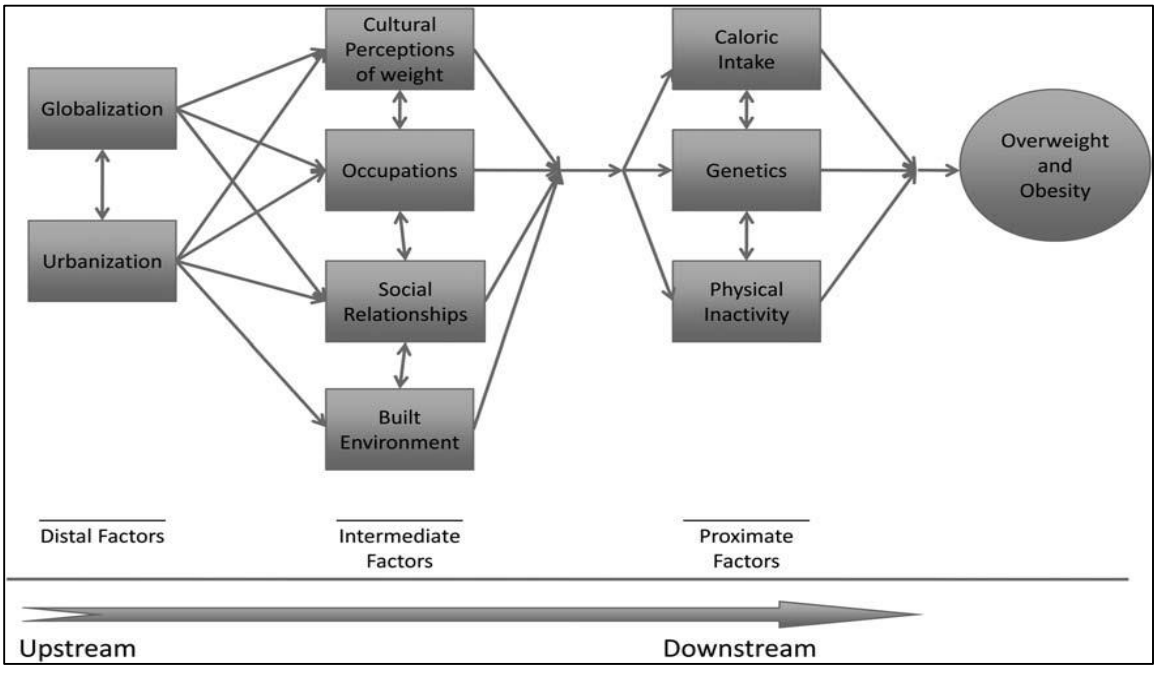
1.2.3 Causality continuum model for obesity research in sub-Saharan Africa

The rise in the prevalence of obesity in developing countries is reported to be occurring faster than it occurred in developed countries (WHO, 2006; Prentice, 2006). Even though the prevalence of obesity is reported to be lowest in the sub-Saharan Africa region, the rise in its prevalence is reported to be fastest in the sub-Saharan Africa and the Asian regions (WHO, 2011). Despite the documented rising prevalence of obesity in sub-Saharan Africa, there is a paucity of context specific theoretical frameworks for addressing the challenge of obesity in the sub-Saharan Africa region. In an effort to address this shortfall, Scott et al. (2012) propose a causality continuum model for addressing the rising problem of obesity in sub-Saharan Africa (Figure 1.3).

Figure 1.3: A causality continuum model for obesity in sub-Saharan Africa



Source: Scott et al., 2012

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Similar to the socio-ecological and social determinants of health models, the causality continuum model establishes obesity as an outcome of distal and proximate factors which influence caloric intake and energy expenditure. Like the socio-ecological model, the causality continuum model shows the built environment as an intermediate determinant of obesity through its influence on the proximate individual obesogenic behaviours i.e. caloric intake and physical inactivity (Figure 1.3). A key feature of the causality continuum model specific to the sub-Saharan Africa region is the inclusion of cultural perceptions of weight. In a region where fatness is associated with wealth, prestige and wellbeing particularly for women (Puoane, 2005b; Renzaho, 2004; van der Sande et al. 2001), the inclusion of the cultural perceptions of weight is a useful addition to the conceptualisation of obesity in sub-Saharan Africa.

1.3 Conceptual Model

In this study, obesity, measured as respondents body mass index (BMI) and waist-to-height ratio, is conceptualised as an outcome which is a function of community level factors (the built environment) at the higher level and individual characteristics including socio-demographic characteristics and lifestyle behaviours at the lower level. While individual lifestyle behaviours impact the proximate determinants of obesity, these lifestyle behaviours are also in turn influenced by conditions in the built environment. The built environment in this study is sub-divided into three components: (1) the food environment, (2) the physical activity environment and (3) the social environment.

The food environment can be broadly conceptualised as any opportunity (including physical, socio-cultural, economic and policy factors at both micro and macro levels) to

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obtain food (Townsend and Lake, 2009). The food environment examines the food resources in the community including food availability and accessibility in addition to food advertising and marketing (Lake and Townsend, 2006). The food resources examined in this study include out-of-home cooked foods, convenience foods and fruits and vegetables.

The food environment may influence people's dietary behaviour through providing access to a variety of food options including out-of-home cooked foods for ready consumption, convenience foods from convenience stores for home consumption and healthy food resources such as fruits and vegetables (Cummins and Macintyre, 2006). The number of out-of-home cooked food places, convenience stores and fruit and vegetable sales points in the community are included in the conceptual model as measures of the food environment.

Compared to home cooked foods, out-of-home cooked foods are of lower nutritional quality with high fat and energy content (Finkelstein et al., 2005; Kain et al., 2003). Given these characteristics, obesity is expected to increase as the number of out-of-home cooked foods in the community increases. Similarly, the food resources available at convenience stores are usually processed and or energy dense foods (Popkin, 2010). Such food resources contribute to weight gain due to their high caloric content. In this study, BMI and waist-to-height ratio are expected to increase as the number of convenience stores in the community increases. Fruits and vegetables are considered healthy because they generally have low energy content while having high fibre and anti-oxidants (Salehi et al., 2010). The availability of fruits and vegetables is expected to be protective of weight gain, thus reducing the risk of obesity.

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The environment in which people live contributes to obesity through its influence on physical activity (WHO, 2014a; Sallis et al., 2012; Harrison et al., 2007). People who live in well planned communities with recreational centres, walk ways and properly laid out streets are more likely to be physically active. Presence of physical activity space(s) in the community is included in the conceptual model as a feature of the community physical activity environment which will encourage physical activity among residents of the community and hence influence their BMI and waist-to-height ratio.

The social environment influences peoples' social behaviour by defining which behaviours are acceptable (Scott et al., 2012). Community social norms and expected behaviours are thus likely to influence peoples' behaviour. In communities where fatness is associated with wealth and wellbeing, being obese is likely to be an accepted norm and people are likely to conform to this norm (Scott et al., 2012). The perception about the community ideal body size is included in the conceptual model under the social environment as a predictor of obesity.

The study controls for other confounding variables that also influence obesity including community characteristics and individual socio-demographic characteristics and lifestyle behaviours. At the community level, crime acts as a stress inducer and an inhibitor of physical activity. Crime increases the risk of obesity by inducing stress and increasing the body's allostatic load (McEwen, 2000). People are also more likely to be physically active if they feel safe in their communities (Harrison et al., 2007). Community crime level is included in the conceptual model as a predictor of obesity. Social networks and other social process e.g. social cohesion and trust among community members act as stress buffers and hence reduce the risk of obesity (Stansfeld, 1999; Reaven, 1988). Social

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cohesion and trust among community members are also included in the conceptual model as community control variables.

The characteristics of the household individuals belong also influence the risk of obesity for members of the household through mechanisms such as socio-economic status. In most developing country contexts, people from rich household have been found to be more likely to be obese compared to their counterparts from poor households. This study controls for the wealth status of the household individual respondents belong to.

The characteristics of individuals including their socio-demographic characteristics and lifestyle behaviours also influence their chances of being obese. The risk of obesity increases as people age, and compared to males, females are at a higher risk of being obese (Kanter and Cabellero, 2012; Case and Mendez, 2009; Prentice 2006). In developing countries there is a reverse relationship between education and obesity; those who are highly educated have increased risk of obesity (Cohen et al., 2013; Dake et al., 2011; Olatunbosun et al., 2010). This study controls for the socio-demographic characteristics of respondents including their age, sex, marital status, religious affiliation, ethnicity, duration of stay in the community, occupation and level of education.

Individual lifestyle behaviours, particularly those that impact energy balance (i.e. dietary behaviour and physical activity) are included in the conceptual model as individual control factors. Smoking status and alcohol consumption, hours of rest a day and membership in community physical activity groups are also controlled for. Figure 1.4 demonstrates the relationship and influencing pathways between the built environment, individual lifestyle behaviours and obesity (BMI and waist-to-height ratio).

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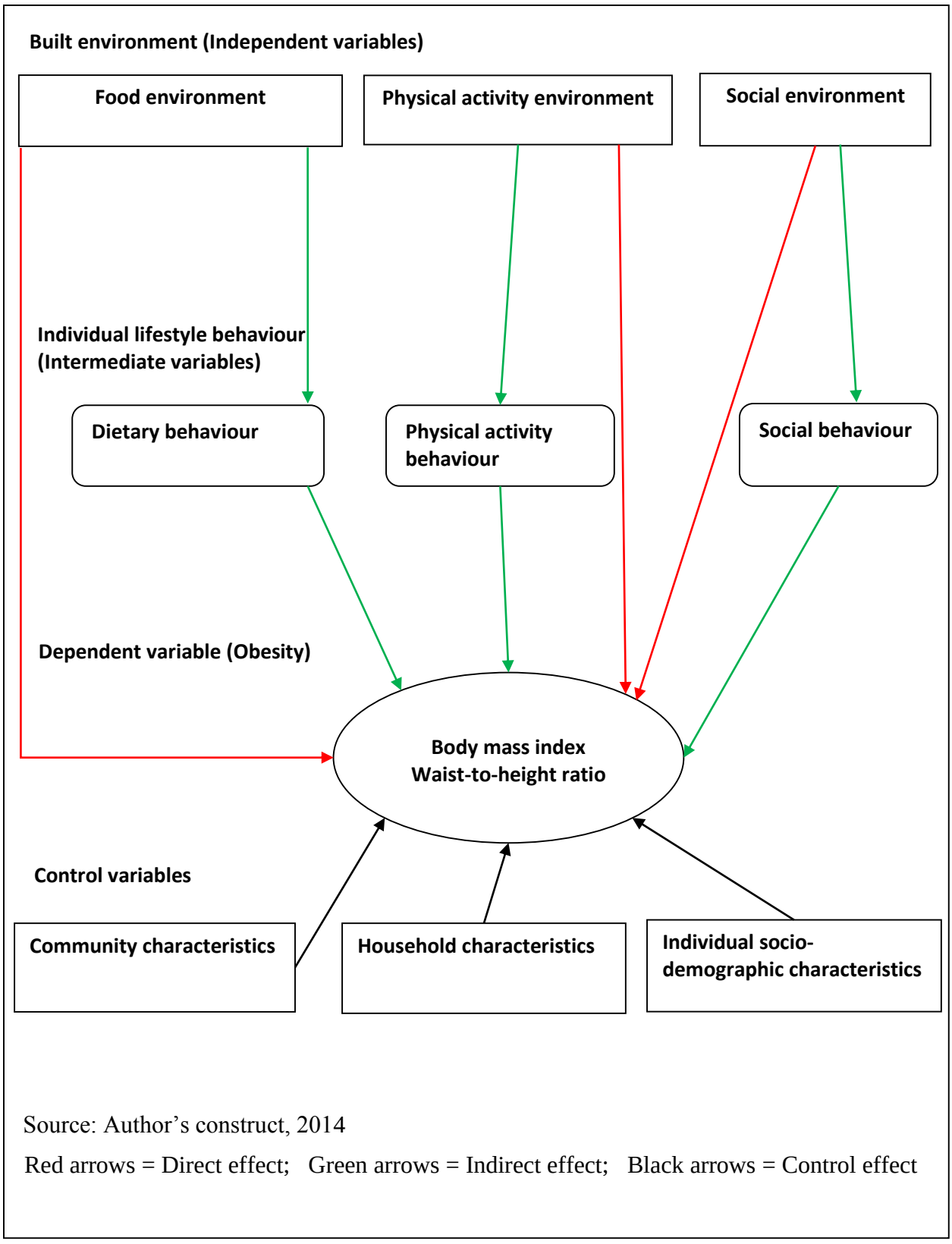
Figure 1.4: Conceptual model showing the direct and indirect influence of the built environment on the risk of obesity controlling for community, household and individual characteristics



Source: Author's construct, 2014

Red arrows = Direct effect; Green arrows = Indirect effect; Black arrows = Control effect

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1.4 Hypotheses

The hypotheses for this study are framed around the features of the built environment based on their proposed influence on obesity. It is hypothesised that:

1. BMI (and waist-to-height ratio) increases as the number of out-of-home cooked food places in the community increases.
2. BMI (and waist-to-height ratio) increases as the number of convenience stores in the community increases.
3. BMI (and waist-to-height ratio) decreases as the number of fruit and vegetable stands/sales points in the community increases.
4. BMI (and waist-to-height ratio) decreases if there is a physical activity space in the community.
5. BMI (and waist-to-height ratio) increases as the community perceived ideal body size increases.

It is also hypothesised that;

6. The features of the built environment influences the BMI (and the waist-to-height ratio) of females and males differently.

1.5 Study Organisation

The study is organised under eight chapters. The first chapter (Chapter one) which is the introductory chapter includes the study background, the research questions and the study objectives. Chapter one also contains the theoretical and conceptual foundations for the study, the conceptual framework, hypotheses and the organisation of the study. Chapter

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two focuses on reviewing literature pertinent to the subject area of this research while chapter three provides details of the study area and the methodology.

Chapter four examines the built environment in the study area while chapter five provides an overview of the characteristics of the respondents and examines individual level factors associated with obesity. The influence of the community and individual level factors on obesity is examined in chapter six. The differences in the risk of obesity for females and males living in the same built environment are examined in chapter seven. The summary, conclusions, limitations and recommendations from the study are provided in the last chapter, chapter eight.

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CHAPTER TWO

LITERATURE REVIEW

2.1 Contextual factors and health outcomes

Research in advance countries such as the United States of America and the United Kingdom has established that, health is a function of both the characteristics of individuals and the characteristics of the environment they live in (Ross et al., 2004; Hill and Peters, 1998). Furthermore, health research shows that the characteristics of people and the context they live in are tightly related (Cummins et al., 2007), and that the places people interact with in their daily lives directly or indirectly affect individual and population health outcomes (Stevenson et al., 2009). Given the demonstrated effects of contextual factors on health, researchers have become increasingly interested in place-based influence on health and how context plays a role in shaping peoples' health experiences and health outcomes (Stevenson et al., 2009; Macintyre et al., 2002; Diez Roux, 2001). Smoking, mortality, low birth weight, obesity and chronic diseases are among some of the several health outcomes and behaviours that have been found to be influenced by contextual factors.

The growing literature on contextual influences on health shows that neighbourhood socio-economic status is often linked to various dimensions of residents' health including the risk of obesity, atherosclerosis and mortality (Zick et al., 2009). People who live in deprived areas have been found to have higher ill-health and mortality rates compared to their counterparts who live in non-deprived areas (Wang et al., 2007; Stafford et al., 2005). The differences in health outcomes between deprived and non-deprived communities stem from differences in the physical and social environments that influence availability and access to recreational parks and super markets that stock fresh foods. The

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effect of socio-economic status on the prevalence of obesity is mediated by low-income which limits the availability of more healthy foods (Ali and Crowther, 2009). For example, in the United States (US), it has been reported that supermarkets are less common in low socio-economic neighbourhoods. However, small grocery stores and convenience stores which mostly carry less healthy foods and at higher prices than supermarkets are more common in low socio-economic status neighbourhoods (Moore and Diez-Roux, 2006; Sloane et al., 2003; Morland et al., 2002).

Contextual factors can be either integral to the community e.g. presence or absence of a health facility in the community, or an aggregation of individual characteristics, e.g. the proportion of unemployed residents in an area (Pickett and Pearl, 2001). Contextual factors operate independently or together with individual factors through certain mechanisms to influence health. Macintyre et al. (2002) report that variations in health stem from three components of the community environment, namely: compositional, contextual and collective characteristics.

Compositional variations refer to the characteristics of individuals concentrated in particular places. Contextual variations refer to the opportunity structures in the local physical and social environment. Collective variations draw on the socio-cultural and historical features of the community including aspects such as social capital and social cohesion. Collective explanation emphasises the importance of shared norms, traditions, interests and values of the community that shape individual behaviour and thus influences health behaviours and outcomes.

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These compositional, contextual and collective variations in neighbourhood environmental conditions have been proposed as an explanation for the variations in obesity (Macintyre et al., 2002). For example, residents in poor neighbourhoods may not be able to buy fresh foods or pay to use recreational facilities because of poverty (a compositional explanation), or there may not be healthy food options or enough recreational spaces in the neighbourhood (a contextual explanation), or it may be more culturally acceptable to be overweight/obese (a collective explanation). Thus the neighbourhood environment may influence obesity by offering residents healthy or unhealthy food choices, providing safe, friendly and accessible recreational facilities for physical activity and supporting norms that promote a healthy body weight.

2.2 Genetic influence, environmental factors and obesity

The aetiology of obesity shows excess caloric intake and physical inactivity as the main causes of the condition (Hill and Peters, 1998). In simple terms, obesity occurs when caloric intake exceeds energy expenditure. However, several factors influence caloric intake and energy expenditure, making the causes of obesity more complex rather than simple. Obesity is thus more appropriately considered a complex disease with multiple causes including polygenic, metabolic, psychosocial and environmental influences (Huot et al., 2004; Bouchard 1994, 1991).

Research emphasises the significant influence of genetics on obesity through susceptibility genes and gene-environment interactions. However, it is also argued that genes only provide susceptibilities or vulnerabilities for obesity rather than acting as causal factors (Poston and Foreyt, 1999). Susceptibility genes thus increase the risk for obesity

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but are not sufficient or necessary to cause obesity. Genetic explanations are thus unlikely to explain the rapid rise in obesity over a relatively short period of time (Cohen-Cole and Fletcher, 2008; Tremblay et al., 2004).

Rather than genetics being the sole predisposing factor of obesity, it has been demonstrated that obesity is the result of complex interactions between genetic and environmental factors (Tremblay et al., 2004; Perusse and Bouchard, 1999). This gene-environment interaction effect has been demonstrated through experimental studies with identical twins which shows that monozygotic twins with the same or similar genetic make-up exhibit different obesity phenotypes in response to different environmental manipulations (Tremblay et al., 2004).

Community environmental factors impact obesity by influencing energy intake through providing access to food resources while influencing energy expenditure by facilitating or impeding physical activity (Grafova et al., 2008; Inagami, 2006; Swinburn et al, 1999). An environment that has recreational facilities, is walkable and perceived to be safe enhances physical activity while an environment with high crime rates hinders physical activity. The availability of healthy foods such as fruits and vegetables in the community, number of fast-food outlets and advertisements that promote sedentary lifestyles and consumption of energy-dense foods influence obesogenic behaviours among community members (Cohen et al., 2006; Sallis et al., 1996).

In addition to influencing caloric intake and energy expenditure, environmental influences on individual obesogenic behaviours also operate through the social environment. The social environment includes life experiences, social relationships,

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organisational structure, social norms and values that define the social context (Sorensen et al., 2003; Stroller and Gibson, 1999). Measures of the social environment include social capital and social cohesion.

Social capital measures the quality and quantity of social resources in a community (Kawachi, 1999). A closely related concept to social capital is collective efficacy which is defined as the norms and networks that enable collective action (Cohen et al., 2006). The level of collective efficacy in a community is integral to that community and cannot be reduced to the characteristics of the members. Evidence from research indicates that collective efficacy is associated with a number of health outcomes that cluster at the neighbourhood level, including premature mortality and cardiovascular disease (Cohen et al., 2003; Lochner et al., 2003). Also, living in a community with a low level of collective efficacy has been found to be related to excess weight gain. People who live in communities with low collective efficacy receive little or no social support from the community. Residents of such communities are more likely to have high stress and cortisol levels which over time result in excessive weight gain, particularly truncal obesity (McEwen 1998a; McEwen 1998b).

Social norms, standards or models constitute the social context in which individual behaviour occur (Stroller and Gibson, 1999) while the social context provides the context against which the appropriateness of a specific behaviour is evaluated (Bettenhausen and Muringhan, 1985). Social norms also present a context within which individuals make decisions about their behaviours (Sorensen et al., 2002). In a neighbourhood setting, social influences exerted by others form a crucial component of the social environment that shapes individual health behaviour (Emmons et al., 2007). Social environmental influences

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may include community norms and values relating to eating and physical activity as well as contextual influences such as social networks and social support for behaviours such as leisure walking (Papas et al., 2007). The social environment in a neighbourhood indirectly affects obesity by influencing obesity related factors and behaviours.

2.3 Gender differences in the risk of obesity

Globally, the prevalence of overweight and obesity varies greatly among men and women, between and within countries with marked variations between developed and developing countries. Generally, more women than men are overweight or obese globally. In developing countries, women are disproportionately affected compared to men while in some developed countries, for example, in Western Europe more men are obese (Kanter and Caballero, 2012; Case and Menendez, 2009).

The disparities in obesity among men and women have both biological and social causes and may vary by sex or by gender (Christakis and Fowler, 2007; Wardle et al., 2004). Sex "refers to the biological and physiological characteristics that define men and women" while gender refers to the socially constructed roles, behaviours, activities and attributes that a given society considers appropriate for men and women" (WHO, 2014b).

From the biological perspective, it has been found that men and women differ in their pattern of fat deposition, mobilisation and utilisation (Power and Schulkin, 2008). These differences in fat metabolism between men and women are reported to be as a result of evolutionary adaptive forces and early life conditions (Case and Menendez, 2009; Power and Schulkin, 2008). From the perspective of evolutionary biology, Power and Schulkin (2008) report that, modern obesity can be explained as adaptive responses to the modern

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environment that results in maladaptive physiological responses and that the differences in the risk of obesity between men and women are reflections of the different adaptive pressures that have shaped male and female biology.

Biologically, hormonal and metabolic differences influence the proportion and distribution of fat between men and women throughout the life course. In all races and cultures, women have greater adipose stores than men even after controlling for BMI. This difference in adiposity is present even at birth (Power and Schulkin, 2008). Also, factors acting during puberty influences the risk of obesity among females (Ali and Crowther, 2009). In their adult years, the biological factor of reproduction and menopause affects fat distribution in women that may increase the risk of obesity and exacerbate the negative health effects associated with obesity (Regitz-Zagrosek et al., 2007; Morita et al., 2006).

Metabolically, women are inclined to store more fat than men (Power and Schulkin, 2008). Also, there are gender differences in carbohydrate metabolism that results in increases in triglyceride levels in women. Due to the difference in carbohydrate metabolism between men and women, Power and Sculkin (2008) argue that, "the increased intake of refined carbohydrates in developing countries may affect excess weight gain in women more than in men".

Social factors that influence the gender differences in the risk of obesity include socio-economic status, level of education, differences in physical activity stemming from gender differences in occupations and perceptions about body size. Obesity has been found to be consistently associated with socioeconomic status among women but not men (Case and Menendez, 2009). In developing countries, women of high socio-economic status tend

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to be obese. Similarly, highly educated women tend to be more obese compared to their counterparts who are not educated (Cohen et al., 2013). An explanation that has been proposed for this pattern is that, women who are less educated or of low socio-economic status tend to engage in manual work which involves exerting physical activity (Puoane et al., 2002) whereas highly educated women and women of high socio-economic status tend to engage in sedentary types of work.

In most of the developing world, occupations of both men and women involved exerting energy and occupations remained a significant source of physical activity until the latter part of the twentieth century when wage labour begun replacing traditional agricultural work (Kanter and Caballero, 2012). Traditionally, men in regions such as South Asia, Middle East, Latin America, North Africa and sub-Saharan Africa perform a much higher daily amount of physical activity than women do (Sodjinou et al., 2008). The involvement of both men and women in wage labour has resulted in decreased levels of physical activity in women more than in men (McGarvey, 1991), contributing to higher levels of obesity among women than men.

Perceptions about body size is one of the key social factors that influence disparities in the prevalence of obesity among men and women in developing countries especially in regions such as North and sub-Saharan Africa (Scott et al., 2012; Kanter and Caballero, 2012; Matoti-Mvalo, 2011; Abubakari et al., 2008). In a study carried out in Benin by Kiawi et al. (2006), participants believed that obesity is s sign of good living. These perceptions have been reported in other countries in sub-Saharan Africa including Kenya, Senegal, Nigeria, Gambia and South Africa (Pouane et al., 2005b; Holdsworth et al., 2004; van der Sande, 2001).

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Several reasons explain why these beliefs persists and probably perpetuate obesity among women. Among black women in South Africa, it is believed that large people are happy and healthy whereas those who are slender are perceived to have personal problems and such people may have diseases such as HIV/AIDS which prevents them from putting on weight (Matoti-Mvalo and Puoane, 2011). Obesity among women is also seen as an indicator of beauty and serves as a societal driving force for certain practices (Abubakari et al., 2008). In some places in Nigeria, young women are sent to fattening houses to prepare them for marriage (Markey et al., 2002) and once married, putting on weight is a sign that the woman in being well cared for by her husband, thus conferring honour on her husband. This fattening process among young women prior to marriage and putting on weight after marriage is also a common practice in Cameroon (Kiawi et al., 2006).

Other similar cultural practices and believes exist in other regions of the developing world including East Asia and the Pacific (Davis et al., 2004). In the Marshall Islands, thinness among women may be associated with infertility and illness whereas a larger body shape is associated with being healthy (Gittleshon et al., 2003). In North Africa, females wearing loose fitting dresses hide a woman's body shape, a phenomenon referred to as "hidden obesity" by Mokhtar et al. (2001). In their review of global gender disparities in obesity, Kanter and Caballero (2012) indicate that these socio-cultural beliefs and practices in North and sub-Saharan Africa may indirectly discourage leisure time physical activity among women and may thus affect excess weight gain among women more than among men in these regions.

In addition to the biological and social causes, current knowledge indicates that a myriad of sociocultural dynamics exacerbate the global gender disparities in obesity and

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different contextual factors influence gender differences in food consumption and physical activity which drive the gender disparities in obesity (Kanter and Caballero, 2012). In a study examining the environmental factors associated with overweight among adults in Nigeria, Oyeyemi et al. (2012a) provide supporting evidence that different environmental factors are relevant for preventing obesity among African men and women. In their study, poor aesthetics and traffic were related to overweight in women while among men, low residential density and poorly maintained pedestrian facilities were positively related to being overweight (Oyeyemi et al. 2012a).

In other related studies, although good neighbourhood aesthetics was found to be associated with walking among both men and women (Oyeyemi et al., 2011), high speed traffic was an important barrier to physical activity among women in Nigeria but not men (Oyeyemi, 2012b). The findings from these studies reiterate the importance of considering sex-specific environmental interventions for obesity control in Africa (Oyeyemi et al., 2012a).

Men and women have been found to perceive conditions in their environment differently even when they live in the same place. These differences in the perception of environmental conditions influence the risk of obesity through its impact on physical activity. In a study conducted in Taiwan, Chen and Wen (2010) found that women and men have different reactions to neighbourhood level residential insecurity. Women who lived in neighbourhoods with a high degree of perceived insecurity were at a greater risk of being obese. The authors explain that, threatening conditions (i.e. increased residential insecurity) in the environment may induce physiological responses that may cause obesity which probably explains the increased risk of obesity among women.

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2.4 Studies exploring the relationship between the built environment and obesity

2.4.1 Studies conducted in developed countries

In developed countries including the United Kingdom (UK), United States (US), Australia and Canada, research findings demonstrate the link between the built environment and obesity (Townshend and Lake, 2009). Wang et al. (2006) examined whether socio-economic and food-related physical characteristics of the neighbourhood are associated with BMI, independent of individual-level socio-demographic and behavioural characteristics. The study was conducted among 7,595 adults aged between 25-74 years in 82 neighbourhoods in agricultural regions of California using multilevel analysis. The results from this study show that adults who live in low socio-economic neighbourhoods had a higher mean BMI than adults who lived in high socio-economic neighbourhoods after adjusting for age, gender, ethnicity, individual level socio-economic status, smoking, physical activity and nutrition knowledge. In this study, higher neighbourhood density of small grocery stores was associated with higher BMI among women and closer proximity to chain supermarkets was also associated with higher BMI among women.

Using data from the 2003 Health Survey of England (HSE)[2], Poortinga (2006) examined the association between perceptions of the local environment and obesity among a sample of 14, 836 individuals aged 16 years and older in England from a multilevel perspective. The measures of the perceptions of the local environment used in the study include friendliness, access to amenities (good leisure things, leisure centres and community centres) and the presence of social nuisances (vandalism, graffiti, deliberate

[2] The HSE is a series of annual studies sponsored by the UK Department of Health covering the English adult (16 years and older) population living in private households.

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damage to property and teenagers hanging around on the streets). Participants in the study were classified as obese if they had BMI $\geq$ 30.00 kg/m^2 and not obese if they had BMI < 30.00 kg/m^2. The results of the study revealed that, access to good leisure things reduced the risk of being obese by 17% while perceptions of social nuisances; "vandalism, graffiti, deliberate damage to property" and "teenagers hanging around on streets" increased the risk of being obese by 29% and 19% respectively. These effects persisted even after physical activity level and socio-demographic characteristics were controlled for. The study also revealed that people with a high level of trust were 14% less likely to be obese compared to people with a low level of trust, and also compared to those living in urban areas, those living in suburbs were 25% more likely to be obese (Poortinga, 2006).

The prevalence of obesity has been observed to be increasing in Canada since 1953 (Pouliou and Elliott, 2010). Data from the 2005 Canadian Community Health Survey (CCHS) shows that approximately 8 million adults in Canada were overweight and an additional 4 million adults were obese. Pouliou and Elliott (2010) investigated the individual and socio-environmental determinants of overweight and obesity from a population health perspective. By using a population health perspective, Pouliou and Elliott investigated factors beyond individual characteristics that influence the risk of obesity including aspects of the broader social (social cohesion) and physical environments (e.g. the built environment).

The data for this study was obtained from two sources: (1) the 2003 CCHS and (2) the CanMap RouteLogistics spatial information database on land-use. Data on individual demographic characteristics (including age, marital status, level of education and lifestyle behaviours) and the social environment of individuals (including: (1) whether the

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individual was a member of a voluntary organisation and (2) their sense of belonging to the local community) were obtained from the CCHS. Measures of the built environment used in the study were derived from existing geographic databases provided by CanMap RouteLogistics. Seven built environment variables: land-use mix, street network connectivity, residential density, density of fast food restaurants, density of convenience stores, density of grocery stores and supermarkets and density of recreational activity facilities, were constructed using geographic information systems technology. The measures of the built environment were linked with the geocoded residential address of participants. The final sample included in the analysis was based on 5,418, 218 participants (weighted sample) aged 20 years and older from Canada's two largest metropolitan areas; Toronto and Vancouver.

The results show that residential density is negatively associated with BMI for participants in both Toronto and Vancouver. Also, individuals living in areas of mixed land uses had lower BMIs than those living in single or few land use types in Vancouver but not in Toronto. Similarly, street connectivity was significantly associated with BMI in Vancouver but not in Toronto. The authors conclude that reversing the trend of obesity in Canada will require a multifaceted public health approach where interventions are developed from the individual to the neighbourhood level, with a particular focus on altering obesogenic environments (Pouliou and Elliott, 2010).

In a similar study conducted in Canada, Lebel et al. (2012) sought to: (1) explain differences in local overweight risk in two urban settings (Montreal Island and Quebec City) and (2) explore sex-specific associations with estimated mobility patterns. In this study, overweight (measured as BMI $\geq$ 25.00kg/m^2) was modelled in a multilevel

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analytical framework using indicators of the built and socio-economic environments and individual level estimates of exposure to fast-food restaurants while controlling for age, education and income.

Data on the individual level characteristics were drawn from the 2003 and 2005 CCHS. An individual's exposure to fast-food restaurants was computed using data from a travel questionnaire and geocoded data of all fast-food restaurants and other restaurants in the Tamec 2003-2004 business registry in the two cities. At the neighbourhood level, the objective neighbourhood exposure to "foodscape" measured as the proportion of restaurants classified as fast food restaurant relative to all restaurants within a local unit was used as a measure of the built environment. Other contextual variables used in the study include motor vehicle ownership rate and socio-economic indicators from the 2001 Canadian census.

The results of the study revealed that, neighbourhood exposure to fast-food was associated with increased risk of overweight among men (OR=1.34) and women (OR=1.26) in Montreal and among women (OR=1.28) in Quebec. The results reveal that the contextual variables explained more neighbourhood variation in overweight among men than among women and among participants from Montreal than participants from Quebec. The authors conclude that, local contextual factors influence overweight differently as was observed for Montreal and Quebec. Also, the risk of overweight for men is different from that for women with different contextual factors exerting a different influence among men and women.

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The US has seen a consistent increase in the prevalence of obesity over the last three decades and it remains one of the world's region with the highest prevalence of obesity. Obesity in the US is characterised by wide racial/ethnicity and socio-economic status disparities (Flegal et al., 2002). Black women and people of low socio-economic status are disproportionately affected. Conditions in the local environment have been found to influence the risk of obesity particularly in socio-economically deprived areas where healthy food options and recreational facilities tend to be less common.

Morland et al. (2006) carried out a study with the objective of determining if there is an association between the availability of supermarkets, grocery stores, and convenience stores and cardiovascular risk factors. The study was a cross-sectional study involving a total of 10, 763 men and women who participated in the third visit (1993-1995) of the Atherosclerosis Risk in Communities (ARIC) Study. The study participants resided in 207 census tracts in four ARIC defined geographic areas namely; Mississippi, North Carolina, Maryland and Minnesota.

Individual level data for the study were obtained from the ARIC study. Using BMI as the measure of obesity, individuals were classified as either overweight (BMI $\geq$ 25.00 to 30.00kg/m^2) or obese (BMI > 30.00kg/m^2). Measures of the local food environment were generated using the location (business addresses) of food stores and food service places in the four study sites. The food stores and food service places were geocoded to the census tracts. In this study, supermarkets were defined as large corporate owned "chain" food stores, distinguished grocery stores or smaller non-corporate owned food stores (Morland et al., 2006). Convenience stores included all food stores that carry a limited selection of foods, mostly snack foods, whether attached to a gas station or not. Other

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places where residents buy food were classified as full service restaurants, franchised fast food and limited service restaurants.

The results of a random effects generalized linear model interpreted as prevalence rations (PR) show that, the presence of supermarkets was associated with a lower prevalence of overweight and obesity. In the fully adjusted model, people who lived in an area with at least one supermarket recorded a 6% and a 17% lower prevalence of overweight and obesity respectively, compared to people who lived in areas without any supermarkets. Presence of grocery stores was also associated with a higher prevalence of overweight and obesity. The prevalence of overweight and obesity was 7% and 24% (respectively) higher in areas with at least one grocery store compared to areas with no grocery store. Similarly, the presence of convenience stores was associated with overweight and obesity (PR= 1.07 and 1.19 respectively). The findings of this study suggest that, the characteristics of the local food environment may play a role in the prevention of overweight and obesity (Morland et al., 2006).

2.4.2 Studies conducted in developing countries

Research on the influence of the built environment on obesity in developing countries is still in the formative stage compared to the extent of progress made in developed countries. Studies conducted in developing countries have used both objective and subjective measures of the built environment and different statistical modelling techniques including multiple linear regression, logistic regression and multilevel modelling in a few studies. The results from these studies demonstrate that in developing countries, the built environment significantly influences the risk of obesity.

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For example, Du et al. (2014), explored the relationship between neighbourhood restaurant density and body mass index in rural China using data from the China Health and Nutrition Survey (CHNS). Using a longitudinal study design, participants for this study included individuals (both men and women) aged 18 years and above from the 2004, 2006, 2009 and 2011 waves of the CHNS. The BMI of the study participants was the primary outcome variable in the study and it was used as a continuous variable. Sex stratified random intercept-slope growth models of repeated BMI observations were estimated.

The individual level variables used included age, sex, marital status, highest level of education, per capita household income, current smoking status, drinking, motorcycle ownership, car ownership and moderate/heavy physical activity in working hours. The individual level variables except age, were used as time-varying variables. At the neighbourhood level, three types of types of restaurants: (1) fast food restaurant, (2) indoor restaurant and (3) fixed outdoor food stalls were examined. Fast food restaurants were defined as restaurants or fast food restaurant chains that served western-style food products, such as McDonald's, Kentucky Fried Chicken and Pizza Hut. Indoor restaurants referred to restaurants which are operated indoors or inside an enclosed structure that has a roof and well covered walls and in which cooking and eating are done indoors. Food stalls referred to those which are operated at a fixed place; it may have a roof but no walls and the cooking and eating are done outdoors (Du et al., 2014). In addition to the three types of restaurants, an "urbanicity score" which is a multidimensional index developed specifically in the CHNS to measure the level of urbanisation in Chinese communities (Jones-Smith and Popkin, 2010) was included in the analysis as a neighbourhood variable.

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The results show that, an increase of one indoor restaurant in the neighbourhood was associated with a 0.01 kg/m^2 increase in BMI among men while an increase of one fixed outdoor food stall was associated with a 0.01 kg/m^2 decrease in BMI, also among men. Among women, an increase of one indoor restaurant in the neighbourhood was associated with a 0.005 kg/m^2 increase in BMI, while an increase of one fast-food restaurant and one fixed outdoor food stall was associated with a 0.02 and a 0.004 kg/m^2 decrease in BMI respectively (Du et al., 2014). The urbanicity score was also found to be significantly associated with BMI among both men and women. Higher tertiles of the score were associated with a 0.19 kg/m^2 increase in BMI among men and a 0.09 kg/m^2 increase among women. The findings of this study indicate that, the density of neighbourhood restaurants in rural China is significantly related to BMI. The authors conclude that, providing healthy food choices and developing related public health policies are necessary to tackling obesity among rural Chinese adults.

Chen and Wen conducted a study in Taiwan to examine how neighbourhood factors affect individual obesity by simultaneously examining individual level socio-economic status and neighbourhood-level characteristics using a multi-level approach combined with spatial analysis. The data for this study was obtained from the 2001 Social Development Survey on Health and Safety[3]. The study sample consisted of 27,593 adults aged 20-64

[3] The Social Development Survey on Health and Safety is conducted by the Directorate General of Budget, Accounting and Statistics which is a central government institute in Taiwan (Chen and Wen, 2010).

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years from 262 "townships[4]" excluding retirees, students, those who have been sick for a long period and people who had missing data. Individuals in this study were nested in townships with townships serving as the basic geographic unit of analysis. In this study, a township was considered as constituting a "neighbourhood."

Three neighbourhood variables were used: (1) neighbourhood socio-economic status measured using the per-capita personal income by township, (2) ethnic composition measured using a dummy variable indicating whether a township was an "aboriginal township" or not and (3) perceived level of residential insecurity based on whether residents worried about having an accident or injury in their neighbourhood, felt safe when taking a taxi in their neighbourhoods and experienced general safety issues in the local neighbourhood. The responses to the questions on perceived residential insecurity ranged from 1 "not worried at all" to 4 "very worried." A neighbourhood level composite variable "perceived level of residential insecurity" was constructed by taking the median of the sum of the responses to the three questions for each neighbourhood (i.e. township); large values indicated high levels of worry.

Obesity in this study was measured using individual BMI which was categorised as a binary variable using the BMI cut-off values recommended by the Department of Health in Taiwan. Individuals were categorised as "obese" if they had BMI value ≥ 27.00 kg/m^2 and "not obese" if they had BMI < 27.00 kg/m^2. Other individual characteristics controlled for include age, marital status, smoking and physical inactivity. The results

[4] In the Taiwan's governmental system, a village (*chun-li*) is the smallest administrative unit. Townships are the next highest administrative unit directly above villages. The average area of a township is 100km^2 and the average population density is 1300/km^2.

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indicate that, people who live in the most affluent areas are about 1.14 times more likely to be obese compared to those living in non-aboriginal areas. Also, women who live in neighbourhoods with a high degree of perceived insecurity were at greater risk of being obese. The findings of this study suggest that, adult obesity is associated with socio-economically disadvantaged groups in different neighbourhood context in Taiwan (Chen and Wen, 2010).

Recognising that research focusing on the relation of the built environment to overweight and obesity has rarely been conducted in Africa, Oyeyemi et al. (2012a) conducted a cross-sectional study among a sample of Nigerian adults with the objective of examining the independent associations of neighbourhood physical activity related environmental variables with overweight. Participants for the study were systematically recruited from 38 neighbourhoods in Maiduguri, the capital and largest city in Borno State, North Eastern Nigeria. The neighbourhoods were classified as being of either low[5] or high[6] socio-economic status based on the classification criteria of the Ministry of urban planning and development in Maiduguri.

Using the standard WHO BMI cut-off points, the participants in this study were put in two groups: (1) the normal weight group consisting of those with BMI 18.50 kg/m^2 – 24.99 kg/m^2 and (2) the overweight group consisting of those with BMI $\geq$ 25.00 kg/m^2

[5] Low socio-economic status areas mostly have people who are self-employed (e.g. artisans and traders) or unemployed, with varying educational attainment. Such areas have few houses with functional water sources and modern sanitary facilities.

[6] High socio-economic status areas are mostly inhabited by the elites (i.e. those gainfully employed and who have more than secondary level education). Many of the houses in such areas have functional potable water sources and modern sanitary facilities such as flash toilets.

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including those with BMI > 30.00 kg/m^2. Socio-demographic data including age, sex, marital status, religion, income, educational level and employment status was also collected from the participants. The participants' perception of the neighbourhood environmental factors was assessed using an adapted self-administered version of the Physical Activity Neighbourhood Environmental Scale (PANES). The neighbourhood environmental factors assessed using the PANES included: (1) residential density, (2) access to destinations, (3) connectivity of the street network, (4) infrastructure for physical activity and walking, (5) neighbourhood aesthetics, and (6) neighbourhood safety. The independent association of the perceived environmental variables with overweight was examined using logistic regression analysis.

Participants who reported commercial places such as shops, stores and markets to be further away from their homes were 49% more likely to be overweight compared to their counterparts who reported proximal distance. Similarly, those who did not perceive many beautiful things in their neighbourhood were 58% more likely to be overweight compared to those who perceived beautiful things in their neighbourhood. Participants who perceived their neighbourhood to be unsafe from crime and unsafe from traffic to walk were 47% and 56% more likely to be overweight than those who perceived their neighbourhood as safe (Oyeyemi et al., 2012a).

The results also show that men would be more likely to be overweight when they perceived low residential density and poorly maintained pedestrian pathways while women perceiving poor neighbourhood aesthetics and high traffic were more likely to be overweight. Perception of poor neighbourhood aesthetics was associated with higher levels of overweight among residents of high socio-economic status neighbourhoods. Perception

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of high crime rate was related to higher levels of overweight among residents of high socio-economic status neighbourhoods but not among residents of low socio-economic status neighbourhoods (Oyeyemi et al., 2012a).

The results of this study demonstrate that the influence of the built environment on obesity as observed in developed and some developing may be applicable to the sub-Saharan African context as well. It is therefore important to conduct further research on the relationship between the built environment and obesity to inform public health interventions for tackling obesity in Africa.

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CHAPTER THREE

STUDY AREA AND METHODOLOGY

3.1 Study Area

3.1.1 Socio-demographic profile

This research was undertaken in three urban poor communities: James Town, Ussher Town and Agbogbloshie, all in Accra, Ghana. Also known as Ga-Mashie, James Town and Ussher Town are traditional Ga communities characterised by multiple generations of families living together in large family houses. Recently, people of other ethnicities have moved into this otherwise indigenous Ga community.

Ga-Mashie is among the oldest communities in Accra and is currently ranked one of the most densely populated communities in Accra (Mahama et al., 2011). Ga-Mashie is a low-income relatively stable traditional community organised around social structures such as chieftaincy. From the 2000 Ghana Population and Housing Census, there were 3,336 households and 13,617 people (consisting of 6,624 males and 6,993 females) in James Town while Ussher Town had 5,759 households and 22,140 individuals consisting of 10,219 males and 11,921 females. The average household size in James Town and Ussher Town were 4.1 and 3.9 respectively (Ghana Statistical Service, 2005a; 2005b).

Agbogbloshie on the other hand is one of the largest informal settlements in Accra (Grant, 2006). It is typically a migrant community consisting of several population sub-groups made up of several different ethnicities most of who are from Northern Ghana. Agbogbloshie generally has weaker social ties and less organised social structures than James Town and Ussher Town. Residents of Agbogbloshie face numerous social, health and environmental challenges including crime, drug use, poor sanitation and high incidence

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of malaria (Ahlvin, 2012). From the 2000 Ghana Population and Housing Census, there were a total of 1,583 households in Agbogbloshie with a total population of 7,055 made of 3,380 males and 3,675 females. The average household size was 4.5 (Ghana Statistical Service, 2005c).

The population in the three study communities has increased since the 2000 Population and Housing Census was conducted. The current population figures for the three communities obtained from the 2010 Ghana Population and Housing Census are James Town: 14,279, Ussher Town: 28,142 and Agbogbloshie: 8,305 respectively. These recent population figures represent a 17.7% increase in the population of Agbogbloshie, a 4.9% increase in James Town and a 27.1% increase in Ussher Town over the ten year period (i.e. 2000-2010).

The demographic profile of the study area shows two distinct characteristics; (1) the population is mostly young with almost half (44%) of the entire population being under the age of 15 years and (2) there are more females than males (Razzu, 2005) with the number of females outnumbering that of males at all age-groups (Centre for Community Studies, Action and Development, 2000). The increase in the population of the study area is largely attributable to natural growth considering the youthful nature of the population and also given the fact that 80% of the girls in the area become pregnant before that age of 22 years (Razzu, 2005).

The increase in the population of the study area has compounded certain social problems including overcrowding, lack of basic social services and poor sanitation. For example, about 7-9 people spanning three generations live in the same room with no

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privacy and no spaces for cooking (CHF International, 2012; Razzu, 2005). Activities such as bathing or toileting are done in paid public toilets and bathhouses or in open spaces and along the beach. Other problems prevalent in the area include poor health and low levels of education. The results of a survey conducted in the mid-1990s show that, about 71% of the population died between the age of 1 month and 5 years (Centre for Community Studies, Action and Development, 1994).

On the education front, in the early 2000s, only about a quarter of the school going population in the area were attending primary or junior high school (Razzu, 2005). Fishing is one of the major income generating activity in the Ga-Mashie area. The men go fishing while the women smoke and sell fish (Razzu, 2005). Another major occupation mostly engaged in by women is petty trading which has become a major source of income in recent years (Razzu, 2005).

3.1.2 Socio-cultural context

The indigenous Ga community is organised around strong traditional, social and kinship systems. The social organisation and cultural practices among the indigenous Ga population have not changed much from what was noted by Kilson (1974) in the 1960s. Current contemporary patterns in low-income households are similar to what pertained in the past (Robertson, 1984; Fayorsey, 1995).

One of the social systems in the Ga community that has been passed on from generation to generation is the institution of marriage which is closely linked with household arrangements and which also impacts gender dynamics in autonomy especially

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for women. Traditionally, men and women do not live together in the same house even when they are married (Quarcoopome, 1998). Traditionally men live with patrilineal kin from the father's side of the family while women live with their matrilineal kin from the mother's side of the family (Maxwell et al., 2000; Levin et al., 1999). Children are raised in their mother's house with male children being sent to live in their father's house when they turn 10 (Maxwell et al, 2000; Levin et al., 1999).

This residential arrangement between men and women coupled with low male employment rates and out migration has resulted in the existence of large compound houses with several household units often headed by elderly women; resulting in a large proportion of female headed households (Maxwell et al., 2000; Levin et al., 1999; Fayorsey, 1995). Due to the high proportion of female headed households in the Ga community, females are more autonomous in both their productive and reproductive activities (Fayorsey, 1995; Robertson, 1984). Although women in the Ga community have more autonomy and are independent, their standard of living has not improved, making their households one of the most economically disadvantaged in the city of Accra (Levin et al., 1999; Bortei-Doku Aryeetey and Aryeetey, 1996).

In addition to the male female differences in household arrangement, there are significant differences in the type of income generating activity men and women engage in. Men mostly engage in skilled and unskilled labour, clerical and professional occupations including working in the civil service (Levin et al., 1999). Women engage in two main income generating activities; (1) preparation and sale of street foods including kenkey (a local staple food made from fermented maize dough) and (2) petty trading (Maxwell et al., 2000; Levin et al., 1999).

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Levin et al. (1999) report that in Accra, over 90% of individuals engaged in petty trading as their primary occupation are women while almost all street food vendors are women. The occupational distribution of women in Accra reflects what has been reported in urban areas of West Africa where 60 to 80 percent of the workforce engaged in trading are women (Ruel et al., 1998). The participation of women in the workforce has implications for household food preparation and food security. As women continue to engage in income generating activities, the need for them to save time in activities such as food preparation has increased the share of the food budget spent on processed foods, convenience foods, snacks and meals available as street food (Levin et al., 1999). Furthermore, there is a heavy reliance on street foods in the Ga community (Levin et al., 1999) which has implications for obesity.

3.2 Methodology

3.2.1 Study Design

This study uses cross-sectional data and employs a mixed methods approach; using a triangulation of quantitative, qualitative and spatial data collection and analysis techniques. Using a multilevel analysis framework, this study examines obesity as an outcome of factors at two levels: the individual level constituting the lower level and the community level constituting the higher level. The study involves the collection of primary data at both the community and individual levels.

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3.2.2 Sampling procedure

The three communities (James Town, Ussher Town and Agbogboloshie) were purposively selected as a typical representation of urban poor communities in Accra (Owusu and Afutu-Kotey, 2010). The sampling procedure for the study was aided by drawing on resources provided by the Ghana Statistical Service (GSS). To allow easy canvassing during census enumeration and other national surveys such as the demographic and health survey, the GSS has divided communities into smaller units called Enumeration Areas (EAs). There were a total of 80 EAs in all the three communities with the following sub-divisions: Ussher Town - 48, James Town - 24 and Agbogbloshie - 8.

The target of the study was to survey a total of 1,160 households in the study area. The targeted number of households was achieved by selecting a representative sample of 40 households from 29 EAs using a two-stage sampling procedure. The first stage involved the systematic sampling of 29 EAs (16 in Ussher Town, 8 in James Town and 5 in Agbogbloshie) from the 80 EAs in the three communities. A household listing exercise was carried out in all the 29 selected EAs. The resulting household listing served as the sampling frame from which the respondents for the study were drawn. At the final stage of the analysis for this study, one of the EAs in Agbogbloshie was excluded because of incomplete information on individual observations from that EA. The study thus uses data from 28 EAs.

The second stage of the sampling procedure involved a systematic sampling of 40 households out of the total number of households listed from each of the selected EAs. A household listing was conducted in the selected households through a household interview using a household questionnaire (Appendix 1). All individuals identified to be eligible from

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the household roster in the selected households were interviewed with an individual questionnaire (Appendix 2). A non-response rate of 15% was factored into the sampling procedure. This figure is based on the non-response rate calculated for the study area (Accra Metropolitan Area) from other surveys carried out by the Ghana Statistical Service.

3.2.3 Method of data collection

3.2.3.1 GPS data collection

Data collection for this study was done at two levels: the community level and the individual level. Two procedures were used to collect data at the community level. The first procedure involved the use of Global Positioning System (GPS) technology to gather data on point locations of out-of-home cooked food places, convenience stores and fruit and vegetables stands/sales point in and around the selected EAs. GPS technology was also used to collect data on the location of physical activity spaces such as parks.

The EAs formed the geographical boundary for which the GPS data collection was done. The boundaries of the selected EAs were digitized and geo-referenced using descriptions from hard copy maps. Point locations of stationary out-of-home cooked food places, convenience stores and fruits and vegetable sales/stands points in and around the selected EAs were geocoded. Information on the characteristics of the foods including the type of food was also collected (Appendix 3). The location and type of physical activity space(s) was also collected (Appendix 3).

The GPS data collection was preceded by a reconnaissance survey in the study area to obtain an overview of the nature of the built environment and to inform the data

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collection process. Four field personnel were trained to assist with the data collection process. The GPS data collection was carried out in June 2013.

3.2.3.2 Qualitative data collection

The second community level data collection procedure involved gathering qualitative data on community norms and practices about food preparation and consumption, physical activity and perceptions about body size through focus group discussions. Focus group was used firstly as a means of gathering data on the values, norms and social processes in a communal cultural context (Kitzinger, 1995) and secondly to help explain findings from the quantitative data (Berkwits and Inui, 1998).

Three male members of community who have worked as research personnel on other research projects (including the Climate Change and Human Health in Accra project and the Urban Poverty and Health project) and have previous experience in conducting focus groups were trained to assist with the data collection. As part of the training, the moderators were introduced to the purpose and objectives of the study, they reviewed the question guide in English and the local dialect and also conducted mock interviews. Interviews were conducted during a pilot exercise prior to the actual focus group discussions which were conducted between June and August, 2013. The pilot interviews were conducted among participants from EAs in the community which were not selected for the main study.

The groups were stratified by age (18 - 30 years and above 30 years) and by sex (males and females) across the three study communities, resulting in a total of twelve focus

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groups. These stratification criteria were applied in line with the objective of examining age and gender differences in socio-cultural perceptions and also to examine the differences in the risk of obesity for adult males and females in the study area.

A semi-structured question guide (Appendix 4) was used to gather data on the three components of the built environment (i.e. the food environment, the physical activity environment and the social environment). The groups were moderated by trained field personnel in either the local dialect (Ga or Twi) or English depending on the choice of the participants. The focus groups were conducted in a setting in the community of the participants' choosing and convenience. The settings used for the focus group discussions were enclosed spaces in the community where noise and distractions were minimal including a church building, a community centre and participants' homes. The discussions which lasted for about 45 minutes on average were tape recorded. Field notes were taken during the discussion and the data were transcribed into English.

3.2.3.3 Survey data collection

A household based survey was used to collect data at the individual level. Data on the demographic, socio-economic characteristics and lifestyle behaviours of eligible individuals in the selected households were gathered through interviewer administered face-to-face interviews using a semi-structured questionnaire (Appendix 2). The survey data collection was carried out between 25th November – 22nd December, 2011 under the

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second round of data collection for the Population, Health and Poverty Project[7]. Sixty interviewers were recruited and trained for data collection. The training of the field personnel which was carried out from 10th - 21st November, 2011 focused on reviewing the survey instruments and conducting pilot interviews. Prior to the main fieldwork, the survey instruments were revised based on feedback from the pilot exercise.

3.2.4 Subjects

3.2.4.1 Survey respondents

The target population for the study were males and females aged 15 to 59 years who reside in the three communities (James Town, Ussher Town and Agbogbloshie). Females aged 15 to 49 years and males aged 15 to 59 years who have been part of the selected households for at least 6 months (usual household residents) were considered eligible and were thus interviewed. Interviews were completed for a total of 916 individuals. After excluding individuals with missing data and those who were underweight (i.e. individuals with BMI < 18.50 kg/m^2), the final sample for this study consisted of 657 individuals who had valid information on all the variables used in the analysis.

[7] The Population Health and Poverty Project is a research project implemented by the Regional Institute of Population at the University of Ghana. The aim of the project is to study demographic, health and environmental issues in an urban poor developing country context. The project is conducted in three urban poor communities (James Town, Ussher Town, and Agbogboloshie) in Accra. Data is collected periodically at intervals of 18 months.

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3.2.4.2 Focus group participants

Participants for the focus groups were recruited through the help of the moderators. Community members aged 18 years and older were contacted in their homes and invited to be part of the study. After the purpose of the study was explained to them, those who agreed to be part of the study gave their written consent before the start of the discussions. The groups consisted of between 6 to 8 participants per group and a total of 90 respondents from all the groups.

3.2.5 Variables

3.2.5.1 Dependent variable

The dependent variable for the study is obesity which was measured using two indicators: (1) body mass index (BMI) in kilograms per metres squared and (2) waist-to-height ratio. BMI which measures the degree of body weight in relation to height was computed by dividing the weight[8] of respondents in kilograms by their height[9] in metres squared (Hill et al., 2006; WHO, 2000). BMI is a marker of general obesity (Steyn and Damasceno, 2006) and is the method commonly used to determine obesity in social science research (Faskunger et al., 2009). The index (BMI) is widely accepted for population level analysis and is used internationally as the standard for defining overweight and obesity in adult populations (WHO, 2006). BMI can be used as a continuous variable or as a categorical variable with categorisation usually based on the standard WHO cut-off points

[8] Weight was recorded to the nearest 1 kilogram using a calibrated Seca scale with respondents dressed in light clothing

[9] Height was recorded to the nearest 0.1 of a centimetre with respondents standing upright in the Frankfort horizontal position

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(BMI: <18.50 = underweight, BMI: 18.50 – 24.99 = normal weight, BMI: 25.00 - 29.99 = overweight and BMI ≥ 30.00 = obese). The sample for this study excludes individuals who are underweight (N=51).

Waist-to-height ratio has emerged as a new option among several anthropometric indicators (Kuba et al., 2013) for determining obesity because of a number of added benefits over other indicators. With waist-to-height ratio, one cut-off point can be used for both sexes over a specific age range which makes it more advantageous over waist circumference (Kruger et al., 2013). Waist-to-height ratio has been validated as a useful indicator of coronary risk factor in adults (Hsieh and Yoshinaga, 1995a, Hsieh and Yoshinaga, 1995b). It is suitable for population and epidemiologic studies and can be used for large scale screening for metabolic risk in both adults and children (Ashwell and Hsieh, 2005). Waist-to-height ratio gives an indication of central obesity; it is related to cardiovascular risk and is also a better risk indicator for cardiovascular diseases than BMI (Mokha et al., 2010). The boundary value of 0.5 for determining increased health risk is more applicable to both sexes and people of different ethnic groups than waist circumference (Ashwell and Hsieh, 2005).

Using both BMI and waist-to-height ratio as indicators of obesity in this study offers methodological strength and also provides a better understanding of the dynamics of obesity in the study area in a number of ways. Firstly, both indicators are sex independent, allowing for the assessment of obesity among females and males using the same standards. Secondly, the two indicators assess different risk factors; while BMI assesses general obesity, waist-to-height ratio assesses central obesity and also provides a better assessment of other risk factors such as diabetes and cardiovascular disease conditions.

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In using both indicators in this study, the general prevalence of obesity is assessed using the BMI indicator while the waist-to-height ratio indicator assesses central obesity and gives an indication of the risk for conditions like diabetes and cardiovascular diseases. In assessing the prevalence of obesity among the study sample, BMI and waist-to-height ratio were used as categorical variables. In examining the predictors of obesity in a multilevel analysis framework, the two indicators were used as continuous variables.

3.2.5.2 Independent variables

3.2.5.2.1 Community level variables (Level 2 predictors)

The main predictor variables used in this study were the measures of the built environment, specifically the food environment, the physical activity environment and the social environment which were measured at the EA level. The measures of the food environment include the number of out-of-home cooked food places, number of convenience stores and number of fruit and vegetable stands/sales points in each EA.

Out-of-home cooked food places refer to places where already cooked ready to eat food is sold. It includes places such as chop bars[10], check check joints[11] and other points of sale in and around the EA. The kinds of foods that can be purchased from these locations include kenkey and fish, banku and soup/pepper/stew/fish, fufu and soup, tuo zaafi, check check (including fried rice, plain rice, and jollof rice with chicken/fish/meat), fried eggs and bread, koko, tea etc.

[10] Local restaurant where out-of-home cooked foods are sold.

[11] Local name for places where rice dishes particularly fried rice is sold.

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Convenience stores are small stalls in the community where a variety of processed food items including cooking oil, canned or tinned fish, sweetened carbonated drinks, tinned or evaporated milk, sugar and uncooked rice are sold. These stores typically do not stock perishable goods such as fresh fruits and vegetables. Fruit and vegetable stands/sales point refer to locations in the community where fresh fruits and vegetables are sold.

All places in the community where out-of-home cooked foods and fruits and vegetables were being sold and where convenience stores were being operated at the time of data collection were geocoded. Collectively, out-of-home cooked food places, convenience stores and fruit and vegetable stands/sales points constitute the total food resources available in the community. The measures of the food environment created from the food point location data include:

- **Number of out-of-home cooked food locations:** Total number of out-of-home cooked food places per EA.
- **Number of convenience stores:** Total number of convenience stores per EA
- **Number of fruit and vegetable stands:** Total number of fruit and vegetable stands/sales points per EA.
- **Total number of food resource locations:** Collective total of out-of-home cooked food places, convenience stores and fruit and vegetable stands/sales point per EA.
- **Proportion of out-of-home cooked food places relative to total food resource locations:** Total number of out-of-home cooked food places divided by collective total of food resource locations.

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- **Proportion of convenience stores relative to total food resource locations:** Total number of convenience stores divided by the total number of food resource locations.
- **Proportion of fruit and vegetable stands/sales point relative to total food resource locations:** Total number of fruit and vegetable stands/sales points divided by the total number of food resource locations.
- **Proportion of convenience stores relative to out-of-home cooked food places:** Total number of convenience stores divided by total number of out-of-home cooked food places.
- **Proportion of fruit and vegetable stands/sales points relative to out-of-home cooked food places:** Total number of fruit and vegetable stands/sales locations divided by total number of out-of-home cooked food places.

Similar to the food environment, different features of the physical activity environment were examined using data on the location of physical activity space(s) in the community. Physical activity space(s) in this study denote places in the EA outside of people's homes where community members engage in physical activity. These include places designated for physical activity e.g. football parks and places which are not designated for physical activity e.g. the beach and streets or roads turned into a playing field. It is necessary to consider that in the context of the study area, some places may not be designed for physical activity but may be used by people for physical activity. These places are thus considered as physical activity spaces. All such physical activity spaces in the community were

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geocoded. Measures of the physical activity environment that were created from the spatial data include:

- **Number of physical activity space(s) per EA:** A count of the number of physical activity spaces per EA.
- **Distance to the nearest physical activity space:** The distance (in kilometres) from the centre of each EA to the centre of the nearest physical activity space.
- **Distance to the nearest major park:** The distance (in kilometres) from the centre of each EA to the centre of the nearest major park.
- **Distance to the beach:** The distance (in kilometres) from the centre of each EA to the stretch of the beach closest to the EA.

3.2.5.2.2 Individual level variables (Level 1 predictors)

Individual lifestyle behaviours which are associated with obesity and which may be influenced by the different aspects of the built environment were treated as predictor variables. These include: (1) dietary behaviour measured as respondents' dietary diversity score (i.e. diversity of diets consumed by the respondents in the last seven days preceding the survey), (2) physical activity behaviour measured as respondents' work-related physical activity, leisure time physical activity and membership in a community physical activity group and (3) social behaviour including alcohol consumption and smoking.

Dietary diversity score gives a measure of the quality of the diet consumed by individuals (Kennedy et al., 2010). The score was computed using data from a seven day dietary recall in which respondents reported all the foods they consumed inside or outside

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home in the last seven days prior to the survey irrespective of where the food was prepared (Kennedy et al., 2010). In this study, the dietary diversity score for individuals was computed based on their report of consuming foods from nine food groups (Kennedy et al., 2010) in the last seven days preceding the survey. The score ranged from 0 (meaning the individual did not consume food from any of the nine food groups in the last seven days) to 9 (meaning the individual reported consuming foods from all the nine food groups in the last seven days). The components of the score and the food groups used for the computation are shown in Appendix 5.

3.2.5.2.3 Control variables

The study controls for a range of factors including community characteristics such as population density, trust among community members, crime level and social cohesion which were all measured at the EA level. Household characteristics; specifically wealth status[12] and individual socio-demographic characteristics including age, sex, marital status, ethnicity, religious affiliation, parity (for women), level of education, occupation, length of stay in the community and lifestyle behaviours including physical activity, smoking and alcohol consumption were also controlled for. Table 3.1 shows the different types of variables and how they are being used in the study.

[12] A wealth index score was computed from household assets such as computer, bicycle, car, roofing materials, floor materials and the building material of the wall. The index was divided into quintiles. Respondents belonged to a particular quintile based on score of the household they belong to.

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Table 3.1: Variable description, measurement, form of utilisation and categorisation

VARIABLES	DESCRIPTION AND MEASUREMENT	FORM OF UTILISATION AND CATEGORISATION
DEPENDENT VARIABLES		
Body mass index (BMI)	Weight (in kilograms) divided by height (in meters squared)	1. Continuous 2. Categorical Normal weight (BMI=18.50-24.99kg/m^2) Overweight (BMI=25.00-29.99kg/m^2) Obese (BMI≥30.00kg/m^2)
Waist-to-height ratio (WtHR)	Waist-circumference (in centimeters) divided by height (in centimeters)	1. Continuous 2. Categorical Normal weight (WtHR ≤0.5) At risk (WtHR>0.5)
INDEPENDENT VARIABLES **LEVEL 2 FACTORS**		
Features of the built environment		
Food environment	1. Number of out-of-home cooked foods per EA	Continuous
	2. Number of convenience stores per EA	Continuous
	3. Number of fruit and vegetable stands/sales points per EA	Continuous
Physical activity environment	Presence (or absence) of physical activity space(s)	Categorical Present Absent
Social environment	Community perceived ideal body size	Continuous

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Table 3.1 Continued

VARIABLES	DESCRIPTION AND MEASUREMENT	FORM OF UTILISATION AND CATEGORISATION
Community control variables		
Crime level	The level of crime in the community on a scale of 1(low) to 5 (high) aggregated at the EA level	Continuous
Social cohesion	The degree to which respondents agree or disagree about members of the community coming together to help when there is a problem in the community on a scale of 1 (strongly disagree) to 4 (strongly agree). Individual responses were aggregated to the EA level.	Continuous
Trust among community members	The level of trust among community members on a scale of 1 (low) to 4 (high) aggregated at the EA level.	Continuous
Population density	Total population of the EA divided by the land area of the EA in square meters.	Continuous
LEVEL 1 FACTORS **Individual Socio-Demographic Characteristics And Lifestyle Behaviours**		
Socio-demographic characteristics		
Age	Age of respondents in completed years	Continuous
Sex	Sex of respondent	Categorical Male Female
Ethnicity	Ethnic affiliation of respondents	Categorical Ga-Dangme Akan Other

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Table 3.1 continued

VARIABLES	DESCRIPTION AND MEASUREMENT	FORM OF UTILISATION AND CATEGORISATION
Socio-demographic characteristics continued		
Religion	Religious affiliation of respondents	Categorical No religion Catholic Protestants Pentecostal/Charismatic Other Christian Moslem Traditionalist/Spiritualist
Marital status	Marital status of respondents	Categorical Never married Married Cohabiting Formerly married (including separated, widowed and divorced)
Length of stay in the community	Duration of respondent's stay in the study communities	Categorical Since birth ≤ 10 years > 10 years
Highest level of education	Highest level of education attained by respondents	Categorical No education Primary Middle/JHS Secondary/SHS Higher than secondary level (Higher)

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Table 3.1 continued

VARIABLES	DESCRIPTION AND MEASUREMENT	FORM OF UTILISATION AND CATEGORISATION
Socio-demographic characteristics continued		
Occupation	Type of occupation respondents are engaged in	Categorical No occupation Professional/Technical/Managerial/Clerical Sales/Services Manual workers (including skilled and unskilled manual workers and those engaged in agriculture Other (including students and domestic workers)
Lifestyle Behaviours		
Dietary and food preparation practices		
Dietary diversity score	Summary index (ranging from 0-9) of the diet consumed by respondents from nine food groups in the last seven days immediately preceding the survey	Continuous
Number of cooking days per week	Number of days in a week respondents cook food at home	Categorical Never cook One day (1 day a week) Some days (2-6 days a week) Every day (7 days a week)
Most often used cooking method	The cooking method most often used by respondents when they cook.	Categorical Never cook Frying Stewing Boiling/Steaming
Source of obtaining out-of-home cooked food	The source from which respondents usually purchase out-of-home cooked foods.	Categorical Outside the community From the community

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Table 3.1 continued

VARIABLES	DESCRIPTION AND MEASUREMENT	FORM OF UTILISATION AND CATEGORISATION
Physical activity behaviours		
Work-related physical activity	Intensity of physical activity involved in the work respondents do.	Categorical Not working No activity Moderate activity High activity
Leisure-time physical activity	Intensity of physical activity involved in leisure-time activities respondents engage in.	Categorical No activity Moderate activity High activity
Number of hours spent a day reclining	Number of hours a day respondents spend being idle or in sedentary behaviours such as watching television.	Categorical <1 1-3 >3
Membership in community physical activity group	Whether or not respondents are part of a group in the community who come together to engage in physical activity.	Categorical No community physical activity group Yes No
Social behaviours		
Hours of rest a day	The number of hours respondents sleep a day	Continuous
Smoking status	Assesses respondents smoking behaviour and their smoking patterns in the last 30 days immediately preceding the survey.	Categorical Never smoked Smokes daily Smoked some days in the last 30 days Ever smoked but not in the last 30 days

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Table 3.1 continued

VARIABLES	DESCRIPTION AND MEASUREMENT	FORM OF UTILISATION AND CATEGORISATION
Social behaviours continued		
Alcohol consumption	Assesses respondents' alcohol consumption behaviour and their pattern of consumption in the last 30 days immediately preceding the survey.	Categorical Never consumed alcohol Consumed alcohol in the last 24 hours Consumes alcohol but not in the last 24 hours Consumes alcohol but not in the last 30 days
Control variables		
Household wealth status	The wealth index score was computed using household assets e.g. floor and roofing material. The score was divided into five equal parts to obtain five wealth categories.	Categorical Poorest Poorer Average Richer Richest

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3.2.6 Methods of analysis

A number of analytical techniques including quantitative, qualitative and spatial analyses were used to answer the research questions and to achieve the objectives of the study. The various analytical techniques used in addressing the objectives of the study are discussed as follows:

3.2.6.1 Objective 1: Examination of the different aspects of the built environment

Two approaches were used to achieve this objective. The first approach focused on examining the food and physical activity environments using spatial analyses techniques while the second approached involved qualitative analysis of the focus group data on community norms and practices about food preparation and consumption, physical activity and body size perceptions.

3.2.6.1.1 Analysis of the food environment

A number of spatial analyses techniques are used in assessing the relationship between the built environment and obesity. These include the use of buffers, density measures, spatial interaction models and location-allocation modelling (Edwards, 2010). In this study, the buffers and density measures techniques were the main spatial analysis techniques used in examining the food environment component of the built environment.

Buffers are boundaries of a user specified size placed around selected features such as areas or points using a pre-defined scale (Computer Aided Development Corporation Limited, 2013; Thornton et al., 2011). Buffers can be created using either a Euclidean (straight line) or a network distance (Thornton et al., 2011). Buffers are useful for capturing

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all the features of the built environment that surround a particular location and gives a measure of accessibility. For example, the number of grocery shops within a buffer around a household can be used to estimate the household's accessibility to grocery shops (Thornton et al., 2011). In this study, a 25, 50 and 100metre Euclidean buffer was created around the EA boundary to assess accessibility of food resources over different distances.

Density measures can simply be expressed as a count of features within a specified field e.g. total number of features within an EA or a buffer. However, density is more accurately represented as the relative number of features per geographic area (e.g. number per square metre) or number of features per population (Thornton et al., 2011). Density is a measure of the intensity of exposure to features of the built environment and maybe an important determinant of obesity as it relates to the accessibility of an obesogenic environment (Thornton et al., 2011).

In this study, the out-of-home cooked food density, convenience store density, fruit and vegetable stand density and total food resource density was calculated for each EA to examine variations among the EAs. The population density of each EA was also calculated and used as a control variable in the multilevel analysis. In analysing the nature of the built environment, adjusting for population or geographic area is most useful when examining variations in the distribution of features across areas as these may explain why some areas have more or less features (Handy and Clifton, 2001).

The density and buffer analysis conducted in this study were preceded by a number of data preparatory procedures including creating line and polygon features for the EA boundaries and the buffers and combining these features with the attributes (e.g. the

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population density) of the EA. The area of the buffers created include the area of the original EA boundary plus the specified buffer distance. Density measures were calculated by dividing for example, the total number of out-of-home cooked food places by the land area of the EA. The description of the density and buffer measures created for the food environment are as follows:

- **Out-of-home cooked food density:** Total number of out-of-home cooked food places per EA divided by the land area of the EA in square metres.
- **Convenience store density:** Total number of convenience stores per EA divided by the land area of the EA in square metres.
- **Fruit and vegetable stand density:** Total number of fruit and vegetable stands/sales points in the EA divided by the land area of the EA in square metres.
- **Total food resource density:** Collective total of the number of out-of-home cooked food places, convenience stores and fruit and vegetable stands/sales points per EA divided by the land area of the EA in square metres.
- **Count of total food resources in a 25 metre buffer:** Total number of food resource locations in the original EA boundary plus and a 25 meter buffer distance around the original EA boundary.
- **Count of food resources in a 50 metre buffer:** Total number of food resource locations in the original EA boundary plus a 50 meter buffer distance around the original EA boundary.
- **Count of food resources in a 100 metre buffer:** Total number of food resource locations in the original EA boundary plus a 100 meter buffer distance around the original EA boundary.

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- **Total food resource density in a 25 meter buffer distance:** Total number of food resource locations in the original EA boundary plus a 25 meter buffer distance divided by the total area of the EA and the 25 metre buffer.
- **Total food resource density in a 50 meter buffer distance:** Total number of food resource locations in the original EA boundary plus a 50 meter buffer distance divided by the total area of the EA and the 50 metre buffer.
- **Total food resource density in a 100 meter buffer distance:** Total number of food resource locations in the original EA boundary plus a 100 meter buffer distance divided by the total area of the EA and the 100 metre buffer.

In addition to the density and buffer measures created, the point locations of out-of-home cooked food places, convenience stores, fruit and vegetable stands/sales points in the community were mapped to examine their location, distribution and proximity in the EAs. The variations in the food environment were also examined using the different indicators of the food environment that were created from the spatial data.

3.2.6.1.2 Analysis of the physical activity environment

The physical activity environment in this study was assessed using two measures: availability and proximity. Availability simply refers to whether or not a feature e.g. a park is present in a specified area. Proximity, also referred to as close facility analysis is used to determine which feature (e.g. park) is closest to a particular point or area (e.g. a household) and or the actual distance to the nearest feature (Thornton et al., 2011). Proximity can be measured in terms of distance using a Euclidean or network distance. Proximity is also an

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indicator of accessibility; features that are closer to a point or area are more accessible than features that are further away (Thornton et al., 2011).

In this study, the following measures were used in examining the physical activity environment: (1) presence of a physical activity space in the EA, (2) the distance (in kilometres) from the centre of the EA to the closest physical activity space, (3) the distance (in kilometres) from the centre of the EA to the closest major park and (4) the distance (in kilometres) from the centre of the EA to the stretch of the beach closest to the EA. The variability in the measures of the physical activity environment were assessed using the aforementioned indicators which were created from the data. The presence of a physical activity space in the EA was used as a measure of the physical activity environment in the multilevel analysis to examine the effect of the presence (versus the absence) of a physical activity space in the EA on obesity.

3.2.6.1.3 Analysis of the social environment

The social environment aspect of the built environment was examined by analysing the qualitative data on community norms, perceptions and practices surrounding food preparation and consumption, physical activity and body size. A thematic content analysis approach was employed in analysing the qualitative data.

In the initial stages of the qualitative data analysis, the transcripts were read several times to get a general overview of the discussions and examine patterns and interesting points that came up during the discussions. The transcripts were then coded line by line. In the initial coding stage, descriptive in-vivo codes were generated. The descriptive codes and the accompanying quotes were then put in a matrix to examine patterns, similarities

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and differences across and within the groups. A memo writing process was then carried out. The memos were used to document what codes mean and how they will be used in the analysis process.

The next stage of the analysis involved combining descriptive codes which illustrate similar ideas into more analytic and interpretive codes. As the analysis advanced, related analytic codes were merged into major overarching themes. Throughout the analysis process, particular attention was paid to group dynamics and how participants discussed community ideals. Areas of consensus and disagreement were noted.

3.2.6.2 Objective 2: Investigate the mechanism(s) through which the built environment influences the risk of obesity among the urban poor

A two stage analytical approach was used to achieve this objective. At the first stage, a bivariate Ordinary Least Squares (OLS) regression model was specified for each of the Level 1 predictor variables against BMI and waist-to-height ratio to determine which variables were significantly related with BMI and waist-to-height ratio. The variables that were found to be significantly associated with BMI and waist-to-height ratio were further examined for multicollinearity. At the second stage of the analysis, the measures of the built environment were combined with the significant non-collinear Level 1 predictors in a multilevel model.

Multilevel analysis was used as the main analysis tool in this study from a theoretical (Glass and McAtee, 2006) and a statistical standpoint (Rabe-Hesketh and Skrondal, 2012; Luke, 2004; Diez Roux, 2004; 2000). Theoretically, the risk of obesity for individuals is influenced by factors at different levels (Lopez, 2007; Diez Roux, 2001). In

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this study, obesity is modelled as an outcome of factors at the individual and community levels. The hierarchy in the level of factors that influence obesity makes multilevel analysis an appropriate modelling technique.

The sampling process used in this study also makes the use of multilevel modelling appropriate. Respondents for this study were selected through a two-stage sampling procedure. Individuals (lower level) belonging to selected households were selected from EAs (higher level). Individuals are thus nested in EA and are exposed to the same set of environmental factors in the EA that influences obesity. The sampling procedure and the exposure to a common set of factors at the EA level that influence obesity introduces dependency among observations at the individual level. Due to this dependence among observations, the assumption of uncorrelated errors terms is violated (Rabe-Hesketh and Skrondal, 2012; Luke, 2004). Multilevel modelling analysis appropriately models clustered data by accounting for the dependence among observations. By modelling obesity using multilevel analysis, the factors at the individual and community levels that influence obesity can be examined while ensuring that the dependence among observations is appropriately modelled.

Multilevel models are also called hierarchical linear models, random co-efficient models, mixed-effects models, covariance structure models or growth-curve models. The simple aim of a multilevel model is to predict values of a dependent variable based on a function of independent variables from more than one level (Luke, 2004). The simplest form of the multilevel also called the random effects ANOVA model is referred to as the null or empty model. The null model contains no predictor variables. The intercept term in the null model captures mean differences in the dependent variable across groups or

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clusters (Level 2 units) and decomposes the variance in the dependent variable into within and between group variances. The system of equations for the null model is given as:

Level 1 equation (Within cluster differences): $Y_{ij} = \beta_{0j} + r_{ij}$

Level 2 equation (Between cluster differences): $\beta_{0j} = \gamma_{00} + \mu_{0j}$

Substituting the Level 2 equation into the Level 1 equation results in the reduced form equation given as:

Reduced form equation (Combined differences): $Y_{ij} = \gamma_{00} + \mu_{0j} + r_{ij}$ …(Eq 1)

Where Y_{ij} = outcome variable for the i^{th} person in cluster j

γ_{00} = overall mean of the outcome variable (or the model intercept)

μ_{0j} = cluster level random effect (random error term)

r_{ij} = individual level random effect (residual error term)

The variance of r_{ij} is designated as V (rij) = σ^2

The variance of μ_{0j} is designated as V (μ_{0j}) = τ_{00}

The parameters σ^2 and τ_{00} represent the variance or random effects component of the model and are also referred to as the covariance parameters. The variance components are assumed to be normally distributed with a mean of zero and they are uncorrelated across the Level 1 and Level 2 units. Standardizing the covariance parameters gives the Intra-class Correlation Co-efficient (ICC). Mathematically, the ICC is given as:

$$\text{ICC} = \frac{\tau_{00}}{\sqrt{\tau_{00} + \sigma^2}\ \sqrt{\tau_{00} + \sigma^2}} = \frac{\tau_{00}}{\tau_{00} + \sigma^2}$$

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The ICC measures the degree of dependence in the data or the strength of the clustering and is interpreted as the proportion of variance due to the between cluster differences i.e. the proportion of variance in the outcome variable that is accounted for by the clusters (the Level 2 units). The ICC for the null model is also sometimes referred to as the unconditional ICC.

The null model can be expanded by including both Level 1 and Level 2 predictors. The model with both Level 1 and Level 2 predictors is sometimes referred to as intercepts and means as outcomes model. The system of equations for an intercepts as outcomes model with one Level 1 predictor and one Level 2 predictor is given as:

Level 1 equation: $Y_{ij} = \beta_{0j} + \beta_{1j}X_{ij} + r_{ij}$

Level 2 equation: $\beta_{0j} = \gamma_{00} + \gamma_{01}Wj + \mu_{0j}$

$\beta_{1j} = \gamma_{10}$

Substituting the Level 2 equation into the Level 1 equation gives the reduced form equation which is represented as:

Reduced form equation: $Y_{ij} = \gamma_{00} + \gamma_{01}W_j + \gamma_{10}X_{ij} + \mu_{0j} + r_{ij}$ …(Eq 2)

Where Y_{ij} = outcome variable for the i^{th} person in cluster j

W_j = predictor variable for cluster j (Level 2 predictor)

X_{ij} = predictor variable for individual i in cluster j (Level 1 predictor)

γ_{00} = overall mean of the outcome variable (or the model intercept)

γ_{01} = co-efficient associated the Level 2 predictor

γ_{10} = co-efficient associated the Level 1 predictor

μ_{0j} = cluster level random effect (random error term)

r_{ij} = individual level random effect (residual error term)

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The terms $[\gamma_{00} + \gamma_{01}W_j + \gamma_{10}X_{ij}]$ in (Eq 2) represent the fixed components of the model while the terms $[\mu_{0j} + r_{ij}]$ represent the random components. The multilevel model is also called the mixed effects model because of the presence of both fixed and random components.

3.2.6.3 Objective 3: Investigate gender differences in the risk of obesity among females and males living in the same built environment

Although individuals live in the same built environment, the risk of obesity as a result of the influence of the built environment may not be the same for all individuals. To explore the differences in the risk of obesity for females and males living in the same built environment, the influence of the built environment on obesity was investigated separately for females and males. To achieve this objective, the bivariate OLS regression models and the multilevel mixed effects model were specified for females and males separately. This analytical approach helped in examining how the same built environment affects males and females differently.

3.2.7 Ethics of Human Subjects Research

The study protocol was reviewed and granted ethical approval by the Institutional Review Board of the Noguchi Medical Institute for Medical Research at the University of Ghana. All participants in the study gave their written consent to be voluntary participants in the study. The participants were assured that the information they provide will be treated with strict confidentiality and they could redraw from the study at any time without any consequence. The consent form detailing the study procedures, the consent statement and the rights of the participants is shown in Appendix 6.

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CHAPTER FOUR

EXAMINATION OF THE BUILT ENVIRONMENT

4.1 Introduction

The features and characteristics of the community environment including the availability, distribution, proximity and access to a variety of food options and physical activity spaces, community safety, crime rates and area deprivation are among some of the factors found to be associated with obesity at the community level (Lopez, 2007; Glass and McAtee, 2006). This study examines the nature of the built environment in the study area (Figure 4.1 and Map 1) using a combination of spatial, quantitative and qualitative analysis techniques.

The aim of the analyses in this chapter is to examine the features of the built environment and to assess the variability in the measures of the built environment in the study area. The results of the analysis of the food and physical activity environments are presented using a variety of visualisations tools including maps and charts. The results from the qualitative analysis are presented as a combination of analytical interpretation of the data and supporting quotes from the focus group discussions shown in italics. Short quotes are embedded in the body of the text while longer quotes are indented. Where applicable, complementary results from the quantitative data are also presented.

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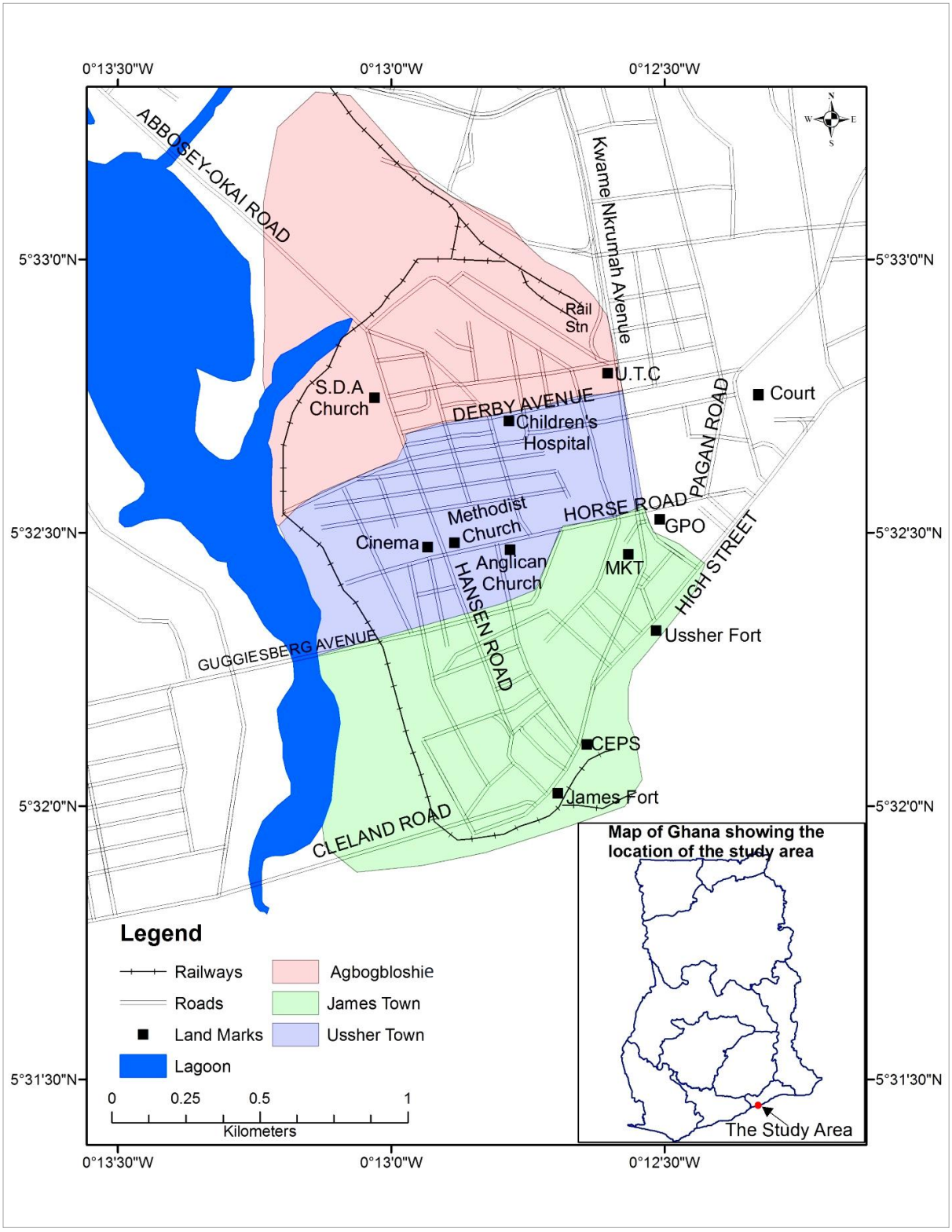
Figure 4.1: Location map showing the study area



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Map 1: Aerial view of the study area showing selected enumeration areas

Source: Authors' Fieldwork, June 2013

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4.2 Characteristic features of the food environment

4.2.1 Distribution of food resources

The results of the spatial analysis reveal an environment which is mostly "obesogenic" in nature; characterised by an abundance of options for out-of-home cooked foods and convenience stores but limited options for fruits and vegetables (Map 2). The results also show that the number of out-of-home food places outweigh that of convenience stores and fruit and vegetable stands/sales points. The distribution of the types of food resources by point location show close proximity of the different food resources to each other with some locations having all three types of food resources at the same location (Map 2).

Majority of the food resources tend to be located along the EA boundary and its immediate peripheries; making food resources more accessible to people living along the boundaries of the EA. A few of the food resources were located within the boundaries of the EA (Map 2).

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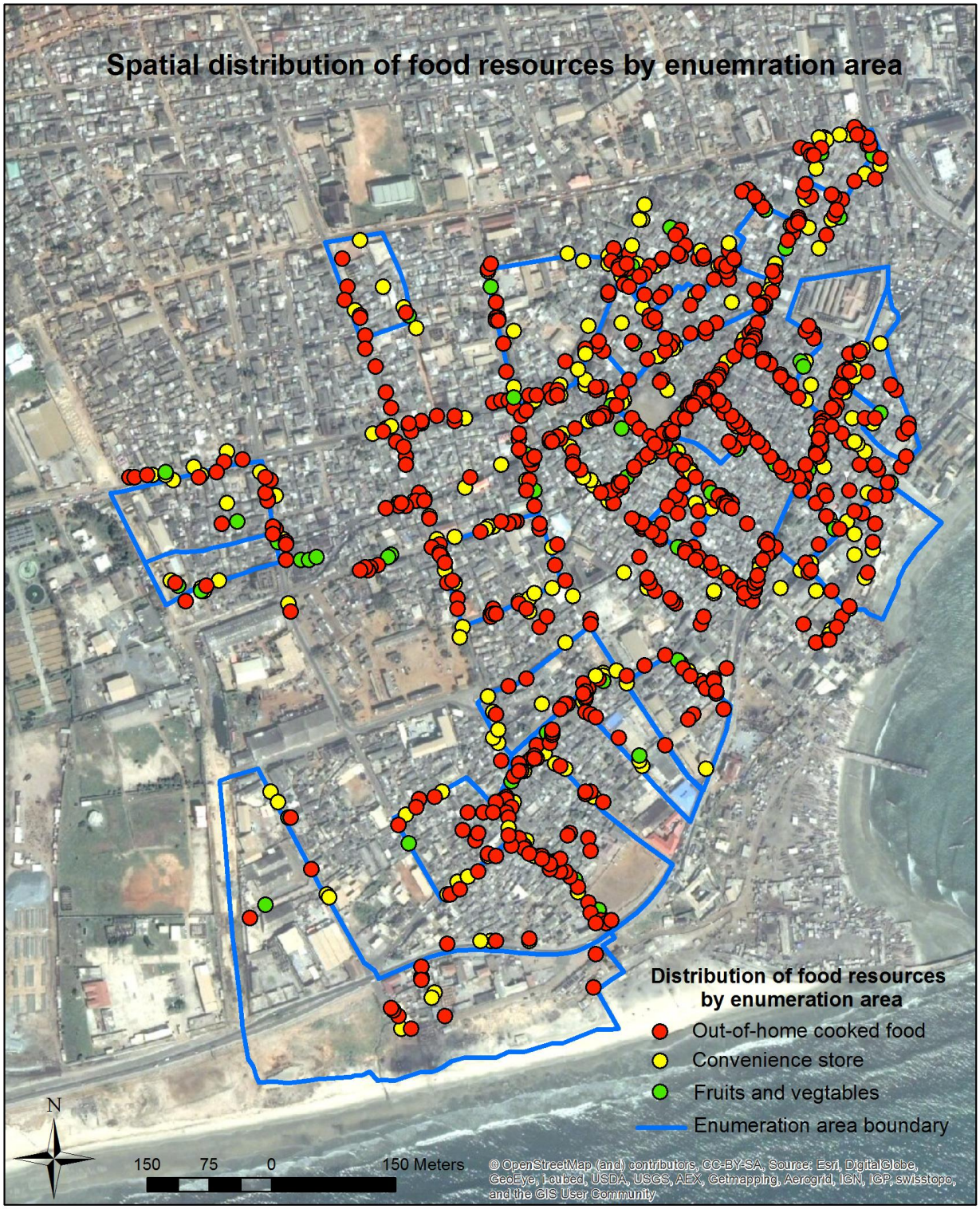
Map 2: Spatial distribution of out-of-home cooked foods, convenience stores and fruits and vegetables stands/sales point by EA



Source: Authors' Fieldwork, June 2013

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4.2.2 Buffer analysis

Different buffer distances were applied to the boundaries of the EAs to examine how far away food resources are from the EA in which the respondents lived. The results show that the greatest concentration of food resources occur within a 25metre buffer zone around the original EA boundaries (Map 3), suggesting that food resources are most accessible in an immediate 25meter distance around the EA. An additional 25metre distance from the 25m buffer (i.e. a 50metre buffer around the original EA boundary) slightly increases the number of options available over that available within the 25m buffer zone. A 100 metre buffer distance around the original EA boundary only marginally increases the options available in the 25metre and 50metre buffer areas (Map 3).

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Map 3: Spatial distribution of total food resources over different buffer distances around the original EA boundaries

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4.2.3 Density analysis

Map 4 shows a choropleth map of the total food resources in each EA relative to the land area (in square metres) of the EA. The results demonstrate variations in the food environment among the EAs. The EAs with the highest total food resource density (dark brown colour shade) also had the highest density of out-of-home cooked foods. The result also shows that EAs close to the periphery of the study community had the lowest density of food resources while those located towards the centre of the study area had the highest densities (Map 5, Figure A).

The results suggest that the distribution of food resources in the EA follows the population distribution in the EAs. A choropleth map showing the population density by EA coupled with observations from the field shows that, EAs located towards the centre (in the northeast side) of the study area showed higher population densities than EAs located towards the peripheries (in the southwest side) of the study area (Map 5, Figure B). Similarly, a choropleth map showing the density of total food resources over different buffer distances (Map 6) shows increasing concentration of food resources for EAs located towards the centre of the study area which also happens to be areas with higher population densities.

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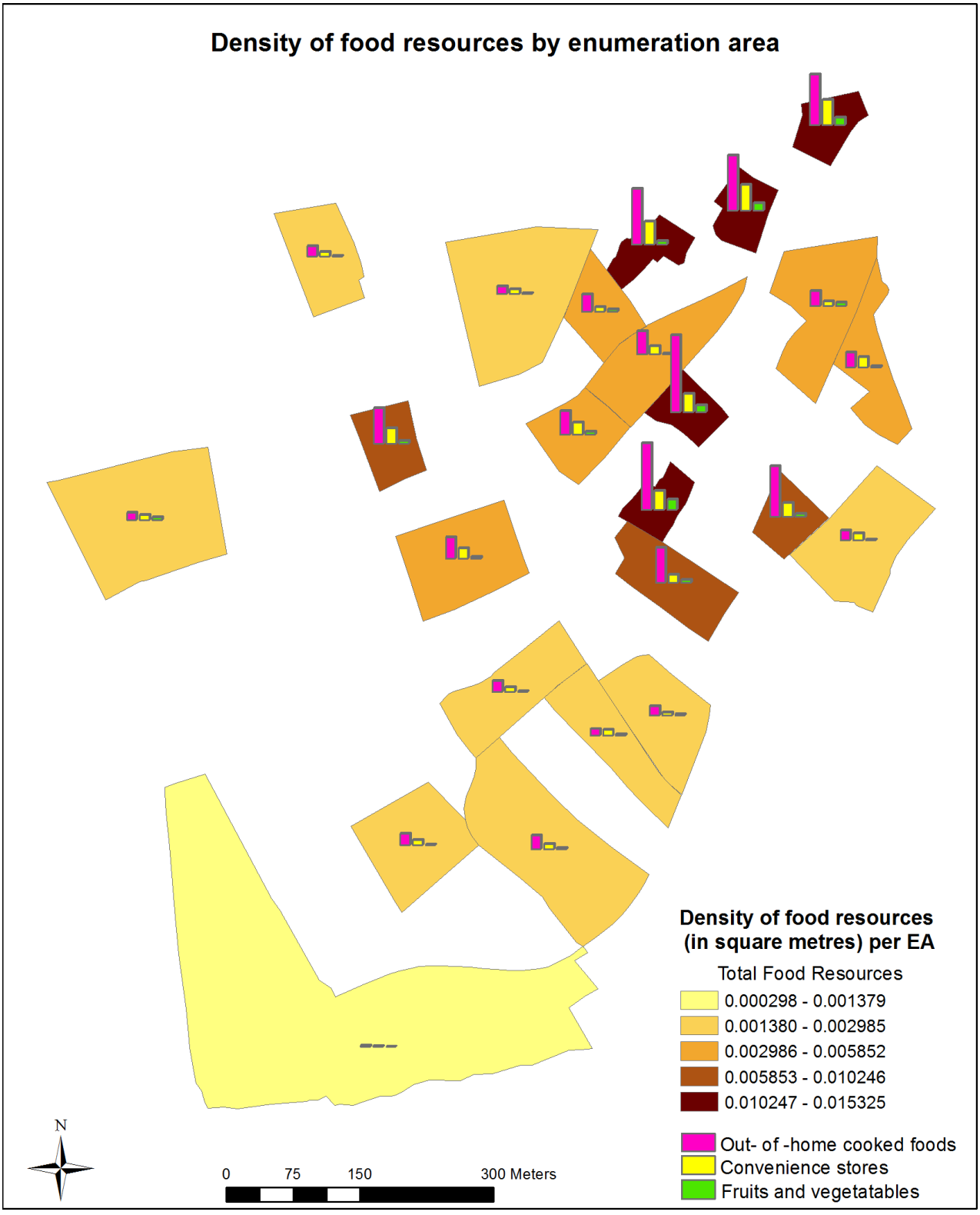
Map 4: Density of food resources in the original boundary of the EA



Source: Authors' Fieldwork, June 2013

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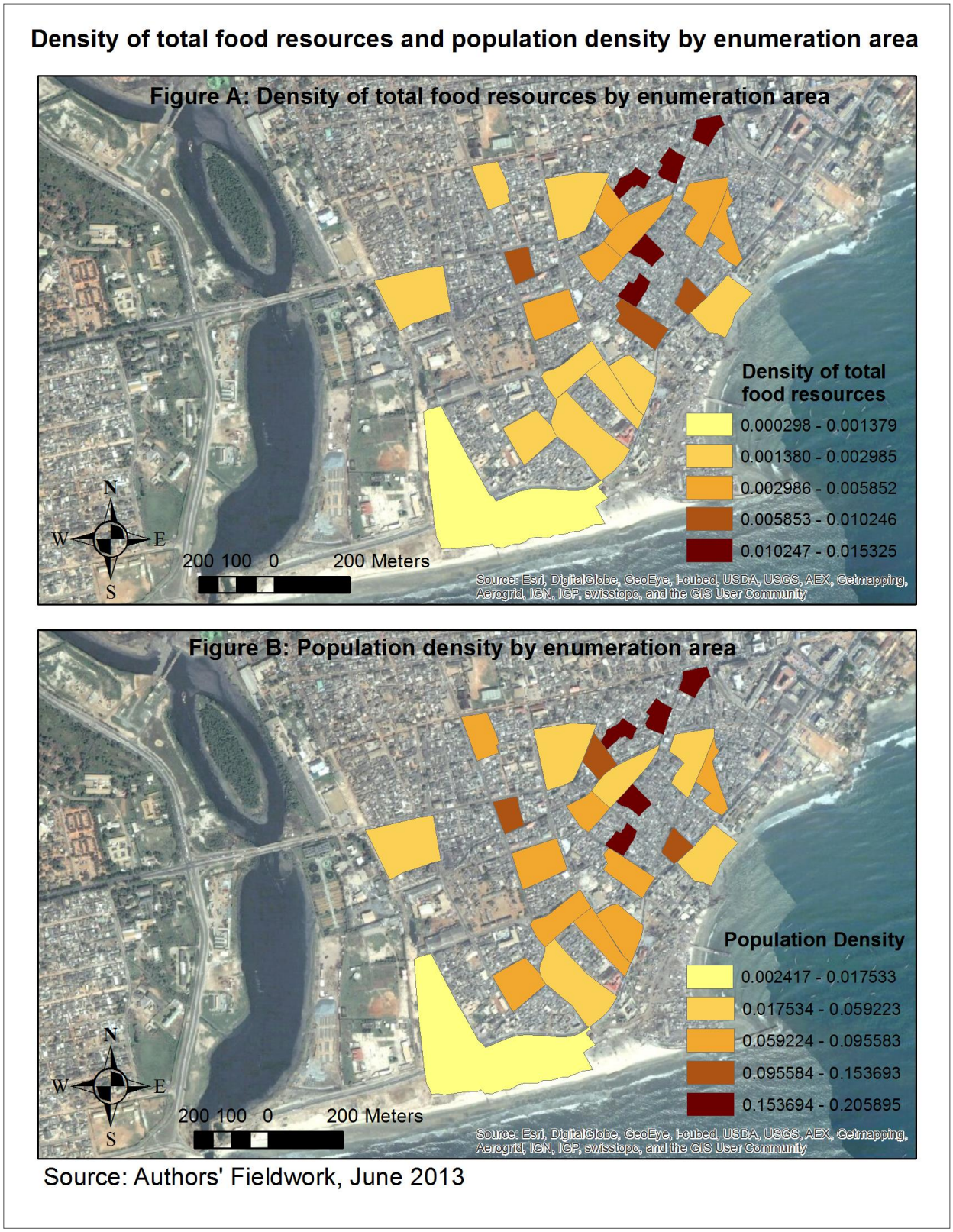
Map 5: Density of total food resources and population density by enumeration area



Source: Authors' Fieldwork, June 2013

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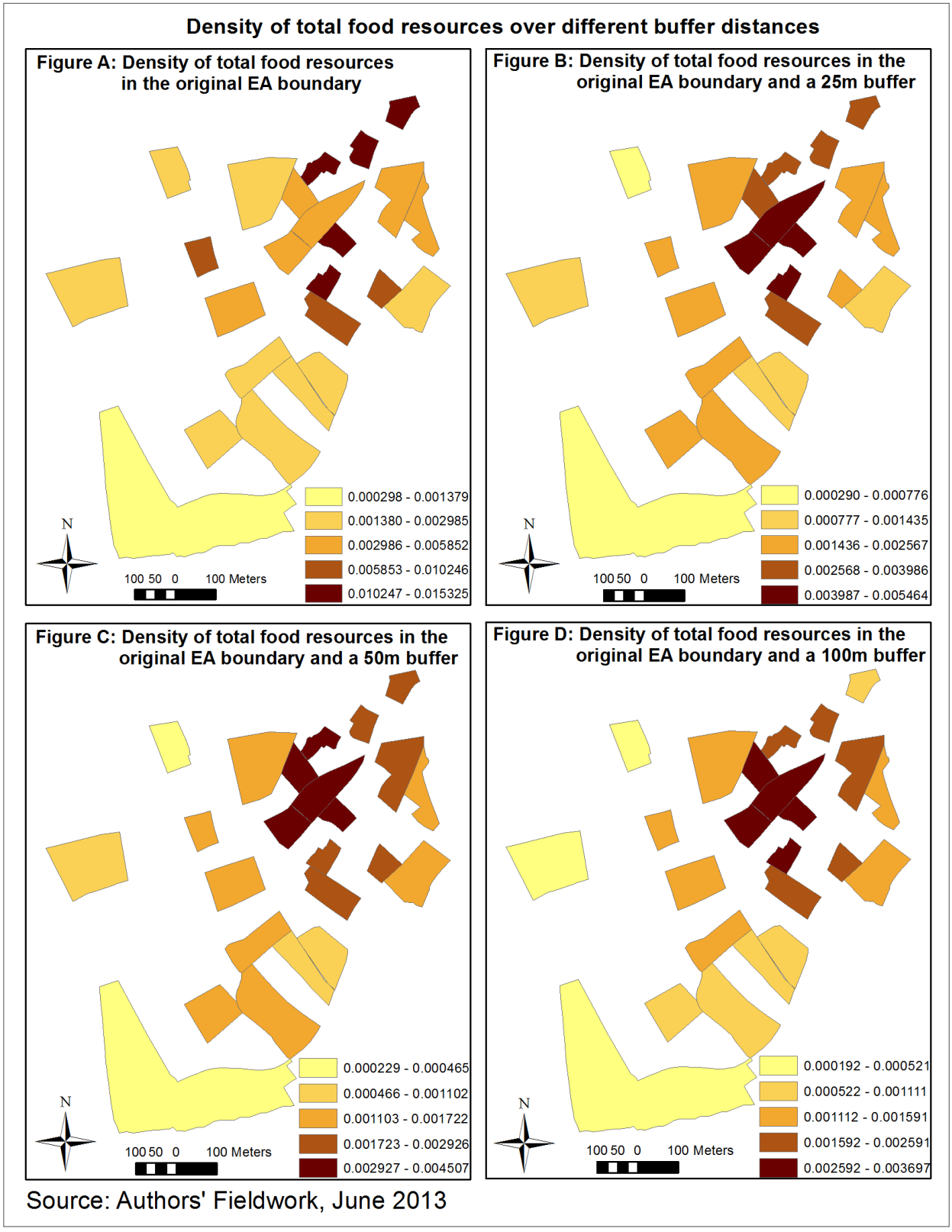
Map 6: Density of total food resources in the original EA and over different buffer distances



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4.2.4 Types and availability of food resources

4.2.4.1 Out-of-home cooked foods

Out-of-home cooked foods formed the highest proportion of the total food resources available in each EA while fruits and vegetables formed the least (Figure 4.2). The most common types of out-of-home cooked foods available in the study area include plain boiled rice, rice boiled with refined vegetable oil, fried rice[13], waakye[14] and jollof rice[15]. These rice dishes were mostly made from polished rice and sold with chicken, meat or fish which were mostly frozen products fried with refined vegetable oil. The sauces that accompanied the rice dishes were also prepared with refined vegetable oils, spices and condiments.

Another common category of out-of-home cooked foods available in the study area were local staple foods including fufu, banku and keneky. Fufu, a pounded starchy staple made from plantain and cassava, is served with a variety of soups including tomato soup also called "light soup", groundnut soup and palm nut soup. Banku (cooked corn and cassava dough) and kenkey (steamed corn dough) are typically served with fried fish and an uncooked sauce which is a blended mixture of pepper, tomato, onion and salt. Banku and kenkey are also sometimes eaten with a stewed sauce or soup.

The results show that a variety of out-of-home cooked foods are commonly available in the study area throughout the day. Residents are thus exposed to a diversity of out-of-home cooked foods including both healthy options such as staples foods made from whole grain and starchy roots and unhealthy options such as stir fried polished rice dishes.

[13] Boiled rice stir fried with vegetables, sausage and eggs
[14] Rice and beans boiled together
[15] Rice cooked in tomato sauce

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4.2.4.2 Convenience foods

The food resources available at convenience stores can be broadly categorised into two groups: (1) those that require further processing before consumption and (2) those that do not require further processing before consumption. The first groups of food resources that require further processing before consumption are basically foods that need to be cooked before they can be consumed. Such food items include uncooked polished rice, canned tomato paste, refined oils and canned meat or canned fish products. These food types are processed to preserve and give them a long shelf life. Processing however affects the nutritional quality of these foods while increasing their caloric value. For instance, compared to unpolished rice, polished rice has less complex carbohydrates which increase the energy density of polished rice.

The second group of foods which do not require processing before consumption include foods such as refined sugars, sweetened carbonated beverages e.g. coca cola, white bread, biscuits and snacks including fried and baked pastries. These food items have high caloric value and their consumption may have implications for obesity (Caballero, 2007).

4.2.4.3 Fruits and vegetables

Fruits and vegetables were the least common type of food resource in the study area (Figure 4.2). Fruits such as oranges, pineapple, water melon, apple and black berries and vegetables such as tomatoes, onions, cabbage and carrots were among the most common types of fruits and vegetables available in the study communities when fruits and vegetables were found in the community.

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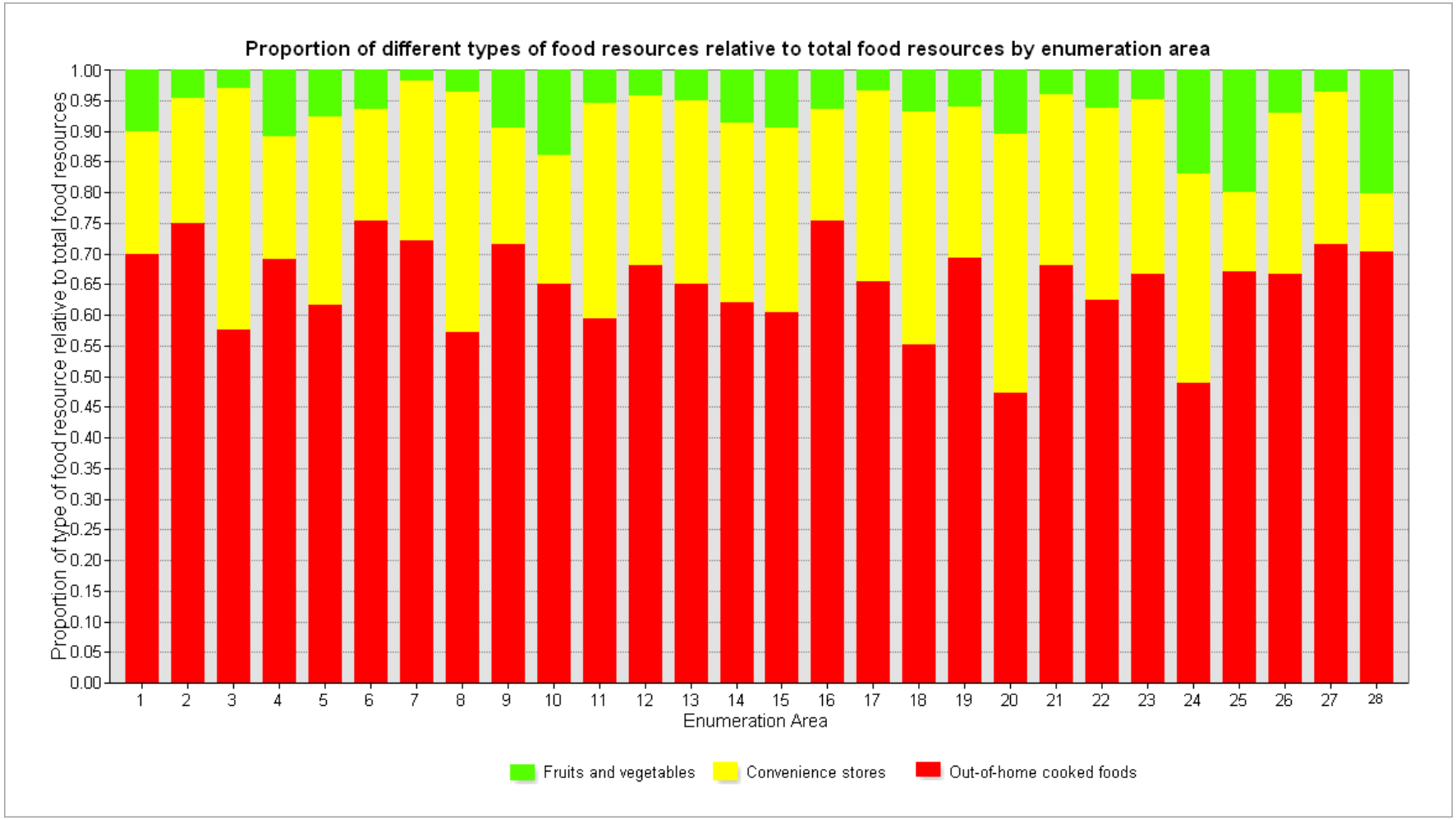
Figure 4.2: Proportion of different types of food resources relative to the collective total of food resources



Source: Authors' Fieldwork, June 2013

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4.2.5 Food resource dependency ratio

The results of the analysis examining the ratio of the number of food resource locations available to residents of the study area shows that there were more out-of-home cooked food places for every 100 people than there were fruits and vegetables (Table 4.1). On average there were about 4 out-of-home cooked food locations for every 100 people per EA with wide variations among the EAs. While for some EAs there was just 1 out-of-home cooked food place for every 100 people, in others there were about 9 out-of-home cooked food places for every 100 people (Table 4.1).

Table 4.1: Food resource dependency ratio showing number of food resource type per 100 people per EA

	Number per 100 people		
Food resource type	**Mean (Standard deviation)**	**Minimum**	**Maximum**
Out-of-home cooked foods	4.077 (1.777)	1.181	8.650
Convenience stores	1.549 (0.552)	0.552	2.614
Fruits and vegetables	0.553 (0.509)	0.122	2.490

Source: Authors' Fieldwork, June 2013
N = 28

There were slightly fewer number of convenience stores per 100 people at an approximate average of 2 per 100 people. There was also less variation in the number of convenience stores per 100 people among the EAs (Table 4.1). Some EAs had less than 1 convenience store per 100 people while others had about a maximum of 3 convenience stores per 100 people.

The distribution of the ratio of the number of fruit and vegetable stands/sales points to the population in the EA shows that on average there was less than 1 fruit and vegetable stands per 100 people per EA. In some EAs there was almost no fruit and vegetable stands

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in the EA while in others there was a maximum of about 2 fruit and vegetable stands/sales points per 100 people (Table 4.1).

4.3 Characteristics of the physical activity environment

The characteristics of the physical activity environment focuses on two aspects: (1) the types and accessibility of community physical activity spaces and (2) community physical activity groups. The types and accessibility of community physical activity spaces were examined using spatial analysis techniques while the community physical activity groups were examined using qualitative techniques.

4.3.1 Community physical activity spaces

4.3.1.1 Types of community physical activity spaces

The results indicate that there are few places in the community used for physical activity. Furthermore, only few of these physical activity spaces in the community are designed to support physical activity e.g. parks for playing football. Other places in the community used for physical activity are not intended for such use e.g. paved and unpaved open spaces, open streets and roads used by motor vehicles (Map 7).

The results also indicate that the community may not only be under resourced with physical activity spaces but also that the limited physical activity spaces are not fully utilised for many reasons. The results from the qualitative data coupled with observations from the field reveal that, physical activity spaces (e.g. the football parks and the roads) were also used for other activities such as funerals which prevent their use for physical activity on such occasions. Also, after episodes of heavy rainfall some of the open spaces

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used for physical activity get flooded and thus become inaccessible for use for physical activity.

Another key concern mentioned by the participants in the focus discussions with regards to the use of roads for physical activities like jogging was their fear of being knocked down by vehicles. Thus aside the fact that the roads are not designated physical activity spaces, the additional risk of accidents makes it a less preferred option for physical activity even though it is used by some young men in the community nonetheless.

The issue of road accidents as a result of using roads and open streets for physical activity was not only a concern for community members but also for the city authorities. A community member informed the author that city authorities (Accra Metropolitan Assembly) have prohibited the use of open spaces such as the roundabout (Map 7) for physical activity. According to her, people who are found playing at the roundabout were arrested by the city authorities (Personal Communication, 2013).

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Map 7: Spatial distribution of the location and type of physical activity spaces

Source: Authors' Fieldwork, June 2013

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Community crime level has been documented in the literature as a key determinant of whether or not people engage in outdoor physical activity (Nugent, 2008). In the qualitative arm of this current study, the issue of crime was discussed during the focus group discussions. The participants indicated that generally, crime was not a concern in the community except for a few instances when some minor crimes were committed in the community. The participants also indicated that crime was not a deterrent to engaging in outdoor physical activities.

The results from the quantitative analysis suggests that crime may not be very prevalent in the study area. The mean aggregated (by EA) crime level shows a mean crime level of about 3 on a scale of 1 (lowest) to 5 (highest). The lowest reported EA crime level was about 2 while in some EAs the average crime level was rated high at about almost 5 (Table 4.2).

Table 4.2: EA crime level, social cohesion and trust among community members

	Mean (Standard deviation)	Minimum	Maximum
Crime	3.374 (0.562)	2.261	4.486
Social cohesion	2.734 (0.198)	2.200	3.095
Trust	2.332 (0.152)	2.043	2.632

Source: Computed from survey data, November-December, 2011
N = 28

Apart from being an inhibitor of physical activity, crime has also been found to increase stress and stress increases the chances of weight gain by increasing the body's allostatic load. On the other hand, some features of the community environment including social cohesion and high levels of trust among community members act as stress buffers; reducing the risk of weight gain. The results show average levels of trust and social

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cohesion (about 2 on a scale of 1 to 4) among residents in the EA with little variation among the EAs (Table 4.2).

4.3.1.2 Accessibility of community physical activity spaces

The results show variations in accessibility (in terms of distance) to different types of physical activity spaces in the study area. Physical activity space(s) in other surrounding EAs were the closest physical activity space(s) to the physical activity space(s) in the various EAs (Figure 4.3). Some of the physical activity spaces which were closest to the EAs were not designated physical activity spaces even though they may be the closest physical activity space. The beach was generally the furthest physical activity space from the EAs (Figure 4.3). On the whole, the distance to major parks such as football parks was mostly shorter than the distance to be beach but a little further than the distance to the nearest physical activity space.

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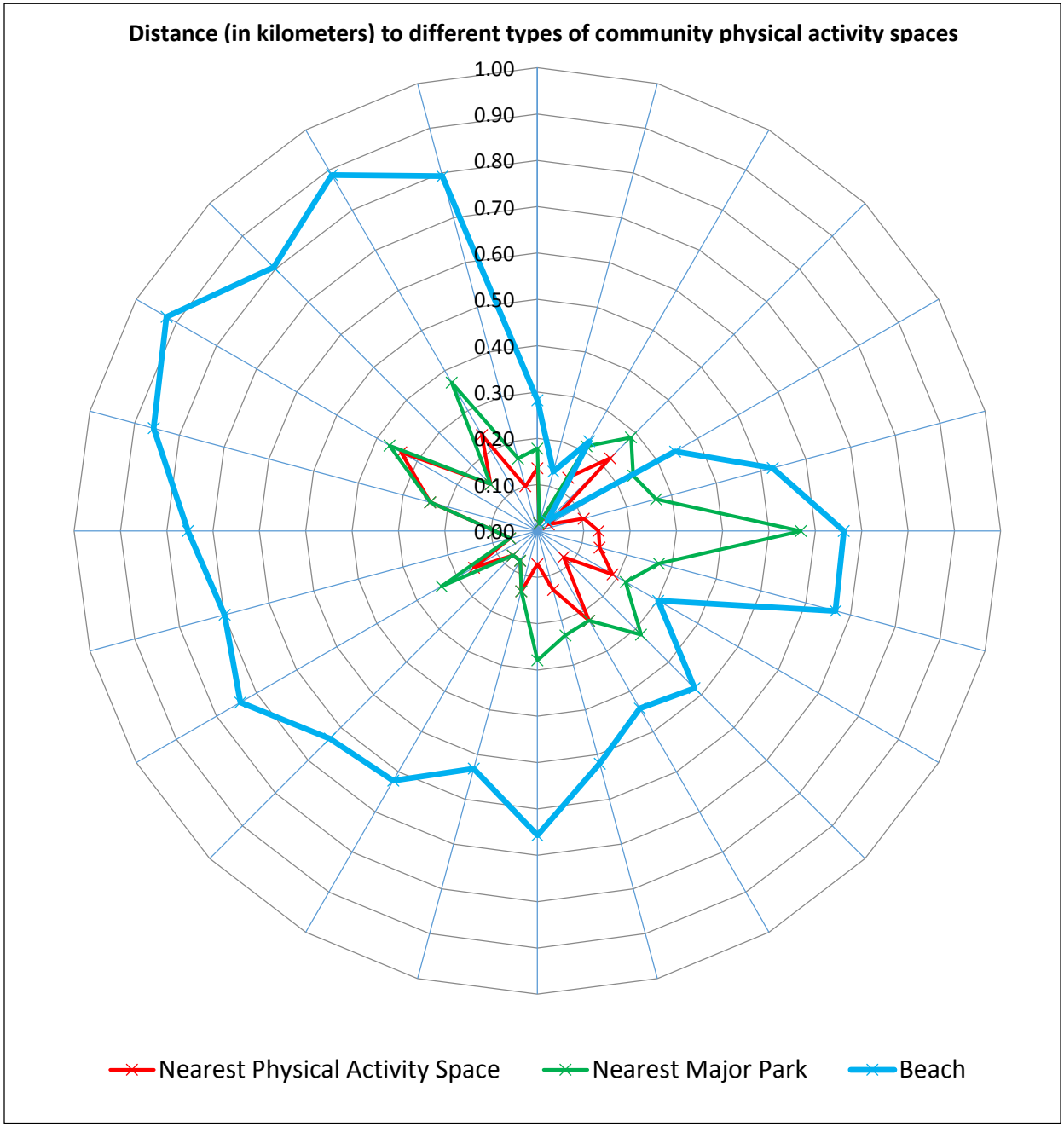
Figure 4.3: Access to different types of community physical activity spaces



Source: Authors' Fieldwork, June 2013

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4.3.2 Community physical activity groups

Access to community physical outlets (Sallis and Glanz, 2006) and participation in group physical activities (Trost et al., 2001) have been found to significantly reduce the chances of obesity. Availability of community physical activity groups and respondents' participation in group activity were examined in this study. The participants in the focus group discussions indicated that, there may or may not be groups in the community that engage in physical activity. Where community physical activity groups were reported to exist, the participants indicated that these were informal groups temporarily formed by people coming together to engage in a particular kind of physical activity. The following quote illustrates this point;

> *"it is not like a group has been formed but people numbering about five can go jogging and others can join at another time. It depends on who is ready to go and jog on that particular day"*

The results also indicate that there are compositional differences in community physical activity groups. For example, community physical activity groups are sometimes organized around activities such as football or boxing or by age and sex. The groups are also more likely to be made up of young people rather than the old or made up of men rather than women. A female participant in one of the elderly women's group reported that:

> *"as for them* [the women] *they don't do physical activities. I have even formed a club but when I asked them to do some activities, they refused."*

The quote illustrates the lower likelihood of women being part of physical activity groups and their reluctance to get involved in group physical activities.

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4.4 Characteristics of the social environment

4.4.1 Perceptions about body size

Preference for and acceptance of fatness as a sign of wealth, beauty and prestige particularly among women has been cited as one of the reasons why African women tend to have large body sizes (Styen and Damasceno, 2006). The socio-cultural constructs surrounding body size could have implications for obesity through its influence on peoples' behaviour (Emmons et al., 2007). The pertaining social norms and perceptions about body size in the context of the study communities were explored qualitatively through focus group discussions with members of the community. The results of the qualitative analysis on body size perceptions are presented on three main thematic areas: (1) society approves a normal body size, (2) gendered expectation about body size and (3) body size conformity strategies.

4.4.1.1 Society approves a normal body size

When asked whether there is a community perception about an ideal body size during the focus group discussions, the participants generally agreed that *"yes"* there is a body size which is acceptable in their community. The participants indicated that, people are supposed to have a *"normal body size."* In some instances during the discussions, a normal body size was equated to a *"medium body size"* rather than a *"slim"* or *"fat"* body size. The discussions revealed that being *"too slim or too fat"* was not acceptable. Thus in the study communities *"one is expected to put on some weight but not be too fat."*

The results suggest that the societal expectation of the ideal body size being normal influences social acceptability or otherwise. Analysis of the participants account revealed

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that being fat or slim attracts negative comments and criticism from members of the community. Having a slim body size was not socially acceptable as being slim was likened to being sick or thinking too much as indicated by the participants;

"when you are slim people think that you are sick or thinking too much."

On the other hand, not being slim was more acceptable and attracts more positive comments. As expressed by the participants;

"when people put on some weight they are seen to have a nice body shape."

Contrary to the general notion that being fat is admired especially for sub-Saharan Africa women, it was observed in this study that the accepted body size is *"normal"* rather than fat. The participants in this study likened being fat to being sick of a disease *"fatness is a disease"* and something that people are shying away from *"people are now running from becoming fat"*. The participants indicated that *"when you are fat it is not beautiful."*

4.4.1.2 Gendered expectation about body size

As part of the discussion on what the community ideal body size is, participant were asked to choose a particular body size from a figural stimuli chart (Figures 4.4 and 4.5) that will be accepted by members of the community as the ideal body size for young men, young women, old men and old women. The interaction among participants in all the groups show that even though there was agreement on community perceptions about what the ideal body size should be, there was no definite initial consensus on the particular size. This was observed in the way participants argued among themselves in agreeing on which body size is the accepted body size for community members, based on their age and sex.

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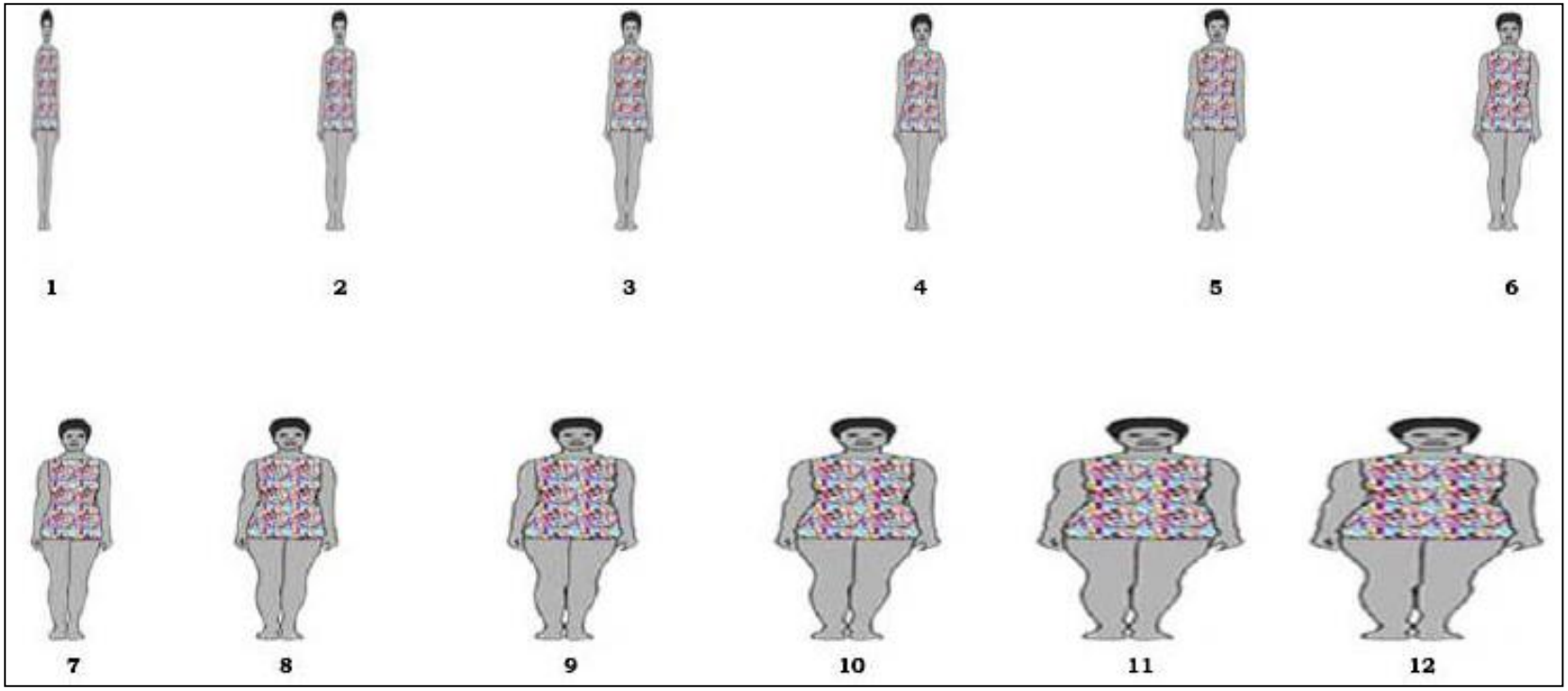
Figure 4.4: Body size chart for females



Source: Adopted from Jumah and Duda, 2007

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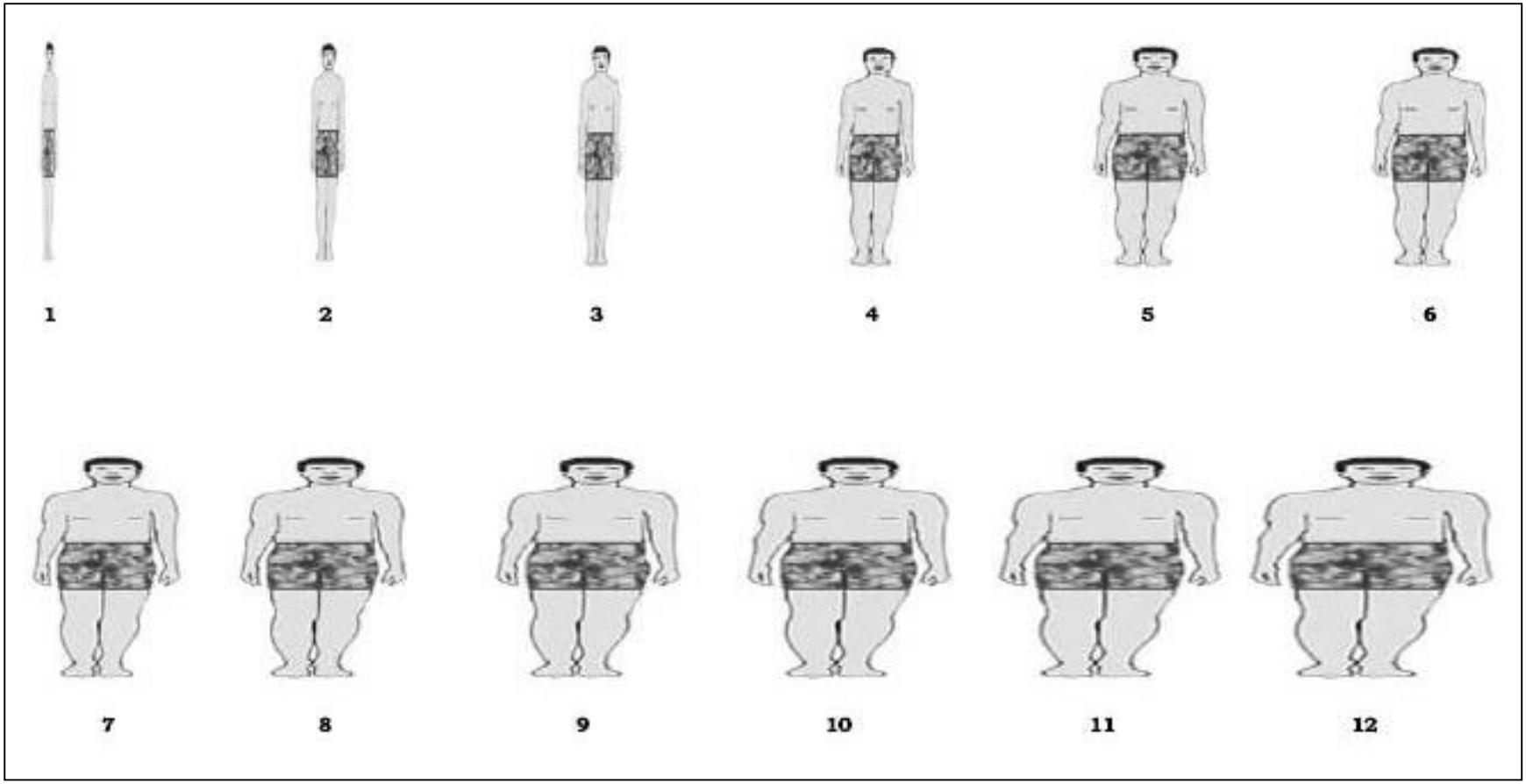
Figure 4.5: Body size chart for males



Source: Adopted from Jumah and Duda, 2007

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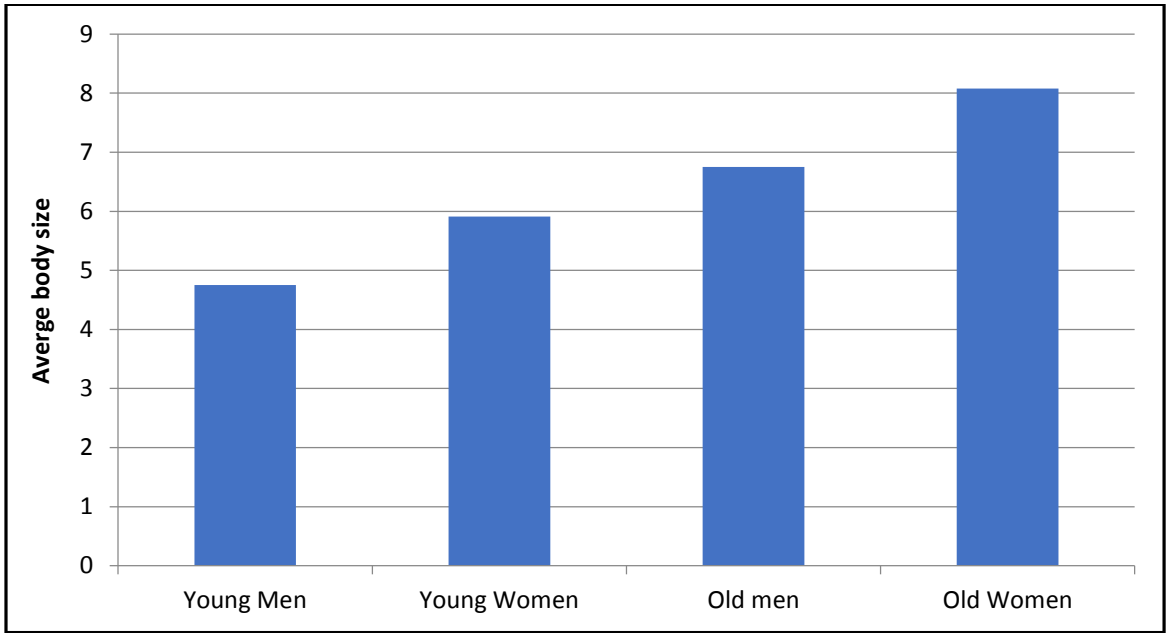
The results show that the expectation about body size were dependent on one's age and sex. Young people were generally expected to have smaller body sizes while old people were expected to have larger body sizes (Figure 4.6). There was also a gender stereotype in the expectations about body size evidenced by the observation that between men and women, women were generally expected to have bigger body sizes than men. Overall, older women were expected to have the largest body sizes. This is depicted in the choice of body size participants made for men and women (Figure 4.6). The analysis revealed that expectations about ideal body size were not peculiar to women but also extends to men as well. Men, particularly young men, were expected to have a well-built body which is seen as attractive.

Figure 4.6: Choice of community ideal body size by age and sex



Source: Authors' Fieldwork, June-August, 2013

Note: The chart shows the average of the body sizes that were chosen in all the groups for young men, young women, old men and old women.

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Several reasons were cited for the gender differences in body size expectations. For women, having a womanly shape and being seen as attractive are among the reasons why women should have the community ideal body size. This perception is illustrated in the following quote;

"As a woman, you should have a normal body size with shape. It makes you look beautiful when you have such a body"

Men are also perceived to have a *"nice body"* when they have well-built muscular bodies and this was especially so for young men.

The perceptions about the community ideal body size were also reflected in the individual choices of the community ideal body size. The results from the quantitative data shows that members of the community generally tend to perceive larger body sizes as acceptable (Table 4.3). Also, similar to the findings from the qualitative analysis, higher proportions of females compared to males chose larger body sizes as the perceived community ideal body size (Table 4.3).

The quantitative results also show that more than half of the respondents considered their body size to be smaller than the perceived community ideal body size (Table 4.4). Just about 1 in 5 of the respondents reported their body size being the same as the community perceived ideal body size. A little more than a quarter of the respondents reported having a bigger body size than the community perceived ideal body size. A slightly higher proportion of females compared to males reported having larger body sizes (Table 4.4).

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Table 4.3: Individual choices of community age-sex specific ideal body size

Body size	Total Sample (%)	Females (%)	Males (%)
1	0.46	0.56	0.33
2	1.83	2.25	1.32
3	3.81	2.82	4.97
4	12.48	9.30	16.23
5	12.33	9.01	16.23
6	20.55	19.15	22.19
7	14.92	12.96	17.22
8	10.65	12.11	8.94
9	8.37	11.27	4.97
10	6.39	9.58	2.65
11	4.57	6.76	1.99
12	3.65	4.23	2.98
Total (N)	**100.00 (657)**	**100.00 (355)**	**100.00 (302)**

Source: Computed from survey data, November-December, 2011

Table 4.4: Comparison of individual body size and community perceived ideal body size

Comparison of individual body size and community perceived ideal body size	Total Sample (%)	Females (%)	Males (%)
Smaller	52.05	52.11	51.99
Same	20.24	19.15	21.52
Larger	27.70	28.73	26.49
Total (N)	**657**	**355**	**302**

Source: Computed from survey data, November-December, 2011

4.4.2 Body size conformity strategies

Analysis of the qualitative data shows that people in the study area adopt a number of strategies in order to have the community accepted body size. The strategies used were categorized under three main sub-themes: (1) using chemical interventions, (2) using physiologic interventions and (3) psychosocial interventions.

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The chemical interventions sub-theme encompasses strategies that involve the use of a chemical substance that influences the body's functioning system and alters weight gain or loss. Physiologic intervention strategies involve actions that impact energy balance and hence weight gain or loss. Unlike the chemical or physiologic intervention strategies, the psychosocial interventions strategy does not require an individual to take any deliberate action to gain or lose weight. Weight gain or loss depends on one's social circumstances which encourages weight gain if favourable but leads to weight loss if unfavourable.

4.4.2.1 Using chemical interventions

The chemical interventions strategy involves people taking chemical substances including medicine, blood tonics, herbal preparations and injections in order to put on weight. While some substances like herbal preparations were believed to make people fat, others such as blood tonics and *"appetizers*[16]*"* were supposed to make people who use such substances eat a lot thus leading to weight gain.

The chemical interventions strategy was mentioned in all the groups and it was portrayed as a strategy mostly used by women who want to put on weight as illustrated in this quote: *"the women take drugs to put on the needed weight."* However, even though taking drugs was mostly associated with women, it was sometimes mentioned as a strategy used by men as well as shown in the following quote: *"even some of the men take drugs to put on weight."*

[16] Alcoholic drinks with very high alcohol content usually consumed prior to eating

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The use of family planning injections was also mentioned as a strategy for weight gain even though not intentionally in some instances. It was particularly mentioned in some of the focus groups that weight gain from using family planning injections is a side effect rather than a deliberate weight gain strategy. This notion was expressed by the participants as illustrated by the following quote:

> *"the family planning injections make them* [the women] *big, but that is not the reason for injecting the family planning"*

The use of chemical interventions was not only intended for weight gain but was also used by some people for weight loss. The participants indicated that people who are fat also resort to taking drugs in order to lose weight.

4.4.2.2 Using physiologic interventions

The array of physiologic strategies employed were observed to be strategies that fall under two main categories: (1) those that increase energy balance e.g. eating a lot, leading to weight gain and (2) those that decrease energy balance, e.g. physical activity, leading to weight loss. The participants said that people who want to gain weight would resort to *"eating a lot"* and or *"sleeping a lot"* or *"eating late at night"* in order to put on weight. Men also adopted physiologic strategies such as weight lifting to build their bodies. The discussions revealed that men sometimes combine physiologic strategies such as weight lifting with chemical intervention strategies e.g. taking tablets to speed up the body building process. To illustrate this point the participants indicated that:

> *"some people* [referring to some men] *also take drugs when they are lifting weight to build their body."*

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The analyses also revealed that the physiologic interventions strategy is not only used for weight gain but is also employed as a weight loss strategy by some people. For example people who are perceived as being fat resort to physiologic strategies such as *"drinking lime juice"* or *"exercising"* in order to lose weight.

4.4.2.3 Psychosocial interventions

The psychosocial interventions strategy acts as a social life enabler of weight gain or loss. This strategy does not requires a deliberate action by individuals to change their body size but rather works through the social circumstances of the life of individuals to influence their body size. According to the participants account, having a comfortable social life can make people gain weight while living in hardship or under stressful social conditions can make people lose weight. Thus peoples' social conditions influence their body size without requiring them to take an action to gain or lose weight. Having a good marriage, particularly for women was mentioned by participants as a social enabler of weight gain as illustrated by the following quote:

> *"when you get married to a good man you will get your peace of mind and therefore you will put on weight."*

Having a good job or having money was also mentioned as an enabler of weight gain as exemplified in the following quote:

> *"when your job enables you to see money always, you can also put on weight because you are always happy"*.

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While the social circumstances of people lives could lead to weight gain, facing challenges could be a cause of weight loss because social problems make people lose weight. The respondents mentioned that:

> *"some people don't have the expected or perceived body size because they think a lot. Others too because of worldly problems and some too money matters they normally become slim"*

Thus social challenges such as unemployment, poverty, marital problems and other such social problems constitute a source of worry to people and thus causes them to lose weight.

4.5 Discussion

The examination of the built environment in the study area shows that the characteristics of the community built environment is similar to that found in other developing country context (Micklesfield et al., 2013) and in economically deprived areas in developed countries (Drewnowski, 2004). For example, the food environment offers more unhealthy options such as polished rice, refined sugar, sweetened carbonated drinks but less healthy options such as fruits and vegetables. This characteristic of the food environment is similar to what exist in most of black South Africa. Micklesfield et al. (2013) report that in informal settlements in black South Africa, informal food vendors who sell less varied and inexpensive food of poor quality were the most convenient places to obtain out-of-home cooked foods.

In urban poor communities such as those in the study area and informal urban poor settlements in black South Africa, there is high dependence on out-of-home cooked foods

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because these foods are convenient and affordable (Temple and Steyn, 2011; Maxwell et al., 2000). The high dependence on out-of-home cooked foods could potentially increase the risk of obesity for residents of these poor communities because of the poor nutritional quality and the high calorie content of these foods.

The characteristics of the physical activity environment in the study area is also similar to that reported in other studies where limited physical activity resources were available in poor areas (Gordon Larsen et al., 2006). The findings of the current study indicate that, the physical activity environment in the study area does not provide a variety of options for residents to engage in physical activity, and where available, some physical activity spaces may not be supportive of physical activity.

The physical environment being an inhibitor of physical activity has been reported in other studies in the sub-Saharan Africa region (Oyeymei et al., 2012a; Kiawi et al., 2006). Among urban residents in Cameroon, poor infrastructure was reported as one of the things that prevented people from engaging in physical activity (Kiawi et al., 2006). The physical activity environment in the study area may increase the risk of obesity by not providing sufficient physical activity resources and not being supportive of physical activity.

The findings from the qualitative analysis reveal that a normal body size which was described as “not being too small and not too fat” is the accepted community ideal body size. This description corroborates the description of normal weight “when somebody is physically not too fat or small” among urban residents in Cameroon (Kiawi et al., 2006). The results suggest that a thin body size is not an accepted body size in the community and

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a large body size is not accepted either. Having either of these body sizes attracted criticisms. While a small body size is associated with sickness, poverty and social problems, a large body size is also seen as unattractive and as a disease condition in some instances.

The criticism of small body sizes have also been reported in other sub-Saharan African settings. For example words such as “mkonda”, “umuguta” and “caato quruntay” are used to refer to a woman with a small body size (skinny lady) in Kenya, Central Africa and Somalia respectively (Renzaho, 2004). Unlike in Western countries where thin body sizes are preferred, in the sub-Saharan Africa context a thin body size is undesirable because of negative connotations associated with being thin. Similar to the negative comments a thin body size attracted from people in the study area for the current study, in South Africa, thinness is associated with poverty, having personal problems and being sick of HIV/AIDS (Matoti-Mvalo and Puoane, 2011). The negative comments and social stigma associated with small body sizes may contribute to the risk of obesity by causing people to adopt a variety of strategies in order to put on weight.

4.5 Conclusion

The aim of the analysis in this chapter was to examine the different aspects of the built environment in the study area. The results suggests that the built environment presents multiple risks for obesity among residents of the study area. These risks stem from all the three aspects of the built environment. From the perspective of the food environment, the imbalance of food options coupled with the limited options for fruits and vegetables compared to out-of-home cooked foods and convenience foods suggests the existence of a

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food desert in the study area. Food deserts in the context of the study area is not entirely based on socio-economic or geographical access but rather the inequality in the availability of healthy (fruits and vegetables) versus unhealthy (convenience foods) options as has been observed in other sub-Saharan countries such as Windhoek in Namibia (Ndeyapo, 2013). The existence of a food desert may have implications for obesity for residents of the study area.

The second source of risk for obesity comes from the physical activity environment. The options for physical activity are not only limited but are also unsafe (in the case of the use of roads and open street options) or used for other purposes which preclude their use for physical activity. The social environment constitutes the third potential source of risk of obesity for residents of the study area. The societal perception about ideal body size has the tendency of increasing the risk of obesity through the expectation of people putting on some weight and not being too slim. This socio-cultural risk factor may be highest for elderly women compared to young women or young men.

The results in this chapter does not only present the risks of obesity from the built environment but also shows the variability in the measures of the built environment among the EAs. The variability in the measures of the built environment makes them appropriate for multilevel analysis. The influence of the measures of the food, physical activity and social environments on obesity among the total sample and among females and males are examined in chapters six and seven respectively.

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CHAPTER FIVE

CHARATERISTICS OF THE STUDY RESPONDENTS AND THEIR ASSOCIATION WITH OBESITY

5.1 Introduction

The characteristics of individuals including their age, sex and socio-economic status predispose them to being obese (Biritwum, 2005; Amoah, 2003). Also, people's lifestyle behaviours, including what they eat, whether or not they are physically active, drink alcohol or smoke, influences their chances of being obese (Steyn and Damasceno, 2006). The socio-demographic characteristics and lifestyle behaviours of the respondents together with the prevalence of obesity are examined in this chapter using descriptive statistical analyses procedures. The association between the socio-demographic characteristics and lifestyle behaviours of the respondents and obesity (BMI and waist-to-height ratio) is also examined using OLS regression analysis.

5.2 Individual characteristics

5.2.1 Socio-demographic characteristics

The respondents ranged in age from 15 to 59 years with an average age of 31 years (Table 5.1). There were slightly more female than male respondents. The sample consists predominantly of Gas who constituted more than half (58.6%) of the total sample. More than two-fifths of the respondents were either Pentecostals or Charismatics and a little more than one-tenth of them were Moslems. About a quarter of the respondents were married and a little more than one-third have never been married (Table 5.1). About two-fifths of the respondents indicated that they have been living in the study area since they were born.

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A little more than a quarter (about 28%) reported having lived in the study community for more than 10 years while an almost equal proportion (about 29%) said they have been living in the community for 10 years or less (Table 5.1).

Reflective of the national pattern of education, very few (about 5%) of the respondents have completed tertiary level education (Table 5.1). On the other hand, about 45 percent have completed middle or junior secondary level education. With regards to occupational distribution, a little over two-fifths of the sample worked in the sales/service sector and a little under one-tenth worked as professional/technical/managerial or clerical workers. Only a little over a quarter of the respondents worked in occupations that involve exerting a lot of energy including skilled and unskilled manual workers and those engaged in agriculture. The results show an almost equal distribution of the study sample in the quintiles of household wealth status (Table 5.1).

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Table 5.1: Percentage distribution of the study sample by individual socio-demographic characteristics

Continuous variable	**Mean**	**Standard deviation**
Age	31.45	10.46
Categorical variables	**Percentage**	**Number**
Sex		
Male	45.97	302
Female	54.03	355
Ethnicity		
Ga-Dangme	58.60	385
Akan	26.33	173
Other	15.07	99
Religion		
No religion	6.85	45
Catholic	5.48	36
Protestants	22.83	150
Pentecostal/Charismatics	41.10	270
Other Christian	9.28	61
Moslem	11.42	75
Traditionalist/Spiritualist	3.04	20
Marital status		
Never married	38.20	251
Married	24.66	162
Cohabiting	20.09	132
Formerly married	17.05	112
Length of stay in community		
Since birth	43.23	284
≤ 10 years	29.22	192
> 10 years	27.55	181
Highest level of education		
No education	5.78	38
Primary	19.03	125
Middle/JHS	44.90	295
Secondary	25.72	169
Higher	4.57	30
Occupation		
No occupation	11.72	77
Professional/Technical/Managerial/Clerical	8.22	54
Sales/Services	42.77	281
Manual worker	28.01	184
Other	9.28	61
Total	**100.00**	**657**

Source: Computed from survey data, November-December, 2011

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5.2.2 Lifestyle behaviours of respondents

The lifestyle behaviours of the respondents in the study are examined using descriptive analytical tools. Three main categories of lifestyle behaviours: (1) dietary behaviours, (2) physical activity behaviours and (3) social behaviours were examined.

5.2.2.1 Dietary behaviours

5.2.2.1.1 Food preparation practices

Reflective of the characteristics of urban poor communities, about one-tenth of the study sample never cook food at home (Table 5.2). About one-sixth of the respondents cooked food at home just one day in the week while a little over a quarter (28.92%) reported cooking every day of the week. The most often used cooking method was boiling or steaming. Majority (78.84%) of the respondents indicated that when they buy out-of-home cooked food, they buy it from a source within the community while the remaining 1 in 5 indicated that they buy out-of-home cooked food from a source outside the community.

Table 5.2: Percentage distribution of study sample by food preparation practices

	Percentage	Number
Number of cooking days per week		
Never cook	10.81	71
One day	16.13	106
Some days	44.14	290
Everyday	28.92	190
Most often used cooking method		
Never cook	10.81	71
Frying	5.63	37
Stewing	4.26	28
Boiling/Steaming	79.30	521
Source of out-of-home cooked food		
Outside the community	21.16	139
From the community	78.84	518
Total	**100.0**	**657**

Source: Computed from survey data, November-December, 2011

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5.2.2.1.2 Dietary diversity

The respondents reported consuming a diet consisting of foods from diverse food groups (Table 5.3). The least consumed food type was dark green leafy vegetables; consumed by a little over half of the sample while the most consumed food type was starchy staples; consumed by almost all the respondents. The respondents reported consuming a diet consisting of foods from an average of seven different food groups, and a little over one-fifth of the sample reported consuming foods from all the nine different food groups.

Table 5. 3: Percentage distribution of respondents by dietary diversity

	Percentage of respondents who	
Components of dietary diversity score	**Consumed**	**Did not consume**
Starchy staples	99.85	0.15
Dark green leafy vegetable	54.03	45.97
Vitamin A rich fruits and vegetables	81.58	18.42
Other fruits and vegetables	92.39	7.61
Meat and fish	96.50	3.50
Eggs	73.97	26.03
Legumes nuts and seeds	61.49	38.51
Milk and milk products	59.97	40.03
Fats and oils	67.88	32.12
Dietary diversity score (Categorical)	**Percentage**	**Number**
0	0.15	1
1	0.61	4
2	1.67	11
3	1.83	12
4	6.39	42
5	9.59	63
6	16.29	107
7	22.37	147
8	19.48	128
9	21.61	142
Total	**100.00**	**657**
Dietary diversity score (Continuous)	**Mean**	**Standard deviation**
	6.88	1.78

Source: Computed from survey data, November-December, 2011

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5.2.2.2 Physical activity behaviours

There were variations in the amount of work related physical activity reported by the respondents. While about one-fifth of the respondents indicated that their work did not involve any form of physical activity, another 44 percent of them reported that their work involved moderate physical activity. Only about 8 percent of the respondents indicated that their work involves high levels of physical activity. With regards to leisure-time physical activity, a high proportion (about 64%) of the respondents reported being sedentary; they did not engage in any leisure-time physical activity. Only a little over one-tenth (12.18%) of the respondents engaged in highly active leisure-time physical activities (Table 5.4).

Majority of the respondents reported spending some hours of their day being idle. Close to half of the respondents spent 1 to 3 hours a day reclining and more than a third (about 34%) of them spent more than 3 hours in a day being idle. With regards to whether or not they were part of a group or groups in the community that engaged in physical activity, only one-tenth of the respondents indicated that they belonged to any such community physical activity group. Another 40 percent indicated that they were not members of any community physical activity group. In all, about half of the respondents said they were no physical activity groups in the community (Table 5.4).

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Table 5.4: Percentage distribution of study sample by physical activity behaviours

	Percentage	Number
Work related physical activity		
Not working	20.40	134
No activity	27.70	182
Moderate activity	43.53	286
High activity	8.37	55
Leisure-time physical activity		
No activity	64.23	422
Moderate activity	23.59	155
High activity	12.18	80
Number of hours spent reclining a day		
< 1	19.63	129
1-3	46.27	304
> 3	34.09	224
Membership in community physical activity group		
No community physical activity group	49.47	325
Yes	10.20	67
No	40.33	265
Total	**100.0**	**657**

Source: Computed from survey data, November-December, 2011

5.2.2.3 Social behaviours

The respondents indicated that they had about an average of seven and half hours of rest a day (Table 5.5). Smoking was not very common among the study sample. More than 4 in 5 of the respondents reported that they have never smoked (Table 5.5). Only 2.4% of the respondents reported smoking every day.

Alcohol consumption on the other hand was more common among the study sample compared to smoking. Only about a third of the sample reported having never drank alcohol while about one-fifth of them reported having drunk alcohol in the last 24 hours immediately preceding the survey (Table 5.5).

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Table 5.5: Percentage distribution of study sample by their social behaviours

Continuous variable	**Mean**	**Standard deviation**
Hours of rest a day	7.49	1.80
Categorical variables	**Percentage**	**Number**
Current smoking status		
Never smoked	82.65	543
Smokes daily	2.44	16
Smoked some days in the last 30days	10.96	72
Ever smoked but not in the last 30 days	3.96	26
Alcohol consumption		
Never consumed alcohol	35.46	233
Consumed alcohol in the last 24 hours	18.11	119
Consumes alcohol but not in the last 24 hours	21.61	142
Consumes alcohol but not in the last 30 days	24.81	163
Total	**100.0**	**657**

Source: Computed from survey data, November-December, 2011

5.3 Household wealth status

The results with regards to the distribution of respondents by their household wealth status does not show marked differences. There was an almost equal distribution of respondents by the wealth status of the household they belonged to (Table 5.6). Close to 21 percent of the respondents belonged to households in the richest category while a little less than one-fifth belonged to the poorest category.

Table 5.6: Percentage distribution of respondents by their household's wealth status

Household wealth status	**Percentage**	**Number**
Poorest	19.48	128
Poorer	20.40	134
Middle	20.09	132
Richer	19.18	126
Richest	20.85	137
Total	**100.00**	**657**

Source: Computed from survey data, November-December, 2011

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5.4 Prevalence of obesity among the study sample

The results reveal high levels of obesity among the study sample with a mean BMI of 25.58 kg/m^2. Using the standard WHO categorisation, the respondents in the study sample can be said to be overweight on average based on their average BMI value of 25.58 kg/m^2 (Table 5.7). A mean waist-to-height ratio of 0.50 among the study respondents also signifies that on average the respondents can be considered as being at risk of being obese. Additionally, about every 2 in 5 of the study participants are overweight or obese based on either their BMI or their waist-to-height ratio (Table 5.7).

Table 5.7: Distribution of obesity among the study sample

Continuous variables	**Mean**	**Standard deviation**
BMI	25.58	6.00
Waist-to-height ratio	0.50	0.09
Categorical variables	**Percentage**	**Number**
BMI		
Normal weight	58.14	382
Overweight	23.29	153
Obese	18.57	122
Waist-to-height ratio		
Normal weight	57.23	376
At risk of obesity	42.77	281
Total	**100.00**	**657**

Source: Computed from survey data, November-December, 2011

5.4 Factors associated with obesity

5.4.1 Socio-demographic factors associated with obesity

BMI and waist-height ratio were found to increase as the age of the respondents increases (Table 5.8). Being female was associated with about a 4.1 kg/m^2 increase in BMI

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and a 0.08 unit increase in waist-to-height ratio, suggesting that females in the study community have increased risk of having higher BMI and waist-to-height ratio compared to their male counterparts. The ethnicity of respondents did not show a statistically significant association with BMI or with waist-to-height ratio. The religious affiliation of the respondents on the other hand was significantly associated with BMI and waist-to-height ratio. Compared to having no religious affiliation, belonging to the "Other Christian" religious affiliation or being a "Traditionalist or Spiritualist" was associated with increased BMI and waist-to-height ratio (Table 5.8).

Other than having never been married, all other categories of respondents' marital status were associated with increasing BMI and waist-to-height ratio. The magnitude of the increase was highest for formerly married respondents (Table 5.8). How long respondents have been staying in the study communities also exhibited a statistically significant relationship with their BMI and their waist-to-height ratio. Compared to having lived in the community since being born, having lived in the community for 10 years or less was associated with about a 2 kg/m^2 reduction in BMI and a 0.02 unit reduction in waist-to-height ratio. This result suggests that the influence of the built environment on obesity could vary depending on how long people have been exposed to the environmental conditions in the study communities.

The level of education attained by respondents exhibited a statistically significant association with their BMI and waist-to-height ratio (Table 5.8). Compared to having no formal education, completing primary level education was associated with a higher increase in BMI. Similarly, the type of occupation respondents were engaged in was significantly associated with both BMI and waist-to-height ratio and the results show

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similar patterns for both indicators. Working in the sales/service sector was associated with about a 2 kg/m^2 increase in BMI and a 0.03 unit increase in waist-to-height ratio compared to not working. Conversely, being in the "Other" occupational group which includes being a student was associated with a about a 2.6 kg/m^2 reduction in BMI and a 0.03 unit reduction in waist-to-height ratio (Table 5.8).

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Table 5.8: Socio-demographic factors associated with BMI and waist-to-height ratio

	BMI		Waist-to-height ratio	
	Model P-value	**β-estimate (s.e.)**	**Model P-value**	**β-estimate (s.e.)**
Age	**0.0000**	0.174 (0.021)***	**0.0000**	0.0033 (0.0003)***
Sex [Male]	**0.0000**		**0.0000**	
Female		4.146 (0.441)***		0.0815 (0.0065)***
Ethnicity [Ga-Dangme]	**0.3670**		**0.6580**	
Akan		- 0.776 (0.549)		- 0.0063 (0.0085)
Other		- 0.297(0.676)		0.0035 (0.0105)
Religion [No religion]	**0.0186**		**0.0055**	
Catholic		0.689 (1.332)		0.0281 (0.0206)
Protestants		0.918 (1.013)		0.0229 (0.0157)
Pentecostal/Charismatics		1.536 (0.959)		0.0336 (0.0148)*
Other Christian		3.180 (1.171)**		0.0592 (0.0181)**
Moslem		1.107 (1.123)		0.0273 (0.0174)
Traditionalist/Spiritualist		4.563 (1.601)**		0.0824 (0.0247)**
Marital Status [Never married]	**0.0000**		**0.0000**	
Married		2.588 (0.588)***		0.0493 (0.0091)***
Cohabiting		2.696 (0.628)**		0.0421 (0.0097)***
Formerly married		3.551 (0.663)***		0.0547 (0.0102)***
Length of stay in community [Since birth]	**0.0003**		**0.0211**	
≤ 10 years		- 1.937 (0.555)**		- 0.0162 (0.0086)
> 10 years		0.287 (0.565)		0.0101 (0.0088)

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Table 5.8 continued

	BMI		Waist-to-height ratio	
	Model P-value	**β-estimate (s.e.)**	**Model P-value**	**β-estimate (s.e.)**
Highest level of education [No education]	**0.0022**		**0.0005**	
Primary		2.345 (1.101)*		0.0259 (0.0170)
Middle/JHS		0.680 (1.024)		0.0054 (0.0158)
Secondary		- 0.414 (1.067)		- 0.0135 (0.0165)
Higher		- 0.358 (1.451)		- 0.0412 (0.0224)
Occupation [No occupation]	**0.0000**		**0.0000**	
Professional/Technical/Managerial/Clerical		0.320 (1.039)		- 0.0014 (0.0161)
Sales/Services		2.028 (0.753)**		0.0338 (0.0117)**
Manual worker		0.015 (0.794)		0.0031 (0.0123)
Other		- 2.593 (1.003)*		- 0.0325 (0.0156)*

Source: Computed from survey data, November-December, 2011
[ ]: Reference Category s.e.: standard error N=657
*P < 0.05 **P < 0.01 ***P < 0.001

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5.4.2 Lifestyle behaviours and obesity

5.4.2.1 Dietary behaviours and obesity

The diversity of diets consumed by respondents did not show a statistically significant relationship with BMI and waist-to-height ratio (Table 5.9). How often respondents cooked food at home on the other hand was significantly associated with BMI. The results indicate that compared to not cooking, cooking every day of the week was associated with about a 2 kg/m^2 increase in BMI and a 0.037 unit increase in waist-to-height ratio (Table 5.9).

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Table 5.9: Food preparation and dietary practices associated with BMI and waist-to-height ratio

	BMI		Waist-to-height ratio	
	Model P-value	**β-estimate (s.e.)**	**Model P-value**	**β-estimate (s.e.)**
Dietary diversity score	**0.1788**	0.177 (0.131)	**0.1273**	0.0031 (0.0020)
Number of cooking days per week [Never cook]	**0.0400**		**0.0079**	
One day		0.357 (0.916)		0.0069 (0.0142)
Some days		1.022 (0.791)		0.0189 (0.0122)
Everyday		1.996 (0.831)*		0.0370 (0.0128)**
Most often used cooking method [Never cook]	**0.2670**		**0.2595**	
Frying		0.337 (1.216)		0.0152 (0.0188)
Stewing		0.498 (1.338)		0.0198 (0.0207)
Boiling/Steaming		1.318 (0.759)		0.0233 (0.0118)*
Source of obtaining out-of-home cooked food [Outside the community]	**0.3091**		**0.8549**	
From the community		0.583 (0.573)		- 0.0016 (0.0089)

Source: Computed from survey data, November-December, 2011
[ ]: Reference Category s.e.: standard error N = 657
*P < 0.05 **P < 0.01 ***P < 0.001

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5.4.2.2 Physical activity behaviours and obesity

The amount of physical activity involved in the work that respondents do was found to be significantly related to their BMI and their waist-to-height ratio (Table 5.10). The results were however opposite of what was expected. Regardless of the level of activity involved in the work respondents do, there was a 1.6 kg/m^2 to 2.4 kg/m^2 unit increase in BMI (Table 5.10). Similarly, moderate activity was associated with a 0.03 unit increase in waist-to-height ratio compared to not working. Not exerting any physical activity during work was associated with a 0.02 unit increase in waist-to-height ratio compared to not working.

The results in Table 5.10 shows that regardless of the amount of physical activity involved, engaging in some form of leisure-time physical activity is associated with a reduction in BMI and waist-to-height ratio. The magnitude of the reduction was however higher for respondents whose leisure-time physical activities involve high energy expenditure (Table 5.10). Additionally, being a member of a community physical activity group was associated with a 2.9 kg/m^2 and a 0.06 unit reduction in BMI and waist-to-height ratio respectively. The amount of time respondents spent a day in sedentary activities such as watching television was not associated with BMI or waist-to-height ratio (Table 5.10).

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Table 5.10: Physical activity behaviours associated with BMI and waist-to-height ratio

	BMI		Waist-to-height ratio	
	Model P-Value	**β-estimate (s.e.)**	**Model P-Value**	**β-estimate (s.e.)**
Work-related physical activity [Not working]	**0.0016**		**0.0084**	
No activity		1.622 (0.677)*		0.0222 (0.0105)*
Moderate activity		2.426 (0.622)***		0.0330 (0.0097)**
High activity		1.998 (0.952)*		0.0274 (0.0148)
Leisure-time physical activity [No activity]	**0.0000**		**0.0000**	
Moderate activity		- 1.734 (0.554)**		- 0.0406 (0.0084)***
High activity		- 3.087 (0.720)***		- 0.0580 (0.0110)***
Number of hours spent reclining a day [< 1]	**0.2786**		**0.1306**	
1-3		- 0.744 (0.630)		- 0.0140 (0.0098)
> 3		0.011 (0.663)		0.0010 (0.0103)
Membership in community PAG [No community physical activity group]	**0.0014**		**0.0014**	
Yes		- 2.885 (0.798)***		- 0.0563 (0.0123)***
No		- 0.693 (0.492)		- 0.0136 (0.0076)

Source: Computed from survey data, November-December, 2011
[ ]: Reference Category PAG: Physical Activity Group s.e.: standard error N = 657
*P < 0.05 **P < 0.01 ***P < 0.001

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5.4.2.3 Social behaviours and obesity

The results indicate that each additional hour of rest respondents have a day is associated with a 0.3 kg/m^2 reduction in their BMI and a 0.005 unit reduction in their waist-to-height ratio (Table 5.11). Similar to the findings of Amoah (2003), smoking was not significantly associated with BMI, but was significantly associated with waist-to-height ratio. On the other hand, alcohol consumption was not associated with either BMI or waist-to-height ratio (Table 5.11).

5.4.3 Household wealth status and obesity

There was no statistically significant association between the wealth status of the household the respondents belonged to and their BMI or their waist-to-height ratio (Table 5.12). However, even though statistical significance was not achieved, the results indicate that belonging to a household of average wealth status was associated with a decline in both BMI and waist-to-height ratio compared to being a member of a household in the poorest wealth category (Table 5.12).

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Table 5.11: Social behaviours associated with BMI and waist-to-height ratio

	BMI		Waist-to-height ratio	
	Model P-Value	**β-estimate (s.e.)**	**Model P-Value**	**β-estimate (s.e.)**
Hours of rest a day	**0.0104**	- 0.339 (0.132)*	**0.0283**	- 0.0045 (0.0020)*
Current smoking status [Never smoked]	**0.0650**		**0.0295**	
Smokes daily		- 1.868 (1.517)		- 0.0412 (0.0235)
Smoked some days in the last 30 days		- 1.802 (0.750)*		- 0.0263 (0.0116)*
Ever smoked but not in the last 30 days		- 0.899 (1.201)		- 0.0248 (0.0186)
Alcohol consumption [Never consumed alcohol]	**0.1747**		**0.8417**	
Consumed alcohol in the last 24 hours		1.029 (0.675)		0.0059 (0.0105)
Consumes alcohol but not in the last 24 hours		1.075 (0.634)		0.0064 (0.0099)
Consumes alcohol but not in the last 30 days		1.141 (0.612)		0.0078 (0.0095)

Source: Computed from survey data, November-December, 2011
[ ]: Reference Category s.e.: standard error N = 657
*P < 0.05 **P < 0.01 ***P < 0.001

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Table 5.12: Results of a linear regression analysis of the association between respondents' household wealth status and obesity

	BMI		Waist-to-height ratio	
	Model P-Value	**β-estimate (s.e.)**	**Model P-Value**	**β-estimate (s.e.)**
Household wealth status [Poorest]	**0.2348**		**0.5902**	
Poorer		1.329 (0.741)		0.0061 (0.0115)
Average		- 0.064 (0.743)		- 0.0104 (0.0115)
Richer		0.748 (0.752)		0.0052 (0.0117)
Richest		1.000 (0.737)		0.0041 (0.0114)

Source: Computed from survey data, November-December, 2011
[ ]: Reference Category s.e.: standard error N = 657
*P < 0.05 **P < 0.01 ***P < 0.001

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5.5 Discussion

The aim of the analysis in this chapter was to examine the characteristics of the respondents and their association with obesity. The socio-demographic characteristics of the study sample reflects the national population characteristics. The sample is made up of slightly more females than males (Ghana Statistical Service, 2013). More than half of the respondents have lived in the community since their birth and more than half were Gas. The dominance of Gas could probably be because the study area is an indigenous Ga community (Robertson, 1984) with recent in-migration of people of other ethnic groups. The distribution of the study sample by socio-economic status indicators (level of education and type of occupation) shows close to half of the sample completing basic education with very few of them having completed tertiary level of education. The low level of education probably explains why a greater proportion of them are employed in the sales/service sector (Ghana Statistical Service, 2013).

The food preparation patterns reported by the respondents is similar to that reported in other urban areas (Nugent, 2008). Just a little over a quarter of the respondents in the current study reported cooking food at home every day of the week day while about one-tenth of them reported never cooking food at home. In urban areas such as the setting of this study, a number of factors explain why people do not cook food at home but rather depend on out-of-home cooked foods (Scott et al., 2012). Among the urban poor, it is economically cheaper for people to buy out-of-home cooked food than to cook food at home (Micklesfield et al., 2013). The economic advantage of buying out-of-home cooked food over cooking at home was cited in the focus groups as one of the reasons why people in the study area did not often cook food at home. Other reasons that were also cited include

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lack of time to cook and lack of a cooking space. The high dependence on out-of-home cooked foods could have implications for obesity among the study sample.

Based on their reports of physical activity, the study sample can be described as sedentary as has been observed among urban populations in other sub-Saharan African countries (Assah et al., 2009). About two-thirds of the sample reported not engaging in leisure-time physical activity and about one-third of them spent more than three hours in a day being idle. On the work front, only about one-tenth of the sample reported their work involving highly intense physical activity. Similar low levels of physical activity have been reported in other urban areas of developing countries due to changing modes of transportation (from walking to motorised means of transportation), increasing sedentary nature of jobs and technology inclined leisure-time physical activity e.g. watching television (Abubakari et al., 2008).

The results demonstrate the expected relationship between age and obesity (Swinburn et al., 2011). Similar to the results of other studies conducted in Ghana (Amoah, 2003), BMI was found to increase as age increases. The results also reveal the increased risk of obesity for females compared to males as has been found in other studies (Swinburn et al., 2011; Abubakari et al., 2008). The relationship between education and obesity in the current study is contrary to the results of other studies conducted in Ghana (Amoah, 2003, Biritwum et al., 2005) and other sub-Saharan African countries (Cohen et al., 2013).

In the sub-Saharan Africa region, there is a reported direct relationship between education and obesity (Micklesfield et al., 2013). Having high levels of education is associated with increased odds of obesity (Cohen et al., 2013). A contrary pattern was

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however realised in this study. Primary level of education was associated with about 2 kg/m^2 increase in BMI compared to having no formal education. This reverse relationship between education and obesity has also been reported in other regions of sub-Saharan Africa (Micklesfield et al., 2013). This result points to the changing and complex dynamics of the relationship between socio-economic status and obesity in developing countries (Scott et al., 2012).

The benefit of having sufficient rest playing a protective role against obesity (Knutson, 2012) was observed in this study. The respondents reported having an average of seven and half hours of rest a day and each additional hour of rest respondents' had was found to be associated with a significant reduction in their BMI and waist-to-height ratio. Alcohol consumption did not show a statically significant influence on neither BMI nor waist-to-height ratio.

Similar to other study findings, smoking was not significantly associated with BMI (Amoah, 2003) but was significantly associated with waist-to-height ratio. The association between smoking and obesity is complex. Studies show that former smokers are more likely to be overweight or obese compared to those who have never smoked (Kruger et al., 2009). Former smokers have also been found to have higher BMI values than non-smokers (Healthon et al., 2006). On the other hand, there is a reported lower risk of overweight and obesity among current smokers compared to non-smokers (Hou et al., 2008; Biritwum et al., 2005).

The complexity of the relationship between smoking and obesity is explained by biologic and physiologic changes associated with smoking. Cigarette smoking has been

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found to be closely related to eating practices; people who smoke have a suppressed appetite for food which results in weight loss (Maletnlema, 2002). Cessation of smoking (or nicotine withdrawal) can lead to symptoms of irritability, anxiety, restlessness, depression, sleep disturbance and increased appetite which lead to increased intake of food (Kruger et al., 2009). Increased intake of food influences weight gain through the accumulation of excess calories which increases the risk of obesity.

5.5 Conclusion

In this chapter, the relationship between the characteristics of the respondents and the dependent variables (BMI and waist-to-height ratio) were analysed to examine which variables were significantly associated with (rather than just correlated with) the dependent variables. The same set of socio-demographic variables (age, sex, religion, marital status, length of stay in the community, level of education attained and occupation) and lifestyle behaviours (number of cooking days per week, work-related physical activity, leisure time physical activity, membership in a community physical activity group and hours of rest a day) were found to be significantly related with BMI and waist-to-height ratio. Smoking was found to be significantly associated with waist-to-height ratio but not BMI. The pattern of association between the socio-demographic characteristics and the lifestyle behaviours of the respondents were similar for both BMI and waist-to-height ratio.

At the next stage of the analysis, the socio-demographic characteristics and lifestyle behaviours found to be significantly associated with BMI and waist-to-height ratio are included in a multilevel model as Level 1 factors to examine their influence on obesity. The measures of the built environment which represent the Level 2 factors are also included

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in the multilevel model to examine the influence of both the community and individual level factors on obesity. The results of the multilevel analysis are presented in the next chapter.

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CHAPTER SIX

COMMUNITY AND INDIVIDUAL PREDICTORS OF OBESITY

6.0 Introduction

In this chapter, the influence of the measures of the built environment on obesity is examined in a multilevel model with BMI and waist-to-height ratio as the outcome variables. The measures of the built environment constitute the Level 2 factors while the significant individual socio-demographic characteristics and lifestyle behaviours constitute the Level 1 factors. Table 6.1 shows how the measures of the built environment and the other variables are used in the multilevel model.

The multilevel model is specified in three steps: the first model (Model 1) is the null model, the second set of models (Model 2) examine the independent effects of the Level 2 factors (i.e. the measures of the built environment) on BMI and waist-to-height ratio. The third set of models (Model 3) examine the combined effect of the Level 2 and Level 1 factors on BMI and waist-to-height ratio, controlling for community characteristics and individual characteristics (Table 6.1). The results displayed in the tables show the estimates of the measures of the built environment and the estimates of the Level 1 predictors that were significant. Variables that were also included in the model but were not significant predictors are shown below the table.

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Table 6.1: A matrix showing how the predictor variables are used in the multilevel model

Level 2 Variables (Measures of the built environment)		
Food environment	***Physical activity environment***	***Social environment***
Number of out-of-home cooked foods	Presence of a physical activity space	Perception about community ideal body size
Number of convenience stores		
Number of fruit and vegetable stands		
Level 1 Variables (Lifestyle behaviours)		
Dietary behaviours	***Physical activity behaviours***	***Social behaviours***
Number of cooking days per week	Work related physical activity	Hours of rest a day
	Leisure time physical activity	Smoking status*
	Membership in community PAG	
Control variables		
Individual characteristics	***Community Characteristics***	
Age	Crime level	
Sex	Social cohesion	
Marital status	Trust among community members	
Religious affiliation	Population density	
Length of stay in the community		
Level of education		
Occupation		

PAG: Physical Activity Group

* Applicable only to the waist-to-height ratio model

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6.1 The influence of the built environment on BMI

Table 6.2 presents the results of a linear mixed effects model with BMI as the outcome variable. The random effects component of the model shows that the BMI of the respondents is influenced by factors at both the community and individual levels. Thus the variations in BMI among the study sample can be decomposed into between EAs variance and variance among individuals. The intra-class correlation co-efficient (ICC) from Model 1 indicates that approximately 4 percent of the variation in BMI is due to differences between EAs.

The results from Model 2 show the effect of the measures of the built environment on BMI independent of the community and individual control variables. The results show marginal effects of out-of-home cooked food places and convenience stores on BMI with the former decreasing BMI and the latter increasing BMI. The perception about the community ideal body size also showed a marginal positive influence on BMI. Although statistical significance was not achieved the presence of a physical activity space in the EA was associated with a 1 kg/m^2 reduction in BMI.

After controlling for individual and community characteristics, out-of-home cooked foods and convenience stores were observed to significantly influence BMI (Model 3, Table 6.2). The results show that each additional out-of-home cooked food place located in the EA decreases BMI by 0.07 kg/m^2 while each additional convenience store increases BMI by about 0.2 kg/m^2. The presence of a physical activity space in the EA was associated with a 0.4 kg/m^2 reduction in BMI although this was not statistically significant.

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Of all the individual characteristics included in the model age, sex, religious affiliation, length of stay in the community and level of education were the only significant predictors of BMI (Table 6.2, Model 3). Each additional increase in the age of respondents was associated with a 0.15 kg/m^2 increase in their BMI. Compared to being a male, being a female was associated with a 4 kg/m^2 increase in BMI. Being a Pentecostal/Charismatic Christian was associated with a 2.2 kg/m^2 increase in BMI compared to having no religious affiliation.

Having lived in the community for less than or up to ten years was associated with a 1.6 kg/m^2 reduction in BMI compared to having lived in the community since birth. The results with regards to education reveals about a 3 kg/m^2 higher BMI for those who have completed primary level education compared to their counterparts who have no formal education (Table 6.2, Model 3).

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Table 6.2: Results of a multilevel model examining the influence of the built environment on BMI

	Model 1 (Null Model)	Model 2 (Unadjusted Model)	Model 3 (Adjusted Model)
	β-estimate (s.e.)	β-estimate (s.e.)	β-estimate (s.e.)
Intercept	25.613 (0.329)***	24.846 (1.242)***	17.266 (2.409)***
Fixed effects			
Level 2 covariates			
Number of out-of-home cooked foods		- 0.074 (0.038)$^{+}$	- 0.074 (0.036)*
Number of convenience stores		0.167 (0.100)$^{+}$	0.188 (0.092)*
Number of fruit and vegetable stands		0.102 (0.111)	0.052 (0.109)
Physical activity space [Absent]			
Present		- 1.097 (0.671)	- 0.358 (0.781)
Perception about community ideal body size		0.172 (0.098)$^{+}$	- 0.054 (0.091)
Crime			0.979 (0.627)
Social cohesion			0.439 (1.804)
Trust			3.073 (2.144)
Level 1 covariates			
Age			0.148 (0.028)***
Sex [Male]			
Female			4.193 (0.504)***
Religion [No religion]			
Catholic			- 0.247 (1.220)
Protestants			0.045 (0.931)
Pentecostals/Charismatics			0.465 (0.892)
Other Christian			2.187 (1.073)*
Moslem			0.893 (1.038)
Traditionalist/Spiritualist			2.670 (1.448)$^{+}$

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Table 6.2 continued

	Model 1 (Null Model)	Model 2 (Unadjusted Model)	Model 3 (Adjusted Model)
	β-estimate (s.e.)	**β-estimate (s.e.)**	**β-estimate (s.e.)**
Length of stay in community [Since birth]			
≤ 10 years			- 1.633 (0.540)**
> 10 years			- 0.432 (0.526)
Level of education [No education]			
Primary			2.566 (0.988)**
Middle/JHS			1.542 (0.942)
Secondary			1.704 (1.012)+
Higher			2.310 (1.392)+
Random effects			
Intra EA variance	1.480 (0.972)	1.235 (0.928)	0.816 (0.861)
Individual variance	34.723 (1.973)	34.574 (1.960)	26.388 (1.543)
Intra-Class Correlation Coefficient (ICC)	**4.09%**	**3.45%**	**3.00%**

Source: Computed from GPS and Survey data
[ ]: Reference Category s.e.: standard error
+ P <0.10 *P < 0.05 **P < 0.01 ***P < 0.001
Note: Model 3 includes marital status, occupation, work related physical activity, leisure time physical activity, hours of rest a day, number of cooking days a week and population density

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6.2 The influence of the built environment on waist-to-height ratio

The results of the waist-to-height ratio model are presented in Table 6.3. The intra-class correlation co-efficient (ICC) from the null model (4.26%) was slightly higher than that from the BMI model (4.09%). The random effects component show that the waist-to-height ratio of respondents is influenced by factors at both the community and individual levels. The measures of the built environment however, did not significantly predict waist-to-height ratio either independently or after controlling for the individual and community characteristics (Table 6.3).

Although the results were not statistically significant, the influence of the measures of the built environment were similar to that observed in the BMI model. Each additional out-of-home cooked food place located in the EA was associated with a decline in waist-to-height ratio while each additional convenience store located in the EA was associated with an increase in waist-to-height ratio (Table 6.3, Model 2 and Model 3). The presence of a physical activity space was also associated with a decline in waist-to-height ratio; though statistical significance was not achieved.

Age, sex, religious affiliation and level of education were the only significant individual characteristics in the full model (i.e. Model 3, Table 6.3). Similar to the pattern of results obtained from the BMI model, each additional increase in age was associated with a corresponding increase in waist-to-height ratio ($\beta = 0.0034$) and being female was associated with a 0.083 unit increase in waist-to-height ratio compared to being male. Completing primary level education was associated with an approximate 0.04 unit increase in waist-to-height ratio compared to having no formal education (Table 6.3, Model 3).

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Table 6.3: Results of a multilevel model examining the influence of the built environment on waist-to-height ratio

	Model 1 Null Model β-estimate (s.e.)	Model 2 Unadjusted Model β-estimate (s.e.)	Model 3 Adjusted Model β-estimate (s.e.)
Intercept	0.5038 (0.0051)***	0.4850 (0.0198)***	0.3418 (0.0338)***
Fixed effects			
Level 2 covariates			
Number of out-of-home cooked foods		- 0.0010 (0.0006)	- 0.0008 (0.0006)
Number of convenience stores		0.0014 (0.0016)	0.0019 (0.0015)
Number of fruit and vegetable stands		0.0027 (0.0018)	0.0013 (0.0018)
Physical activity spaces [Absent]			
Present		- 0.0109 (0.0109)	- 0.0075 (0.0130)
Perception about community ideal body size		0.0038 (0.0015)	- 0.0002 (0.0013)
Crime			0.0019 (0.0105)
Social cohesion			- 0.0158 (0.0299)
Trust			0.0312 (0.0359)
Level 1 covariates			
Age			0.0034 (0.0004)***
Sex [Male]			
Female			0.0830 (0.0074)***
Religion [No religion]			
Catholic			0.0126 (0.0176)
Protestants			0.0117 (0.0134)
Pentecostals/Charismatics			0.0208 (0.0128)
Other Christian			0.0440 (0.0154)**
Moslem			0.0239 (0.0149)
Traditionalist/Spiritualist			0.0479 (0.0210)*

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Table 6.3 continued

	Model 1 Null Model	Model 2 Unadjusted Model	Model 3 Adjusted Model
	β-estimate (s.e.)	**β-estimate (s.e.)**	**β-estimate (s.e.)**
Level of education [No education]			
Primary			0.0368 (0.0143)*
Middle/JHS			0.0269 (0.0136)+
Secondary			0.0272 (0.0146)+
Higher			0.0183 (0.0202)
Random effects			
Intra EA variance	0.0004 (0.0002)	0.0004 (0.0002)	0.0003 (0.0002)
Individual variance	0.0083 (0.0005)	0.0082 (0.0005)	0.0055 (0.0003)
Intra-Class Correlation Coefficient (ICC)	**4.26%**	**4.17%**	**5.53%**

Source: Computed from GPS and Survey data
[ ]: Reference Category s.e.: standard error
+ P <0.10 *P < 0.05 **P < 0.01 ***P < 0.001
Note: Model 3 includes marital status, occupation, work related physical activity, leisure time physical activity, hours of rest a day, smoking, number of cooking days a week and population density

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6.3 Discussion

The results from the multilevel models show that some aspects of the built environment significantly influence BMI. The number of out-of-home cooked food places and convenience stores located in the EA were found to exhibit a statistically significant influence on BMI. The relationship between out-of-home cooked foods and BMI (and waist-to-height ratio even though this was not significant) was opposite of what was hypothesised. Instead of the hypothesised direct relationship between the number of out-of-home cooked food places and BMI, a reverse association was realised.

Out-of-home cooked foods often contribute to obesity because these foods are generally more salty, fatty, energy dense and of less nutritional quality compared to home cooked foods (Finkelstein et al., 2005); explaining why such foods contribute to weight gain. However, the relationship between the number of out-of-home cooked food places and BMI as was found in this study suggests that increasing number of out-of-home cooked food places may not necessarily contribute to weight gain as has been reported in other studies (Abubakari et al., 2008).

The out-of-home cooked foods available in the study community consist of a variety of different food types including traditional staple foods such as keneky, banku and fufu and western type foods including fried rice and instant noodles. Most of the traditional staple foods are made from whole unpolished ingredients which probably makes them less obesogenic (Popkin et al., 2012). Also, even though the out-of-home cooked foods are being sold commercially, their preparation may not be different from how home foods are prepared. The out-of-home cooked foods were also mostly prepared with ingredients used for home food preparation. The out-of-home cooked foods in the study communities may

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thus not have obesogenic characteristics typical of commercially prepared foods. There is the need for further research to examine the relationship between out-of-home cooked foods and obesity among the study population. Such studies should focus on examining the nutritional composition of the out-of-home cooked foods available in the study community and whether or not these foods contribute to weight gain.

The study findings support the hypothesised relationship between convenience stores and BMI. The food resources available in convenience stores are mostly processed foods with high caloric value (Renzaho, 2004). These foods are typically obesogenic and this probably explains why having more convenience stores in the community is associated with increasing BMI. In urban poor areas such as the setting for this study, the availability of convenience foods increases the susceptibility of residents to obesity. This is because in such areas, convenience foods tend to be more common and less expensive than fresh food options such as fruits and vegetables (Nugent, 2008; Misra and Khurana, 2008; Renzaho, 2004). The limited options for healthy foods and the availability and affordability of unhealthy options such as convenience foods potentially explain why increasing number of convenience stores in the study area contribute to increasing BMI.

A number of studies in other context have found a significant association between the physical activity environment and obesity (Oyeyemi et al., 2012a). However, in this current study, even though the presence of a physical activity space was associated with a reduction in BMI and waist-to-height ratio, this relationship was not statistically significant. This finding is similar to the findings of Mendes et al. (2013) among an urban population in Belo Horizonte in Brazil. In their study, Mendes et al. found that even though the presence of parks/public squares/places for practicing physical activity was associated

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with lower prevalence ratios for overweight/obesity, the relationship was not statistically significant.

The EA average crime level did not significantly predict BMI or waist-to-height even though community crime level has been reported to be associated with obesity in several other studies (Nugent, 2008; Gordon-Larsen et al., 2006). This finding is similar to the findings of a study conducted among adults in Nigeria where perception of high crime rate was not significantly related to overweight among participants who resided in neighbourhoods of low socio-economic status (Oyeyemi et al., 2012a). During the focus group discussions for this current study, the participants indicated that crime was not a major problem in their community. This probably explains why crime was not a significant predictor in the quantitative analysis.

6.4 Conclusion

The results of the analysis in this chapter provide supporting evidence that obesity in this urban poor setting is an outcome of factors at both the community and individual levels. While some features of the built environment exert a significant influence on BMI, there was no such influence on waist-to-height ratio. The results also show mixed patterns in the influence of the food environment on BMI.

There was a negative relationship between the number of out-of-home cooked food places available in the EA and BMI. This relationship was marginally significant independent of other individual factors but statistically significant after controlling for individual and community factors. Furthermore, the results reveal a positive relationship

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between the number of convenience stores available in the EA and BMI. This relationship was marginally significant in the absence of individual characteristics and community controls but statistically significant in the presence of the community and individual control factors.

The study findings highlight the point that obesity is an outcome of a complex interaction between factors operating at different levels; at the community (i.e. the EA level) and individual levels in the case of this study. Obesity research and interventions aimed at reducing obesity in developing countries, particularly in urban poor settings need to focus not only on individual characteristics but also on factors in the built environment that increases the risk of obesity among the urban poor. For example, the availability of convenience stores in urban poor settings constitutes a potential risk for obesity as demonstrated in this study.

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CHAPTER SEVEN

GENDER DIFFERENCES IN THE INFLUENCE OF THE BUILT ENVIRONMENT ON OBESITY

7.0 Introduction

The sex distribution of obesity globally and in the sub-Saharan Africa region shows a disproportionately high prevalence among females compared to males (Abubakari et al., 2008). In a review of the relationship between socio-economic status and obesity in developing countries, Monteiro et al. (2004) concluded that, obesity is as much a problem among low income groups as it is among high income groups and that women are more affected than men. While differences in socio-economic status and levels of physical activity have been cited as some of the possible reasons for the high prevalence of obesity among women and men, the built environment has also been found to influence obesity differently for men and women (Kanter and Caballero, 2012).

This aim of the analysis in this chapter is to examine the differences in the influence of the built environment on obesity for females and males living in the same built environment. The results are presented under three main sub-sections. The first sub-section examines the differences in the socio-demographic characteristics and lifestyle behaviours of females and males. The second sub-section examines gender differences in the relationship between the socio-demographic characteristics and life style behaviours and obesity. In the third sub-section, the influence of the built environment on obesity is examined for females and males in separate multilevel models.

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7.1 Socio-demographic characteristics and life style behaviours of females and males

7.1.1 Differences in socio-demographic characteristics

The average age of the females and males did not differ much (Table 7.1). The males were just about a year older on average than their female counterparts. A higher proportion of males compared to females were Gas. Among both males and females, those who belong to the Pentecostal/Charismatic religious affiliation formed the highest proportion with the proportion being higher among females compared to males.

With regards to marital status, while about two-fifths of the males were not married just about one-third of their female counterparts were not married. On the other hand, a higher proportion of females compared to their male counterparts were previously married. Regarding how long respondents have stayed in the study community, a greater proportion of the males compared to females reported having lived in the study area since their birth. About one-third of the female respondents reported having no children while another one-third had one or two children. Also, 1 in 3 of the women reported having three or more children (Table 7.1).

The results show sex disparities in educational attainment (Table 7.1). Three times more females compared to males had no formal education. On the other hand, about seven times more males compared to females have completed tertiary level education. The results also show that, about equal proportions of males and females reported having completed middle/JHS primary level education (Table 7.1).

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Table 7.1: Differences in socio-demographic characteristics of respondents by sex

Continuous variable	**Females**	**Males**
Age	**Mean (std dev)**	**Mean (std dev)**
	31.06 (9.56)	31.90 (11.42)
Categorical variables	**Percentage (N)**	**Percentage (N)**
Ethnicity		
Ga-Dangme	54.37 (193)	63.58 (192)
Akan	27.89 (99)	24.50 (74)
Other	17.75 (63)	11.92 (36)
Religion		
No religion	5.07 (18)	8.94 (27)
Catholic	5.35 (19)	5.63 (17)
Protestants	21.41 (76)	24.50 (74)
Pentecostal/Charismatics	44.79 (159)	36.75 (111)
Other Christian	9.01 (32)	9.60 (29)
Moslem	11.27 (40)	11.59 (35)
Traditionalist/Spiritualist	3.10 (11)	2.98 (9)
Marital Status		
Never married	33.24 (118)	44.04 (133)
Married	25.07 (89)	24.17 (73)
Cohabiting	21.13 (75)	18.87 (57)
Formerly married	20.56 (73)	12.91 (39)
Length of stay in community		
Since birth	40.56 (144)	46.36 (140)
≤ 10 years	30.99 (110)	27.15 (82)
> 10 years	28.45 (101)	26.49 (80)
Parity		
0	31.27 (111)	NA
1-2	35.77 (127)	NA
3+	32.96 (117)	NA
Highest level of education		
No education	8.17 (29)	2.98 (9)
Primary	25.63 (91)	11.26 (34)
Middle/JHS	45.35 (161)	44.37 (134)
Secondary	19.72 (70)	32.78 (99)
Higher	1.13 (4)	8.61 (26)
Occupation		
No occupation	12.39 (44)	10.93 (33)
Professional/Technical/Managerial/Clerical	4.23 (15)	12.91 (39)
Sales/Services	56.06 (199)	27.15 (82)
Manual worker	20.85 (74)	36.42 (110)
Other	6.48 (23)	12.58 (38)
Total	**100.00 (355)**	**100.00 (302)**

Source: Computed from survey data, November-December, 2011 NA: Not applicable

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A slightly higher proportion of female respondents compared to their male counterparts were not working while about three times more males compared to females worked in professional/technical/managerial/clerical types of jobs. Females dominated sales/service sector jobs while their male counterparts dominated jobs that involved exerting energy (i.e. the manual work category).

7.1.2 Differences in lifestyle behaviours between females and males

In this section, the gender differences in lifestyle behaviours were examined. Three main lifestyle behaviours; (1) dietary behaviours (inducing dietary diversity and food preparation practices), (2) physical activity behaviours and (3) social behaviours were examined.

7.1.2.1 Dietary behaviours

7.1.2.1.1 Differences in dietary diversity

The dietary patterns of females and males did not vary much (Table 7.2). All the male respondents and almost all the female respondents reported eating foods from the starchy staples food group. Among females and males, dark green leafy vegetables were reported to be the least consumed food group. On average, both males and females consumed foods from about seven food groups.

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Table 7.2: Differences in the diversity of diets consumed by female and male respondents

	Females		Males	
	Percentage (Number) who		Percentage (Number) who	
	Consumed	Did not consume	Consumed	Did not consume
Components of dietary diversity score				
Starchy staples	99.72 (354)	0.28 (1)	100.00 (302)	0.00 (0)
Dark green leafy vegetable	54.93 (195)	45.07 (160)	52.98 (160)	47.02 (142)
Vitamin A rich fruits and vegetables	82.25 (292)	17.75 (63)	80.79 (244)	19.21 (58)
Other fruits and vegetables	91.83 (326)	8.17 (29)	93.05 (281)	6.95 (21)
Meat and fish	97.18 (345)	2.82 (10)	95.70 (289)	4.30 (13)
Eggs	77.46 (275)	22.54 (80)	69.87 (211)	30.13 (91)
Legumes nuts and seeds	61.97 (220)	38.03 (135)	60.93 (184)	39.07 (118)
Milk and milk products	63.38 (225)	36.62 (130)	55.96 (169)	44.04 (133)
Fats and oils	68.17 (242)	31.83 (113)	67.55 (204)	32.45 (98)
Dietary diversity score (Continuous)	**Mean**	**Standard deviation**	**Mean**	**Standard deviation**
	6.97	1.75	6.77	1.82
Dietary diversity score (Categorical)	**Percentage**	**Number**	**Percentage**	**Number**
0	0.28	1	-	-
1	0.56	2	0.66	2
2	1.13	4	2.32	7
3	1.69	6	1.99	6
4	6.48	23	6.29	19
5	8.45	30	10.93	33
6	14.08	50	18.87	57
7	24.79	88	19.54	59
8	20.00	71	18.87	57
9	22.54	80	20.53	62
Total	**100.00**	**355**	**100.00**	**302**

Source: Computed from survey data, November-December, 2011

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7.1.2.1.2 Differences in food preparation and dietary practices

The results show that a higher proportion of males compared to females tend to never cook (Table 7.3). Also, compared to their female counterparts, a lesser proportion of males reported cooking food at home every day of the week. For both males and females, boiling or steaming was the most often used cooking method. Majority of both males and females reported buying out-of-home cooked food from their community rather than from outside their community. The proportion of female respondents who reported buying out-of-home cooked foods from within the community was slightly higher compared to their males counterparts (Table 7.3).

Table 7.3: Differences in food preparation practices between females and males

	Females Percentage (Number)	**Males** Percentage (Number)
Number of cooking days per week		
Never cook	5.92 (21)	16.56 (50)
One day	16.34 (58)	15.89 (48)
Some days	45.07 (160)	43.05 (130)
Everyday	32.68 (116)	24.50 (74)
Most often used cooking method		
Never cook	5.92 (21)	16.56 (50)
Frying	5.07 (18)	6.29 (19)
Stewing	4.51 (16)	3.97 (12)
Boiling/Steaming	84.51(300)	73.18 (221)
Source of obtaining out-of-home cooked food		
Outside the community	19.44 (69)	23.18 (70)
From the community	80.56 (286)	76.82 (232)
Total	**100.00 (355)**	**100.00 (302)**

Source: Computed from survey data, November-December, 2011

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7.1.2.2 Differences in physical activity behaviours

With regards to the amount of physical activity involved in the work they do, about one-third of the male respondents indicated that their jobs did not require them to exert energy compared to a quarter of their female counterparts (Table 7.4). On the other hand, a higher proportion of females compared to males reported that their jobs involve moderate physical activity; while about half of the females reported that their jobs involved exerting moderate physical energy just a little over a third of their male counterparts reported so (Table 7.4).

With regards to leisure-time physical activity, females tend to be more sedentary compared to males. About twice as many females compared to males do not engage in leisure-time physical activity (Table 7.4). Similarly, about five times as many males compared to females engage in leisure time physical activities that involve expending high levels of energy. Almost equal proportions of males and females reported similar patterns of sedentary activity; about one-third of both females and males reported spending more than three hours in a day reclining or watching television.

More than half of the females reported that there were no physical activity groups in their community compared to about 2 in 5 of their male counterparts. About equal proportions of females and males said they were not members of community physical activity group whereas about four times as many males compared to females reported being members of a community physical activity group (Table 7.4).

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Table 7.4: Differences in physical activity behaviours between females and males

	Females	Males
	Percentage (Number)	**Percentage (Number)**
Work related physical activity		
Not working	19.72 (70)	21.19 (64)
No activity	24.79 (88)	31.13 (94)
Moderate activity	48.85 (172)	37.75 (114)
High activity	7.04 (25)	9.93 (30)
Leisure-time physical activity		
No activity	81.13 (288)	44.37 (134)
Moderate activity	14.65 (52)	34.11 (103)
High activity	4.23 (15)	21.52 (65)
Number of hours spent reclining a day		
< 1	20.28 (72)	18.87 (57)
1-3	45.07 (160)	47.68 (144)
> 3	34.65 (123)	33.44 (101)
Membership in community PAG group		
No community PAG	55.21 (196)	42.72 (129)
Yes	4.79 (17)	16.56 (50)
No	40.00 (142)	40.73 (123)
Total	**100.00 (355)**	**100.00 (302)**

Source: Computed from survey data, November-December, 2011
PAG: Physical Activity Group

7.1.2.2 Differences in social behaviours

The results in Table 7.5 show that the number of hours respondents rested a day did not differ much between female and male respondents. Both females and males reported about similar average hours of rest a day. Smoking was generally low among the study sample and it was found to be more common among males than females (Table 7.5). About 1 in 10 females and a little over 1 in 10 of their male counterpart reported smoking some days in the last 30 days prior to the survey. Similarly, alcohol consumption was more common among males than among females. The proportion of male respondents who

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reported consuming alcohol in the last 24 hours immediately preceding the survey was about 9 percentage points higher than that of their female counterparts.

Table 7.5: Differences in social behaviours between females and males

	Females	**Males**
Continuous variable	**Mean (Std. dev.)**	**Mean (Std. dev.)**
Hours of rest a day	7.60 (1.71)	7.36 (1.83)
Categorical variables	**Percentage (N)**	**Percentage (N)**
Current smoking status		
Never smoked	88.73 (315)	75.50 (228)
Smokes daily	0.28 (1)	4.97 (15)
Smoked some days in the last 30 days	9.86 (35)	12.25 (37)
Ever smoked but not in the last 30 days	1.13 (4)	7.28 (22)
Alcohol consumption		
Never consumed alcohol	39.15 (139)	31.13 (94)
Consumed alcohol in the last 24 hours	13.80 (49)	23.18 (70)
Consumes alcohol but not in the last 24 hours	22.54 (80)	20.53 (62)
Consumes alcohol but not in the last 30 days	24.51 (87)	25.17 (76)
Total	**100.00 (355)**	**100.00 (302)**

Source: Computed from survey data, November-December, 2011
N: Number Std. dev.: Standard deviation

7.1.3 Differences in household wealth status among females and males

The results shown in Table 7.6 reveal that, a higher proportion of females compared to males belong to the poorest and poorer households while a slightly higher proportion of males compared to females belonged to households of average wealth status. A greater proportion of males compared to females (23.18% versus 15.77%) belonged to households in the richer category.

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Table 7.6: Differences in household wealth status between females and males

	Females	Males
Household wealth status	**Percentage (N)**	**Percentage (N)**
Poorest	23.23 (86)	13.91 (42)
Poorer	21.41 (76)	19.21 (58)
Middle	19.15 (68)	21.19 (64)
Richer	15.77 (56)	23.18 (70)
Richest	19.44 (69)	22.52 (68)
Total	**100.00 (335)**	**100.00 (302)**

Source: Computed from survey data, November-December, 2011

7.2 Factors associated with obesity among females and males

The relationship between respondents' socio-demographic characteristics and obesity (BMI and waist-to-height ratio) were examined separately for females and males. Bivariate linear regressions examining the relationship between each socio-demographic variable and the measures of obesity (BMI and waist-to-height ratio) were specified for females and males. The relationship between the lifestyle behaviours and obesity were also examined for females and males.

7.2.1 Factors associated with BMI

7.2.1.1 Socio-demographic factors associated with BMI

The result with regards to age shows a statistically significant and consistent relationship with obesity among both males and females. The magnitude of the increase in BMI for each unit increase in age was higher for females than males (Table 7.7). Ethnicity was not significantly associated with obesity among males and females alike. The religious affiliation of females exhibited a statistically significant influence on their BMI while for their male counterparts there was no significant influence.

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Marital status was significantly associated with obesity among both males and females (Table 7.7). Among females, being formerly married was associated with 4 kg/m^2 increase in BMI compared to being never married while among males, being married was associated with close to a 3 kg/m^2 increase in BMI compared to being never married. The duration of stay in the study community was a significant determinant of BMI for females but not for males. Compared to having lived in the community since birth, having lived in the community for ten years or less was associated with a 3.2 kg/m^2 reduction in BMI for females. The number of children women have had was associated with an increase in BMI (Table 7.7). The magnitude of increase was highest for women who have had three or more children compared to their counterparts who have not had children.

The level of education attained by males and females was not significantly associated with their BMI. The type of occupation they were involved in was however, significantly associated with the BMI of both males and females. Among females, being in the "Other" category was associated with a 4 kg/m^2 reduction in BMI compared to not working while among males, being a manual worker was associated with about a 1.6 kg/m^2 increase in BMI compared to not working. Working in the sales/service sector was also associated with a 1.7 kg/m^2 increase in BMI compared to not working.

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Table 7.7: Socio-demographic factors associated with BMI among females and males

	Females		Males	
	Model P-value	**β-estimate (s.e.)**	**Model P-value**	**β-estimate (s.e.)**
Age	**0.0000**	0.273 (0.035)***	**0.0000**	0.106 (0.017)***
Ethnicity [Ga-Dangme]	**0.1968**		**0.2770**	
Akan		- 1.318 (0.849)		- 0.804 (0.502)
Other		- 1.330 (0.998)		- 0.173 (0.666)
Religion [No religion]	**0.0079**		**0.2529**	
Catholic		- 0.724 (2.227)		1.288 (1.132)
Protestants		0.595 (1.774)		0.467 (0.822)
Pentecostal/Charismatics		1.247 (1.684)		0.284 (0.785)
Other Christian		3.719 (1.995)		1.636 (0.978)
Moslem		- 0.325 (1.921)		1.706 (0.937)
Traditionalist/Spiritualist		7.177 (2.591)**		0.158 (1.408)
Marital Status [Never married]	**0.0003**		**0.0000**	
Married		2.182 (0.945)*		2.522 (0.514)***
Cohabiting		2.788 (0.993)**		1.852 (0.558)**
Formerly married		4.206 (1.002)***		0.660 (0.642)
Length of stay in community [Since birth]	**0.0001**		**0.1966**	
≤ 10 years		- 3.243 (0.851)***		- 0.917 (0.509)
> 10 years		0.287 (0.872)		- 0.259 (0.513)
Parity [0]	**0.0000**			
1-2		3.415 (0.851)***		NA
3+		5.374 (0.867)***		NA

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Table 7.7 continued

	Females		Males	
	Model P-value	**β-estimate (s.e.)**	**Model P-value**	**β-estimate (s.e.)**
Highest level of education [No education]	**0.0543**		**0.9711**	
Primary		3.015 (0.851)*		0.927 (1.383)
Middle/JHS		1.911 (1.378)		0.584 (1.271)
Secondary		0.654 (1.508)		0.553 (1.285)
Higher		7.194 (3.643)*		0.581 (1.427)
Occupation [No occupation]	**0.0083**		**0.0116**	
Professional/Technical/Managerial/Clerical		2.155 (2.029)		1.586 (0.855)
Sales/Services		1.243 (1.131)		1.660 (0.745)*
Manual worker		- 0.253 (1.291)		1.567 (0.717)*
Other		- 3.864 (1.746)*		- 0.310 (0.860)

Source: Computed from survey data, November-December, 2011
N (Females) = 355 N (Males) = 302
[ ]: Reference Category s.e.: standard error NA: Not Applicable
*P < 0.05 **P < 0.01 ***P < 0.001

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7.2.1.2 Lifestyle behaviours associated with BMI

7.2.1.2.1 Dietary behaviours associated with BMI

The results suggest that the diversity of diets consumed by females and males was not associated with their BMI (Table 7.8). How often females and males cooked food at home was also not significantly associated with their BMI, neither was the method they most often used in cooking. The sources of obtaining out-of-home cooked foods (whether from the community or from outside the community) was also not associated with the BMI of neither females nor males.

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Table 7.8: Food preparation and dietary practices associated with BMI among females and males

	Females		Males	
	Model P-value	**β-estimate (s.e.)**	**Model P-value**	**β-estimate (s.e.)**
Dietary diversity score	**0.8921**	0.028 (0.209)	**0.0809**	0.203 (0.116)
Number of cooking days per week [Never cook]	**0.1927**		**0.9405**	
One day		- 0.519 (1.748)		- 0.434 (0.745)
Some days		0.397 (1.593)		- 0.111 (0.613)
Everyday		1.691 (1.628)		- 0.217 (0.675)
Most often used cooking method [Never cook]	**0.8341**		**0.9307**	
Frying		- 0.286 (2.217)		- 0.309 (0.993)
Stewing		- 0.161 (2.290)		- 0.763 (1.184)
Boiling/Steaming		0.791 (0.612)		- 0.164 (0.577)
Source of obtaining out-of-home cooked food [Outside the community]	**0.1328**		**0.1525**	
From the community		1.388 (0.921)		- 0.716 (0.499)

Source: Computed from survey data, November-December, 2011
N (Females) = 355 N (Males) = 302
[ ]: Reference Category s.e.: standard error
*P < 0.05 **P < 0.01 ***P < 0.001

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7.2.1.2.2 Physical activity behaviours associated with BMI

The amount of physical activity involved in the work males do was significantly associated with their BMI but not for their females counterparts (Table 7.9). Among males, there was an increase in BMI regardless of the amount of physical activity involved in the work they did. The magnitude of increase in BMI was lowest for respondents whose work involved no physical activity (β = 1.630) and highest for those whose work involved high levels of physical activity (β = 1.966).

Unlike work related physical activity, leisure-time physical activity was not associated with BMI for both females and males. Similarly, the amount of hours spent a day in sedentary activities was not significantly associated with BMI for both males and females. The involvement or otherwise of both males and females in group activity was not found to be significantly associated with their BMI (Table 7.9).

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Table 7.9: Physical activity behaviours associated with BMI among females and males

	Females		Males	
	Model P-value	**β-estimate (s.e.)**	**Model P-value**	**β-estimate (s.e.)**
Work related physical activity [Not working]	**0.0832**		**0.0116**	
No activity		1.907 (1.096)		1.630 (0.587)**
Moderate activity		2.451 (0.970)*		1.669 (0.565)**
High activity		2.579 (1.594)		1.966 (0.801)*
Leisure-time physical activity [No activity]	**0.4762**		**0.1019**	
Moderate activity		0.229 (1.038)		- 0.786 (0.479)
High activity		- 2.144 (1.824)		- 1.046 (0.552)
Number of hours spent reclining/day [< 1]	**0.2652**		**0.1992**	
1-3		- 0.399 (0.976)		- 0.910 (0.573)
> 3		0.936 (1.020)		- 1.050 (0.606)
Membership in community PAG [No community physical activity group]	**0.4339**		**0.1330**	
Yes		- 2.034 (1.741)		- 1.216 (0.609)*
No		- 0.577 (0.759)		- 0.221 (0.461)

Source: Computed from survey data, November-December, 2011
PAG: Physical activity group N (Females) = 355 N (Males) = 302
[ ]: Reference Category s.e.: standard error
*P < 0.05 **P < 0.01 ***P < 0.001

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7.2.1.2.3 Social behaviours associated with BMI

The results indicate that for both males and females, having more hours of rest a day significantly reduces BMI (Table 7.10). The smoking behaviour of both females and males was not found to be significantly associated with BMI. Alcohol consumption on the other hand was associated with BMI among females but not among males. Among females, the results reveal a 2.9 kg/m^2 increase in BMI among those who reported consuming alcohol in the last 24 hours immediately preceding the survey (Table 7.10).

7.2.1.3 Household wealth status and BMI among females and males

The results in Table 7.11 shows that among females, belonging to a household of a poorer wealth status was associated with about a 3 kg/m^2 increase in BMI compared to belonging to a household in the "poorest" wealth category. Among males, belonging to a richer household was associated with an approximate 2 kg/m^2 increase in BMI compared to belonging to the poorest household. Similarly, belonging to the richest household was associated with a 1.5 kg/m^2 increase in BMI compared to belonging to the poorest household.

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Table 7.10: Social behaviours associated with BMI among females and males

	Females		Males	
	Model P-value	**β-estimate (s.e.)**	**Model P-value**	**β-estimate (s.e.)**
Hours of rest a day	**0.0344**	- 0.451 (0.213)*	**0.0008**	- 0.386 (0.114)**
Current smoking status [Never smoked]	**0.1632**		**0.3105**	
Smokes daily		- 8.111 (6.871)		0.901 (0.977)
Smokes but not daily		- 1.871 (1.222)		- 0.958 (0.650)
Ever smoked		3.984 (3.452)		0.360 (0.818)
Alcohol consumption [Never consumed alcohol]	**0.0226**		**0.6681**	
Consumed alcohol in the last 24 hours		2.890 (1.133)*		0.712 (0.581)
No alcohol consumption in the last 24 hours		1.756 (0.957)		0.433 (0.602)
No alcohol consumption in the last 30 days		2.232 (0.932)*		0.314 (0.567)

Source: Computed from survey data, November-December, 2011
N (Females) = 355 N (Males) = 302
[ ]: Reference Category s.e.: standard error
*P < 0.05 **P < 0.01 ***P < 0.001

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Table 7.11: Association between household wealth status and BMI among females and males

	Females		Males	
	Model P-value	**β-estimate (s.e.)**	**Model P-value**	**β-estimate (s.e.)**
Household wealth status [Poorest]	**0.1155**		**0.0726**	
Poorer		2.561 (1.078)*		0.684 (0.738)
Average		0.335 (1.111)		0.808 (0.723)
Richer		1.411 (1.176)		1.858 (0.711)**
Richest		1.885 (1.107)		1.460 (0.715)*

Source: Computed from survey data, November-December, 2011
N (Females) = 355 N (Males) = 302
[ ]: Reference Category s.e.: standard error
*P < 0.05 **P < 0.01 ***P < 0.001

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7.2.2 Factors associated with waist-to-height ratio

7.2.2.1 Socio-demographic factors associated with waist-to-height ratio

The results show that as both females and males age, their waist-to-height ratio also increases. The magnitude of increase was higher for females compared to males (Table 7.12). The ethnicity of both females and males was not associated with their waist-to-height ratio. Among males, religious affiliation was not significantly associated with their waist-to-height ratio. However, religious affiliation was significantly associated with waist-to-height ratio for females.

The marital status of females and males alike was significantly associated with waist-to-height ratio. Among females being formerly married was associated with a 0.06 unit increase in waist-to-height ratio while among males, being married was associated with a 0.05 unit increase in waist-to-height ratio. The duration of stay in the community was found to be associated with waist-to-height ratio for females but not for males (Table 7.12). As was observed with BMI, having stayed in the community for ten years or less was associated with a 0.04 unit reduction in the waist-to-height ratio of females. Also, among females, having children was associated with a significant increase in waist-to-height ratio compared to having no children (Table 7.12).

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Table 7.12: Socio-demographic factors associated with waist-to-height ratio among females and males

	Females		Males	
	Model P-value	**β-estimate (s.e.)**	**Model P-value**	**β-estimate (s.e.)**
Age	**0.0000**	0.0048 (0.0005)***	**0.0000**	0.0023 (0.0003)***
Ethnicity [Ga-Dangme]	**0.3620**		**0.5152**	
Akan		- 0.0150 (0.0121)		- 0.0091 (0.0087)
Other		- 0.0146 (0.0142)		0.0031 (0.0115)
Religion	**0.0013**		**0.2217**	
Catholic [No religion]		0.0025 (0.0314)		0.0383 (0.0196)
Protestants		0.0174 (0.0250)		0.0138 (0.0142)
Pentecostal/Charismatics		0.0291 (0.0237)		0.0084 (0.0136)
Other Christian		0.0695 (0.0281)*		0.0297 (0.0169)
Moslem		0.0090 (0.0271)		0.0286 (0.0162)
Traditionalist/Spiritualist		0.1225 (0.0365)**		0.0106 (0.0243)
Marital Status [Never married]	**0.0002**		**0.0000**	
Married		0.0389 (0.0134)**		0.0496 (0.0088)***
Cohabiting		0.0374 (0.0141)**		0.0322 (0.0095)**
Formerly married		0.0603 (0.0142)***		0.0075 (0.0110)
Length of stay in community [Since birth]	**0.0021**		**0.6864**	
≤ 10 years		- 0.0366 (0.0122)**		- 0.0030 (0.0088)
> 10 years		0.0054 (0.0125)		0.0055 (0.0089)
Parity [0]	**0.0000**		**NA**	
1-2		0.0560 (0.0119)***		NA
3+		0.0825 (0.0122)***		NA

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Table 7.12 continued

	Females		Males	
	Model P-value	**β-estimate (s.e.)**	**Model P-value**	**β-estimate (s.e.)**
Highest level of education [No education]	**0.3378**		**0.8384**	
Primary		0.0386 (0.0208)		- 0.0005 (0.0239)
Middle/JHS		0.0283 (0.0197)		0.0052 (0.0220)
Secondary		0.0150 (0.0215)		0.0004 (0.0222)
Higher		0.0284 (0.0520)		- 0.0104 (0.0247)
Occupation [No occupation]	**0.0397**		**0.1414**	
Professional/Technical/Managerial/Clerical		0.0222 (0.0289)		0.0247 (0.0149)
Sales/Services		0.0217 (0.0161)		0.0228 (0.0130)
Manual worker		0.0111 (0.0184)		0.0223 (0.0125)
Other		- 0.1426 (0.0249)		0.0006 (0.0150)

Source: Computed from survey data, November-December, 2011
N (Females) = 355 N (Males) = 302
[ ]: Reference Category s.e.: standard error
*P < 0.05 **P < 0.01 ***P < 0.001

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7.2.2.2 Lifestyle behaviours associated with waist-to-height ratio

7.2.2.2.1 Dietary behaviours associated with waist-to-height ratio

The diversity of diets consumed by both females and males did not show a statistically significant relationship with their waist-to-height ratio. Neither did the frequency of home food preparation nor the most often used cooking method (Table 7.13). Where males obtained out-of-home cooked foods was observed to significantly influence their waist-to-height but this association was not significant among females. Compared to buying out-of-home cooked foods from a source outside the community, obtaining out-of-home cooked foods from within the community was associated with a 0.02 unit reduction in waist-to-height ratio among males (Table 7.13).

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Table 7.13: Food preparation and dietary practices associated with waist-to-height ratio among females and males

	Females		Males	
	Model P-value	**β-estimate (s.e.)**	**Model P-value**	**β-estimate (s.e.)**
Dietary diversity score	**0.9138**	0.0003 (0.0030)	**0.0844**	0.0035 (0.0020)
Number of cooking days per week [Never cook]	**0.1071**		**0.8714**	
One day		- 0.0125 (0.0274)		-0.0089 (0.0129)
Some days		0.0043 (0.0225)		-0.0036 (0.0106)
Everyday		0.0241 (0.0230)		0.0000 (0.0117)
Most often used cooking method [Never cook]	**0.9340**		**0.8726**	
Frying		- 0.0036 (0.0315)		0.0068 (0.0172)
Stewing		0.0062 (0.0325)		-0.0076 (0.0205)
Boiling/Steaming		0.0090 (0.0221)		-0.0042 (0.0100)
Source of obtaining out-of-home cooked food	**0.3777**		**0.0044**	
From the community [From outside the community]		0.0116 (0.0131)		-0.0245 (0.0086)**

Source: Computed from survey data, November-December, 2011
N (Females) = 355 N (Males) = 302
[ ]: Reference Category s.e.: standard error
*P < 0.05 **P < 0.01 ***P < 0.001

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7.2.2.2.2 Physical activity behaviours associated with waist-to-height ratio

The amount of physical activity females and males exert as part of the work they do did not show a significant association with their waist-to-height ratio (Table 7.14). The results indicate that engaging in leisure-time physical activity significantly reduces waist-to-height ratio among males but not among females. Males who engage in highly intense physical activities during their leisure time reduce their waist-to-height ratio by 0.0252 units while their counterparts who engage in moderate energy tasking physical activities reduce their waist-to-height ratio by a factor of 0.0177.

The amount of hours spent in sedentary activities during the day did not significantly influence waist-to-height ratio for both females and males. Among males, there was a 0.03 unit reduction in waist-to-height ratio among those who join others in the community for physical activity compared to their counterparts who reported that there was no physical activity group in the community (Table 7.14).

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Table 7.14: Physical activity behaviours associated with waist-to-height ratio among females and males

	Females		Males	
	Model P-value	**β-estimate (s.e.)**	**Model P-value**	**β-estimate (s.e.)**
Work related physical activity [Not working]	**0.1058**		**0.0737**	
No activity		0.0248 (0.0156)		0.0253 (0.0102)*
Moderate activity		0.0307 (0.0138)*		0.0215 (0.0099)*
High activity		0.0442 (0.0226)		0.0228 (0.0140)
Leisure-time physical activity [No activity]	**0.7086**		**0.0145**	
Moderate activity		- 0.0114 (0.0147)		- 0.0177 (0.0082)*
High activity		- 0.0145 (0.0144)		- 0.0252 (0.0095)**
Number of hours spent reclining/day [< 1]	**0.1751**		**0.2244**	
1-3		- 0.0073 (0.0138)		- 0.0170 (0.0099)
> 3		0.0145 (0.0144)		- 0.0141 (0.0105)
Membership in community PAG [No community physical activity group]	**0.3205**		**0.0365**	
Yes		- 0.0360 (0.0247)		- 0.0269 (0.0105)*
No		- 0.0070 (0.0107)		- 0.0099 (0.0079)

Source: Computed from survey data, November-December, 2011
PAG: Physical activity group N (Females) = 355 N (Males) = 302
[ ]: Reference Category s.e.: standard error
*P < 0.05 **P < 0.01 ***P < 0.001

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7.2.2.2.3 Social behaviours associated with waist-to-height ratio

The hours of rest respondents had a day was significantly associated with the waist-to-height ratio of both males and females (Table 7.15). Each hour of rest females had a day was associated with a 0.0065 unit reduction in their waist-to-height ratio while among their male counterparts, each additional hour of rest they had a day resulted in a 0.0056 unit reduction in their waist-to-height ratio. Smoking and alcohol consumption among females and males alike was not significantly associated with their waist-to-height ratio (Table 7.15).

7.2.2.3 Household wealth status and waist-to-height ratio among females and males

Among females, no significant association was observed between the wealth status of the household they belong to and their waist-to-height ratio. Among males, belonging to a household in the richer category was associated with a 0.028 unit increase in waist-to-height ratio compared to belonging to a household in the poorest category (Table 7.16).

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Table 7.15: Social behaviours associated with waist-to-height ratio among females and males

	Females		Males	
	Model P-value	**β-estimate (s.e.)**	**Model P-value**	**β-estimate (s.e.)**
Hours of rest a day	**0.0322**	- 0.0065 (0.0030)*	**0.0046**	- 0.0056 (0.0020)**
Current smoking status [Never smoked]	**0.3303**		**0.2143**	
Smokes daily		- 0.1455 (0.0977)		0.0109 (0.0169)
Smoked some days in the last 30 days		- 0.0164 (0.0174)		- 0.0208 (0.0112)
Ever smoked but not in the last 30 days		0.0282 (0.0491)		0.0067 (0.0141)
Alcohol consumption [Never consumed alcohol]	**0.1197**		**0.5985**	
Consumed alcohol in the last 24 hours		0.0317 (0.0161)		0.0099 (0.0100)
Consumes alcohol but not in the last 24 hours		0.0123 (0.0136)		0.0042 (0.0104)
Consumes alcohol but not in the last 30 days		0.0261 (0.0133)		- 0.0038 (0.0098)

Source: Computed from survey data, November-December, 2011
PAG: Physical activity group N (Females) = 355 N (Males) = 302
[ ]: Reference Category s.e.: standard error
*P < 0.05 **P < 0.01 ***P < 0.001

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Table 7.16: Household wealth status and waist-to-height ratio among females and males

	Females		Males	
	Model P-value	**β-estimate (s.e.)**	**Model P-value**	**β-estimate (s.e.)**
Household wealth status [Poorest]	**0.4103**		**0.0790**	
Poorer		0.0222 (0.0154)		0.0050 (0.0128)
Average		- 0.0008 (0.0158)		0.0062 (0.0125)
Richer		0.0170 (0.0168)		0.0280 (0.0123)*
Richest		0.0206 (0.0158)		0.0154 (0.0124)

Source: Computed from survey data, November-December, 2011
PAG: Physical activity group N (Females) = 355 N (Males) = 302
[ ]: Reference Category s.e.: standard error
*P < 0.05 **P < 0.01 ***P < 0.001

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7.2.3 Summary of factors associated with BMI and waist-to-height ratio among females and males

Table 7.17 shows the similarities and differences in the factors associated with BMI and waist-to-height ratio among males and females. Age, marital status and hours of rest a day were all associated with both BMI and waist-to-height ratio among both males and females. Occupation was associated with BMI among males and females and also associated with waist-to-height ratio among females but not among males.

Religious affiliation and how long respondents have been staying in the community was associated with BMI and waist-to-height ratio for females but not males. Alcohol consumption was associated with BMI only among females while work related physical activity was associated with BMI only among males. Leisure time physical activity, membership in a community physical activity group and where out-of-home cooked foods were obtained from were significant predictors of waist-to-height ratio but not BMI among males.

In the next section of this chapter, the factors associated with BMI and waist-to-height ratio among females and males are combined with the measures of the built environment in a multilevel model to examine how the built environment influences the risk of obesity for males and females living in the same built environment. The results displayed in the tables show the β-estimate for the measures of the built environment and the individual variables that were significant in the model. The variables that were included in the model but were not significant are indicated below the table.

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Table 7.17: A matrix showing the similarities and differences in the factors associated with BMI and waist-to-height ratio among females and males

BMI		Waist-to-height ratio	
Females	**Males**	**Females**	**Males**
Age	Age	Age	Age
Marital status	Marital status	Marital status	Marital status
Hours of rest a day	Hours of rest a day	Hours of rest a day	Hours of rest a day
Occupation	Occupation	Occupation	
Parity		Parity	
Religion		Religion	
Length of stay in the community		Length of stay in the community	
Alcohol consumption	Work related physical activity		Leisure time physical activity
			Membership in community physical activity group
			Source of obtaining out-of-home cooked foods

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7.3 The influence of built environment on the risk of obesity for females and males

7.3.1 The influence of the built environment on BMI among females and males

The results of the multilevel models show differences in the influence of the built environment on BMI among females and males. The unconditional ICC (i.e. the ICC from the null model) indicates that, the variations in BMI among males mostly stems from variances among individuals with almost no intra EA variances whereas among females, close to 8 percent of the variances in BMI is due to intra EA differences (Model 1, Table 7.18). Thus while community level factors contribute to the variations in BMI among females, among males community level factors explain very little of the variation in BMI.

The fixed effects component of the model shows that, none of the measures of the built environment exhibited a statistically significant influence on the BMI of males (Table 7.18). On the other hand, among females, there was a marginal effect (at $p < 0.10$) of the number out-of-home cooked food places and convenience stores on BMI in the absence of the community and individual controls (Table 7.18, Model 2). The effect of the number of out-of-home cooked food places on BMI persisted after the inclusion of the control variables (Table 7.18, Model 3). As was observed in earlier models (see section 6.1), each additional out-of-home cooked food located in the EA was associated with a 0.1 kg/m^2 reduction in the BMI of females (at $p <0.10$).

At the individual level, increasing age was associated with an increase in BMI for both females ($\beta=0.140$) and males ($\beta=0.079$). Also, females who have lived in the community for less than or up to 10 years had about 2 kg/m^2 lower BMI compared to their counterparts who have lived the community since they were born.

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Table 7.18: Results of a multilevel analysis of the influence of the built environment on BMI among females and males

	Females			Males		
	Model 1 Null Model	**Model 2 Unadjusted Model**	**Model 3 Adjusted Model**	**Model 1 Null Model**	**Model 2 Unadjusted Model**	**Model 3 Adjusted Model**
	β-estimate (s.e.)	**β-estimate (s.e.)**	**β-estimate (s.e.)**	**β-estimate (s.e.)**	**β-estimate (s.e.)**	**β-estimate (s.e.)**
Intercept	27.554 (0.514)***	27.279 (2.014)***	6.562 (14.417)	23.337 (0.218)***	24.859 (0.954)***	17.566 (5.038)***
Fixed effects						
Level 2 covariates						
Number of out-of-home cooked foods		- 0.106 (0.062)$^{+}$	- 0.138 (0.077)$^{+}$		- 0.018 (0.026)	- 0.013 (0.028)
Number of convenience stores		0.305 (0.164)$^{+}$	0.290 (0.195)		- 0.029 (0.068)	- 0.034 (0.068)
Number of fruit and vegetable stands		0.176 (0.181)	0.223 (0.234)		- 0.073 (0.076)	- 0.076 (0.083)
Physical activity space						
Present [Absent]		- 1.481 (1.113)	- 0.419 (1.670)		- 0.238 (0.451)	0.022 (0.573)
Perception about community ideal body size		- 0.014 (0.149)	- 0.081 (0.141)		- 0.037 (0.100)	- 0.030 (0.097)
Crime			2.018 (1.342)			0.303 (0.097)
Social cohesion			- 0.129 (3.826)			1.989 (1.353)
Trust			4.355 (4.577)			- 0.546 (1.610)
Level 1 covariates						
Age			0.140 (0.050)**			0.079 (0.026)**
Hours of rest a day						- 0.199 (0.116)$^{+}$

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Table 7.18 continued

	Females			Males		
	Model 1 Null Model	**Model 2 Unadjusted Model**	**Model 3 Adjusted Model**	**Model 1 Null Model**	**Model 2 Unadjusted Model**	**Model 3 Adjusted Model**
	β-estimate (s.e.)	**β-estimate (s.e.)**	**β-estimate (s.e.)**	**β-estimate (s.e.)**	**β-estimate (s.e.)**	**β-estimate (s.e.)**
Religion [No religion]						
Catholic			- 0.439 (2.062)			
Protestants			- 0.431 (1.619)			
Pentecostals/Charismatics			0.961 (1.548)			
Other Christian			2.267 (1.867)			
Moslem			0.226 (1.780)			
Traditionalist/Spiritualist			5.069 (2.411)*			
Length of stay in community						
≤ 10 years [Since birth]			- 2.410 (0.891)**			
> 10 years			- 0.067 (0.843)			
Parity [0]						
1-2			2.895 (0.989)**			
3+			3.792 (1.222)**			
Random effects						
Intra EA variance	3.629 (2.374)	3.727 (2.592)	6.353 (3.937)	0.081 (0.334)		
Individual variance	44.262 (3.509)	44.184 (3.498)	34.758 (2.865)	13.381 (1.132)		
Intra-Class Correlation Coefficient (ICC)	**7.58%**	**7.78%**	**15.45%**	**0.06%**		

Source: Computed from survey and GPS data
N (Females) = 355 N (Males) = 302
[ ]: Reference Category s.e.: standard error
$^{+}$ P < 0.10 *P < 0.05 **P < 0.01 ***P < 0.001
Note: Females Model 3 includes occupation, hours of rest a day, alcohol consumption and population density
Males model 3 includes occupation, work related physical activity and population density

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7.3.2 The influence of the built environment on waist-to-height among females and males

The results in Table 7.19 show intra EA variances in the waist-to-height ratio of both males and females; demonstrating that beyond the individual characteristics of males and females, other factors influence their waist-to-height ratio. However, the measures of the built environment did not significantly influence waist-to-height ratio among females or among males.

At the individual level, increasing age was associated with an increase in waist-to-height ratio among females and males. Among females, parity was also found to be significantly associated with waist-to-height ratio (Table 7.19).

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Table 7.19: Results of a multilevel analysis of the influence of the built environment on waist-to-height ratio among females and males

	Females			Males		
	Model 1 Null Model	**Model 2 Unadjusted Model**	**Model 3 Adjusted Model**	**Model 1 Null Model**	**Model 2 Unadjusted Model**	**Model 3 Adjusted Model**
	β-estimate (s.e.)	**β-estimate (s.e.)**	**β-estimate (s.e.)**	**β-estimate (s.e.)**	**β-estimate (s.e.)**	**β-estimate (s.e.)**
Intercept	0.5413 (0.0066)***	0.5204 (0.0272)***	0.3719 (0.1679)*	0.4599 (0.0046)***	0.4971 (0.0190)***	0.4419 (0.1097)***
Fixed effects						
Level 2 covariates						
Number of out-of-home cooked foods		- 0.0009 (0.0008)	- 0.0009 (0.0009)		- 0.0007 (0.0006)	- 0.0005 (0.0006)
Number of convenience stores		0.0030 (0.0022)	0.0023 (0.0023)		- 0.0011 (0.0015)	0.0001 (0.0015)
Number of fruit and vegetable stands		0.0027 (0.0024)	0.0021 (0.0027)		0.0013 (0.0016)	- 0.0004 (0.0018)
Physical activity spaces						
Present [Absent]		- 0.0127 (0.0147)	- 0.0036 (0.0197)		- 0.0018 (0.0098)	0.0093 (0.0127)
Perception about community ideal body size		0.0010 (0.0021)	- 0.0004 (0.0019)		- 0.0014 (0.0017)	- 0.0013 (0.0016)
Crime			0.0097 (0.0155)			- 0.0057 (0.0104)
Social cohesion			- 0.0145 (0.0449)			- 0.0116 (0.0288)
Trust			0.0184 (0.0531)			0.0285 (0.0350)
Level 1 covariates						
Age			0.0039 (0.0007)***			0.0020 (0.0004)***
Religious affiliation						
Catholic [No religion]			0.0042 (0.0286)			
Protestant			- 0.0003 (0.0225)			
Pentecostal/Charismatic			0.0218 (0.0215)			
Other Christian			0.0413 (0.0259)			
Moslem			0.0044 (0.0245)			
Traditionalist/Spiritualist			0.0756 (0.0334)*			

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Table 7.19 continued

	Females			Males		
	Model 1 Null Model	**Model 2 Unadjusted Model**	**Model 3 Adjusted Model**	**Model 1 Null Model**	**Model 2 Unadjusted Model**	**Model 3 Adjusted Model**
	β-estimate (s.e.)	**β-estimate (s.e.)**	**β-estimate (s.e.)**	**β-estimate (s.e.)**	**β-estimate (s.e.)**	**β-estimate (s.e.)**
Marital status						
Married			- 0.0269 (0.0161)$^{+}$			0.0104 (0.0114)
Cohabiting			- 0.0142 (0.0153)			0.0046 (0.0103)
Formerly married			- 0.0129 (0.0165)			- 0.0211(0.0122)$^{+}$
Length of stay in community						
≤ 10 years			- 0.0235 (0.0122)$^{+}$			
> 10 years			0.0022 (0.0117)			
Parity [0]						
1-2			0.0437 (0.0137)**			
3+			0.0443 (0.0169)***			
Source of obtaining out-of-home cooked foods						
From the community [Outside the community]						- 0.0206 (0.0080)$^{+}$
Random effects						
Intra EA variance	0.0005 (0.0003)	0.0005 (0.0004)	0.0007 (0.0005)	0.0002 (0.0002)	0.0002 (0.0002)	0.0002 (0.0002)
Individual variance	0.0091 (0.0007)	0.0091 (0.0007)	0.0068 (0.0006)	0.0038 (0.0003)	0.0038 (0.0003)	0.0031 (0.0003)
Intra-Class Correlation Coefficient (ICC)	**4.76%**	**5.49%**	**9.09%**	**5.60%**	**5.60%**	**7.42%**

Source: Computed from survey and GPS data
N (Females) = 355 N (Males) = 302
[ ]: Reference Category s.e.: standard error
$^{+}$ P < 0.10 *P < 0.05 **P < 0.01 ***P < 0.001
Note: Females Model 3 includes occupation, hours of rest a day and population density
Males Model 3 includes hours of rest/day, leisure time physical activity, membership in community physical activity group and population density

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7.4 Discussion

The results obtained from the sex specific models show that the features of the built environment have different effects on obesity among females and males living in the same built environment. The results also indicate that the effect of the built environment on the risk of obesity for females and males differs depending on the measure of obesity used. The results illustrate the complexity and gender dynamics in the influence of the on the risk of obesity.

As was found in this study, increasing number of out-of-home cooked foods was associated with an increase in BMI among females (at $p < 0.10$) but this effect was not observed for males. This finding corroborates findings in an urban Canadian context where Lebel et al. (2012) found that the food environment influences the risk of obesity differently for men and women. Even though the measures of the built environment were not found to be significantly associated with waist-to-height ratio for both females and males, the ICC obtained indicate that there are intra EA variances in the waist-to-height ratio of both males and females.

The gender differences in the influence of the environment on obesity has also been reported in Nigeria where Oyeyemi et al. (2012a) investigated sex differences in the association between environmental factors and overweight and concluded that, different environmental factors may be relevant for obesity prevention among African men and women.

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7.5 Conclusion

The focus of the analysis in this chapter was to examine the gender differences in the influence of the built environment on the risk of obesity for females and males living in the same built environment. The results reveal two main findings. Firstly, the features of the built environment influences the risk of obesity differently for females and males. Secondly, the gender differences in the risk of obesity differs based on the measure used to assess obesity.

These findings provide empirical evidence of the potential contribution of the built environment to the differences in the risk of obesity for women and men in the sub-Saharan Africa context and the broader African context. There is the need for further research examining the differential influence of the built environment on obesity, particularly waist-to-height ratio for African men and women.

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CHAPTER EIGHT

SUMMARY, CONCLUSION AND RECOMMENDATIONS

8.1 Summary

This study sought to investigate the built environment in an urban poor sub-Saharan Africa context and to examine how the built environment influences the risk of obesity among residents of this urban poor setting. The study was conducted in three urban poor communities (James Town, Ussher Town and Agbogbloshie) in Accra, Ghana. A combination of quantitative, qualitative and spatial data collection and analysis techniques were used to achieve the objectives of the study. The salient findings from the study, the limitations and recommendations for further research are discussed below.

8.1.1 The prevalence of obesity among the study sample

The level of obesity among the study population was found to be high; with about 1 in 5 of the total sample being obese and another 1 in 4 being overweight based on the standard WHO BMI classification. Based on the waist-to-height ratio boundary value of 0.5, about 1 in 4 of the study sample were found to be at risk of obesity. The results reveal sex disparities in the prevalence of obesity. Similar to the prevailing global gender disparity, obesity was found to be more common among females than among males. The relationship between level of education and BMI among the study sample was found to be inverse of what generally pertains in the sub-Saharan Africa region. Lower levels of education, particularly the primary level, was found to be associated with higher BMI.

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8.1.2 Characteristics of the built environment

Three components of the built environment: the food environment, the physical activity environment and the social environment, were examined in this study. Spatial analysis techniques were used to examine the food and physical activity environments while the social environment was examined using qualitative methods of analysis. Where applicable, the findings from the qualitative analysis were supported with quantitative results.

The characteristics of the food environment in the study area is suggestive of an obesogenic food environment. There is a disproportionately high number of out-of-home cooked food places and convenience stores but limited fruit and vegetable options. The out-of-home cooked foods available in the community include a combination of both traditional staple foods and western type foods while the convenience stores provide options for processed and high calorie foods. There were very few stationary locations in the study area where fruits and vegetables are sold.

The examination of the physical activity environment indicates that there are limited number of physical activity spaces in the community. In addition to having limited physical activity spaces, not all the physical activity spaces are designed for such use. The use of facilities such as roads and open streets as physical activity spaces expose residents to harms such as vehicular accidents; making such physical activity space options unsafe. Other physical activity spaces such as parks which are designed to support physical activity are also used for other social activities such as funerals. There is thus competing use for the limited physical activity spaces available in the study community.

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The community perception about body size is for people to have a "normal" body size. A normal body size was described as putting on some weight but not being fat. The community perceptions about body size are dependent on the age and sex of individuals. As such, older people are expected to have larger body sizes compared to younger people and females are expected to have larger body sizes compared to males.

8.1.3 The influence of the built environment on obesity

The influence of the built environment on obesity was examined using multilevel analysis. The measures of the built environment constituted the main Level 2 factors while individual characteristics constituted the Level 1 factors. Other community characteristics including population density were also controlled for in the multilevel analysis. The findings from the multilevel analysis emphasise that, obesity among the general sample (i.e. among males and females together) is an outcome of factors at both the community and individual levels. The variations in BMI and waist-to-height ratio come from two sources: (1) variance at the EA level and (2) variance among individuals.

Among the three components of the built environment that were examined, the food environment was found to significantly influence BMI. Specifically, the number of out-of-home cooked food places and convenience stores located in the EA were found to be significantly associated with BMI among the general sample. Increasing number of out-of-home cooked food places was found to be associated with a reduction in BMI while increasing number of convenience stores was associated with an increase in BMI. The measures of the built environment did not significantly influence waist-to-height ratio among the general sample.

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8.1.4 Differences in the influence of the built environment on obesity for females and males

The differences in the influence of the built environment on obesity among females and males living in the same built environment was examined by specifying separate multilevel models for females and males. The measures of the built environment constituted the main Level 2 factors for both the female and the male models while the characteristics of females and males that were significantly related to their BMI and waist-to-height ratio were included in the multilevel models as Level 1 factors. Community characteristics including population density were controlled for in both the female and male models.

The influence of the built environment on obesity was found to differ for females and males. While the variations in the BMI of females were found to stem from both community and individual factors, the variations in BMI among males were found to be due largely to differences among individuals with very little variation coming from the EA level. Among the various measures of the built environment used in the multilevel model, the number of out-of-home cooked food places were found to marginally reduce BMI among females but not among males.

For both females and males, there were intra EA and individual variances in waist-to-height ratio. However, the measures of the built environment were not found to significantly influence waist-to-height ratio among females or among males.

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8.2 Conclusion

This study concludes that there is a high prevalence of obesity among members of the study area, corroborating the emerging pattern of rising obesity levels among the urban poor in developing countries (Ziraba et al., 2009). Similar to the observed pattern of the distribution of obesity by sex in the sub-Saharan Africa region (Abubakari et al., 2008; Prentice, 2006), more females than males are affected by obesity in the study area.

The relationship between education and obesity in this study was inverse, rather than the direct relationship previously reported in several other studies conducted in the sub-Saharan Africa region (Cohen et al., 2013). Increasing BMI was more likely to occur among people at the lower ends of the education spectrum particularly among those with primary education.

The relationship between the measures of the built environment and obesity as was found in this study demonstrate that obesity among residents of the study area is an outcome of a complex interaction between factors at the community and individual levels working together in a synergistic manner. The food environment aspect of the built environment; specifically increasing number of convenience stores, was found to be associated with increased risk of obesity among the general study sample.

The influence of the built environment on obesity was not the same for females and males. Using BMI as a measure of obesity, there was very little community effects on obesity for males but among females there was some community influence. However, in spite of the observed intra EA variances in BMI among females, the measures of the built environment, particularly increasing number of out-of-home cooked foods had a marginal

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decreasing effect on BMI. Using waist-to-height ratio as the indicator of obesity, the results reveal intra EA variances in the waist-to-height ratio of both males and females. However, none of the measures of the built environment used in the study were found to significantly influence waist-to-height ratio among females and males alike.

8.3 Limitations

The findings from this study and the conclusions drawn from the study may have been influenced by a number of limitations that are worth noting. Firstly, the study area is fairly homogenous, thus there may not be large variations among the EAs (Level 2 units) and this may have influenced the results. Secondly, the number of Level 2 units (EAs) is small (N=28) and this number may not be large enough to detect significant effects. The findings and the conclusions from this study hold true in spite of these limitations.

8.4 Recommendations

8.4.1 Policy recommendations

The study findings especially that pertaining to the relationship between the built environment and BMI among the general sample gives credence to the assertion that obesity is not a result of individual characteristics and behaviours alone. A myriad of factors beyond the individual level also influence obesity. Of particular importance is the influence of increasing numbers of convenience stores on obesity among the urban poor as was found in the current study and in other context such as in the townships of Black South Africa. In tackling the growing obesity problem among the urban poor in sub-Saharan

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Africa, there is a need for regulations on locating and operating convenience stores in urban poor areas such as the setting of the current study.

Drawing on the socio-ecological model, the regulations on locating and operating convenience stores can be carried out at several levels, some of which are outside the scope of the current study. At the national level, countries can regulate the importation of convenience foods and also implement higher taxes on such food items. Some countries in Latin America have been successful in implementing higher taxes on food items such as Coca Cola. This tax intervention is a means of modifying the built environment and indirectly influencing individual behaviours. Such interventions make it more expensive to consume such food items, thereby discouraging their consumption and reducing the associated risk of obesity.

In implementing tax policy regulations at the local community level such as the settings of the current study, higher taxes can be collected for operating conveniences stores. The higher taxes will make operating convenience stores more expensive while also making convenience foods a more expensive options for individual consumers. This tax regulation may help discourage the patronage and consumption of convenience foods and thus help in reducing the risk of obesity.

8.4.2 Further research needs

The findings from this study provide initial exploratory results that provide opportunities for further research. Firstly, the unconditional intra-class correlation co-efficient (ICC) obtained in the current study is low at about 4%. The ICC is probably low

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because the research area is fairly homogenous and also involves a small number of level 2 units (N=28). There is probably low variation among the level 2 units due to the homogeneity of the study area coupled with the small number of level 2 units. To address this limitation, the study design can be modified in one of three ways. The first will be to include more EAs from the current study area in order to increase the number of level 2 units and also introduce more variation. The second approach will be to include more EAs of similar characteristics as the EAs in the current study but from different urban poor communities. This approach will result in an increase in the number of level 2 units while potentially introducing more variation as well. The third approach will be to include EAs from rich communities. This approach will increase the number of level 2 units, introduce more variation among the level 2 units and also allow for comparison of the built environment in poor and rich communities.

The second area of further research identified in this study is to investigate how people living in the study area interact with the built environment. In the current study, peoples' interaction with the built environment was not investigated. In the next stages of this study, how individuals interact with their environment needs to be examined. This can be done by asking respondents questions about which out-of-home cooked foods in their community they consume and how often they consume these foods. Their use of the community physical activity spaces also need to be examined. Whether or not the members of the community use the physical activity spaces available in their community for physical activity and how often they use the community physical activity space(s) need to be investigated.

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Another way to investigate peoples' interaction with the built environment is to examine the built environment within a particular geographic area around where respondents live e.g. in a 50 or 100 meter buffer around their residential structure. Respondents can be asked to indicate whether they consume food resources or use physical activity spaces in the defined geographic area and how often they use these resources. These approaches of examining how individuals interact with their environment will help in understanding how different people utilize resources available in their immediate environment and how that impacts obesity.

Thirdly, the results of the current study indicate that each additional out-of-home cooked food place located in the EA is associated with a reduction in BMI among the general sample. This result is opposite of the hypothesized relationship between out-of-home cooked foods and obesity. Also, this result is contrary to what has been documented in the literature where consumption of out-of-home cooked meals have been reported to contribute to weight gain due to the low nutritional quality, high energy and high fat content of such foods (Micklesfield et al., 2013). It is therefore necessary to investigate why increasing number of out-of-home food places in the study area is protective of obesity.

One of the next steps of this research will therefore entail carrying out a detailed examination of the out-of home cooked foods located in the study area. A number of approaches can be used in examining these out-of-home cooked foods. One of such ways is to determine the composition, the caloric value and nutritional quality of the out-of-home cooked foods by conducting a food analysis on food samples from the study area. The food composition data can then be combined with anthropometric data from residents to explore the relationship between out-of-home cooked foods and obesity. It will be a useful addition

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to investigate the differences in the risk of obesity for residents who consume out-of-home cooked foods and those who do not in conducting this kind of research.

Finally, the results of the current study did not show a significant relationship between the availability of a physical activity space in the EA and obesity. Future research endeavours should consider exploring the use of other measures of the physical activity environment such as land use mix, street connectivity, and walkability and also investigate how these measures of the physical activity environment influence the risk of obesity in the urban poor sub-Saharan African context.

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APPENDICES

Appendix 1: Household Questionnaire

The Built Environment and the Risk of Obesity among the Urban Poor in Accra, Ghana

HOUSEHOLD QUESTIONNAIRE

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IDENTIFICATION

LOCALITY NAME* _____
E.A. BASE _____
NAME OF HOUSEHOLD HEAD _____
E.A. /EDL NUMBER .....
STRUCTURE NUMBER.....
HOUSEHOLD NUMBER .....
GREATER ACCRA.....
ROUND.....
* **CODES FOR LOCALITY NAME:** 1=AGBOGBLOSHIE 2=JAMES TOWN 3=USSHER TOWN

0 3
0 2

INTERVIEWER VISITS

	1	2	3	FINAL VISIT
DATE				DAY
				MONTH
				YEAR 2 0 1 1
INTERVIEWER'S NAME				INT. CODE
RESULT*				RESULT
Next visit: Date				TOTAL NO. OF VISITS
Time				

***RESULT CODES:**
1 COMPLETED
2 PARTLY COMPLETED
3 NO HOUSEHOLD MEMBER AT HOME OR NO COMPETENT RESPONDENT AT HOME AT THE TIME OF VISIT
4 ENTIRE HOUSEHOLD ABSENT FOR EXTENDED PERIOD OF TIME
5 POSTPONED
6 REFUSED
7 DWELLING VACANT OR ADDRESS NOT A DWELLING
8 DWELLING DESTROYED
9 DWELLING NOT FOUND
10 OTHER (SPECIFY) _____

TOTAL PERSONS IN HOUSEHOLD
TOTAL ELIGIBLE WOMEN
TOTAL ELIGIBLE MEN
LINE NO. OF RESP. TO HOUSEHOLD QUEST.
HH INT. IN ROUND 1 1=YES 2=NO

LANGUAGE

LANGUAGE OF QUESTIONNAIRE: **ENGLISH**
LANGUAGE OF INTERVIEW** _____
NATIVE LANGUAGE OF RESPONDENT** _____
WAS TRANSLATOR USED? (YES=1, NO=2) .....
****LANGUAGE CODES**:
1= ENGLISH 2 =AKAN 3= GA 4 =EWE 5 =DAGBANI
6= HAUSA 7= OTHER (SPECIFY) _____

1

SUPERVISOR	FIELD EDITOR	KEYED BY
NAME _____	NAME _____	
DATE _____	DATE _____	

START TIME FOR INTERVIEW HOURS MINS

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HOUSEHOLD SCHEDULE

I would like some information about the people who usually live in your household or who are staying with you now.

LINE NO.	USUAL RESIDENTS AND VISITORS	RELATION-SHIP TO HEAD OF HH	SEX	RESIDENCE			AGE	ELIGIBILITY	
	Please give me the names of the persons who usually live in your household and guests of the household who stayed here last night, starting with the head of the household.	What is the relationship of (NAME) to the head of the household?*	Is (NAME) male or female?	Does (NAME) usually live here? (6months or more)	Did (NAME) sleep here last night? YES→8	Why did (NAME) not sleep here last night?**	How old is (NAME)?	CIRCLE LINE NUMBER OF ALL WOMEN AGE 12- 49***	CIRCLE LINE NUMBER OF ALL MEN AGE 12-59***
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
01			M F 1 2	YES NO 1 2	YES NO 1 2		IN YEARS	01	01
02			M F 1 2	YES NO 1 2	YES NO 1 2		IN YEARS	02	02
03			M F 1 2	YES NO 1 2	YES NO 1 2		IN YEARS	03	03
04			M F 1 2	YES NO 1 2	YES NO 1 2		IN YEARS	04	04
05			M F 1 2	YES NO 1 2	YES NO 1 2		IN YEARS	05	05
06			M F 1 2	YES NO 1 2	YES NO 1 2		IN YEARS	06	06
07			M F 1 2	YES NO 1 2	YES NO 1 2		IN YEARS	07	07
08			M F 1 2	YES NO 1 2	YES NO 1 2		IN YEARS	08	08
09			M F 1 2	YES NO 1 2	YES NO 1 2		IN YEARS	09	09
10			M F 1 2	YES NO 1 2	YES NO 1 2		IN YEARS	10	10
11			M F 1 2	YES NO 1 2	YES NO 1 2		IN YEARS	11	11
12			M F 1 2	YES NO 1 2	YES NO 1 2		IN YEARS	12	12

TICK HERE IF CONTINUATION SHEET USED ☐ NUMBER OF ELIGIBLE WOMEN ☐☐ NUMBER OF ELIGIBLE MEN ☐☐

*** CODES FOR Q3 RELATIONSHIP TO HEAD OF HOUSEHOLD:**

01 = HEAD
02 = SPOUSE
03 = SON OR DAUGHTER
04 = SON-IN-LAW/DAUGHTER-IN-LAW
05 = GRANDCHILD
06 = PARENT
07 = PARENT-IN-LAW
08 = BROTHER/SISTER
09 = CO-WIFE
10 = ADOPTED/FOSTER/STEP-CHILD
11= OTHER RELATIVE(AFFINAL)
12= OTHER RELATIVE (CONSANGUINE)
13= NOT RELATED
98=DON'T KNOW

****CODES FOR Q7**

01=AT WORK
02=NO SPACE FOR SLEEPING
03=TRAVELLED
04=BOARDING HOUSE
06=OTHER (SPECIFY)……..
98=DON'T KNOW

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LINE NO.		EDUCATION (IF AGE 3 OR OLDER & IF ATTENDED SCHOOL)			IF AGE 15 OR OLDER MARITAL STATUS	ETHNICITY	RELIGION
	Has (NAME) ever attended school? **NO→15**	What is the highest level of education (NAME) attended?*	What is the highest grade (NAME) completed at that level?**	**IF AGE IS LESS THAN 25 YEARS** Is (NAME) still in school?	What is the marital status of (NAME)? ***	What is the ethnic group of (NAME)? ****	What is the religion of (NAME)? *****
	(11)	(12)	(13)	(14)	(15)	(16)	(17)
01	YES NO 1 2			YES NO 1 2		96=OTHER	
02	YES NO 1 2			YES NO 1 2		96=OTHER	
03	YES NO 1 2			YES NO 1 2		96=OTHER	
04	YES NO 1 2			YES NO 1 2		96=OTHER	
05	YES NO 1 2			YES NO 1 2		96=OTHER	
06	YES NO 1 2			YES NO 1 2		96=OTHER	
07	YES NO 1 2			YES NO 1 2		96=OTHER	
08	YES NO 1 2			YES NO 1 2		96=OTHER	
09	YES NO 1 2			YES NO 1 2		96=OTHER	
10	YES NO 1 2			YES NO 1 2		96=OTHER	
11	YES NO 1 2			YES NO 1 2		96=OTHER	

Just to make sure that I have a complete listing:

1) Are there any other persons such a small children or infants that we have not listed? YES ☐ → ENTER EACH IN TABLE NO ☐
2) In addition, are there any other people who may not be members of your HH, such as domestic servants, lodgers or friends who usually live here? YES ☐ → ENTER EACH IN TABLE NO ☐
3) Are there any guests or temporary visitors staying here, or anyone else who slept here last night that I have not listed? YES ☐ → ENTER EACH IN TABLE NO (SKIP ONE ROW) ☐
4) Are there any persons who used to live in your household but have moved out in the past 1 year? YES ☐ → ENTER EACH IN TABLE NO HOW MANY? ☐

***CODES FOR Q12 Q15**
0=PRE-SCHOOL
1=PRIMARY
2=JHS/MIDDLE
3=SHS/SECONDARY
4=HIGHER
8=DON'T KNOW

****EDUCATION GRADE Q13**
00=LESS THAN 1 YEAR
98=DON'T KNOW

*****CODES FOR**
0=NEVER MARRIED
1= LIVING TOGETHER
2= MARRIED
3= SEPARATED
4=DIVORCED
5= WIDOWED

******CODES FOR Q16**
01=AKAN 02=GA-DANGME03=EWE
04=GUAN05=GURMA 06=MOLE-DAGBANI
07=GRUSI
08=MANDE
96=OTHER (SPECIFY)
RECORD ADJACENT TO TO THE CODE ABOVE.

*******CODES FOR Q17**
01= NO RELIGION
02= CATHOLIC
03= PROTESTANTS
04=PENTECOSTAL/ CHARISMATIC
05=OTHER CHRISTIAN
06=ISLAM
07=TRADITIONAL/SPIRITUALIST
08=EASTERN RELIGIONS
96=OTHER (SPECIFY).....

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LINE NO.	FOR VISITORS AND USUAL RESIDENTS	VISITORS ONLY	FOR FORMER RESIDENTS/VISITORS ONLY	OCCUPATION
	FOR VISITORS: How long has (NAME) been staying here? ** **FOR USUAL RESIDENTS** How long has (NAME) lived in this household? **	Where did (NAME) come from? *	**ONLY IF '2' IS CIRCLED IN BOTH COLS. 5 & 6** How long did (NAME) live here before moving out?**	What is (NAME) current occupation? That is what kind of work does (NAME) mainly do?
	(18)	**(19)**	**(20)**	**(21)**
01				
02				
03				
04				
05				
06				
07				
08				
09				
10				
11				
12				
13				
14				
15				

*CODES FOR Q19	**CODES FOR Q18 AND Q20	***CODES FOR Q21	
1= WITHIN THE SAME COMMUNITY	1= DAY	01=NO OCCUPATION	07=AGRICULTURE
2= ANOTHER COMMUNITY ACCRA	2= WEEKS	02=PROFESSIONAL/TECHNICAL	08=HOUSEHOLD AND DOMESTIC
3= ANOTHER TOWN	3=MONTHS	03=MANAGEMENT	09=SERVICE
4= RURAL	4= YEARS	04=CLERICAL	10=SKILLED MANUAL
5= BOARDING SCHOOL	5=SINCE BIRTH	05=SALES	11=UNSKILLED MANUAL
8=DON'T KNOW	8=DON'T KNOW	06=AGRICULTURE- SELF EMPLOYED	12=STUDENT
		98=DON'T KNOW	13=OTHER (SPECIFY).....

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LINE NO.		EDUCATION (IF AGE 3 OR OLDER & IF ATTENDED SCHOOL)			IF AGE 15 OR OLDER MARITAL STATUS	ETHNICITY	RELIGION
	Has (NAME) ever attended school? **NO→15**	What is the highest level of education (NAME) attended?*	What is the highest grade (NAME) completed at that level?**	**IF AGE IS LESS THAN 25 YEARS** Is (NAME) still in school?	What is the marital status of (NAME)? ***	What is the ethnic group of (NAME)? ****	What is the religion of (NAME)? *****
	(11)	(12)	(13)	(14)	(15)	(16)	(17)
01	YES NO 1 2	☐	☐☐	YES NO 1 2	☐	☐☐ 96=OTHER	☐☐
02	YES NO 1 2	☐	☐☐	YES NO 1 2	☐	☐☐ 96=OTHER	☐☐
03	YES NO 1 2	☐	☐☐	YES NO 1 2	☐	☐☐ 96=OTHER	☐☐
04	YES NO 1 2	☐	☐☐	YES NO 1 2	☐	☐☐ 96=OTHER	☐☐
05	YES NO 1 2	☐	☐☐	YES NO 1 2	☐	☐☐ 96=OTHER	☐☐
06	YES NO 1 2	☐	☐☐	YES NO 1 2	☐	☐☐ 96=OTHER	☐☐
07	YES NO 1 2	☐	☐☐	YES NO 1 2	☐	☐☐ 96=OTHER	☐☐
08	YES NO 1 2	☐	☐☐	YES NO 1 2	☐	☐☐ 96=OTHER	☐☐
09	YES NO 1 2	☐	☐☐	YES NO 1 2	☐	☐☐ 96=OTHER	☐☐
10	YES NO 1 2	☐	☐☐	YES NO 1 2	☐	☐☐ 96=OTHER	☐☐
11	YES NO 1 2	☐	☐☐	YES NO 1 2	☐	☐☐ 96=OTHER	☐☐
12	YES NO 1 2	☐	☐☐	YES NO 1 2	☐	☐☐ 96=OTHER	☐☐
13	YES NO 1 2	☐	☐☐	YES NO 1 2	☐	☐☐ 96=OTHER	☐☐
14	YES NO 1 2	☐	☐☐	YES NO 1 2	☐	☐☐ 96=OTHER	☐☐
15	YES NO 1 2	☐	☐☐	YES NO 1 2	☐	☐☐ 96=OTHER	☐☐

Just to make sure that I have a complete listing:

5) Are there any other persons such a small children or infants that we have not listed? YES ☐ → ENTER EACH IN TABLE NO ☐
6) In addition, are there any other people who may not be members of your HH, such as domestic servants, lodgers or friends who usually live here? YES ☐ → ENTER EACH IN TABLE NO ☐
7) Are there any guests or temporary visitors staying here, or anyone else who slept here last night that I have not listed? YES ☐ → ENTER EACH IN TABLE NO ☐ (SKIP ONE ROW)
8) Are there any persons who used to live in your household but have moved out in the past 1 year? YES ☐ → ENTER EACH IN TABLE NO ☐

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				HOW MANY?
***CODES FOR Q12 Q15** 0=PRE-SCHOOL 1=PRIMARY 2=JHS/MIDDLE 3=SHS/SECONDARY 4=HIGHER 8=DON'T KNOW	****EDUCATION GRADE Q13** 00=LESS THAN 1 YEAR 98=DON'T KNOW	*****CODES FOR** 0=NEVER 1= LIVING TOGETHE 2= MARRIED 3= SEPARATED 4=DIVORCED 5= WIDOWED	******CODES FOR Q16** 01=AKAN 02=GA-DANGME03=EWE 04=GUAN05=GURMA 06=MOLE-DAGBANI 07=GRUSI 08=MANDE 96=OTHER (SPECIFY) **RECORD ADJACENT TO TO THE CODE ABOVE.**	*******CODES FOR Q17** 01= NO RELIGION 02= CATHOLIC 03= PROTESTANTS 04=PENTECOSTAL/ CHARISMATIC 05=OTHER CHRISTIAN 06=ISLAM 07=TRADITIONAL/SPIRITUALIST 08=EASTERN RELIGIONS 96=OTHER (SPECIFY).....

LINE NO.	FOR VISITORS AND USUAL RESIDENTS	VISITORS ONLY	FOR FORMER RESIDENTS/VISITORS ONLY	OCCUPATION
	FOR VISITORS: How long has (NAME) been staying here? ** **FOR USUAL RESIDENTS** How long has (NAME) lived in this household? **	Where did (NAME) come from? *	**ONLY IF '2' IS CIRCLED IN BOTH COLS. 5 & 6** How long did (NAME) live here before moving out?**	What is (NAME) current occupation? That is what kind of work does (NAME) mainly do?
	(18)	(19)	(20)	(21)
01				
02				
03				
04				
05				
06				
07				

***CODES FOR Q19** 1= WITHIN THE SAME COMMUNITY 2= ANOTHER COMMUNIT ACCRA 3= ANOTHER TOWN 4= RURAL 5= BOARDING SCHOOL 8=DON'T KNOW	****CODES FOR Q18 AND Q20** 1= DAY 2= WEEKS 3=MONTHS 4= YEARS 5=SINCE BIRTH 8=DON'T KNOW	*****CODES FOR Q21** 01=NO OCCUPATION 02=PROFESSIONAL/TECHNICAL 03=MANAGEMENT 04=CLERICAL 05=SALES 06=AGRICULTURE- SELF EMPLOYED 98=DON'T KNOW	07=AGRICULTURE 08=HOUSEHOLD AND DOMESTIC 09=SERVICE 10=SKILLED MANUAL 11=UNSKILLED MANUAL 12=STUDENT 13=OTHER (SPECIFY).....

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HOUSEHOLD CHARACTERISTICS

NO.	QUESTION	RESPONSE	SKIP
22.	What is the **main** source of drinking water for members of your household? **PIPED WATER** 11=PIPED INTO DWELLING/INDOOR 12=PIPED TO YARD/PLOT 13=PUBLIC TAP/STANDPIPE 21=TUBE WELL OR BOREHOLE **DUG WELL** 31=PROTECTED WELL 32=UNPROTECTED WELL **WATER FROM SPRING** 41=PROTECTED SPRING 42=UNPROTECTED SPRING 51=RAINWATER 61=TANKER TRUCK 71=CART WITH SMALL TANK 81=SURFACE WATER (RIVER/DAM/LAKE/POND/STREAM) 91=BOTTLED WATER 92=SACHET WATER 96=OTHER (SPECIFY).....	☐☐	
23.	What kind of toilet facility does your household use? 1=NO FACILITY(BUSH/BEACH/FIELD) 2=WATER CLOSET (W.C)/FLUSH TOILET 3= KVIP 4= PIT LATRINE 5=BUCKET/PAN 6=PUBLIC TOILET (W.C,KVIP, PIT LATRINE,BUCKET/PAN) 8=OTHER (SPECIFY).....	☐	
24.	What is the main source of cooking fuel for this household? 01=NONE/NO COOKING 02= WOOD03=GAS 04=ELECTRICITY05=KEROSENE06=CHARCOAL 07=CROP RESIDUE08=SAW DUST09=ANIMAL WASTE 10=OTHER (SPECIFY).....	☐☐	

25. Does your household have:	YES	NO
a. A CAR	1	2
b. A MOTORCYCLE	1	2
c. A BICYCLE	1	2
d. A BOAT/CANOE	1	2
e. A TRUCK	1	2
f. AN OUTBOARD MOTOR	1	2
g. A REFRIGERATOR	1	2
h. A FREEZER	1	2
i. A GENERATOR	1	2
j. A WASHING MACHINE	1	2
k. A TELEVISION	1	2
l. A RADIO	1	2
m. A TELEPHONE	1	2
n. A CLOCK	1	2
o. AN ELECTRIC/GAS STOVE	1	2
p. A SOFA	1	2
q. A SEWING MACHINE	1	2
r. IRON	1	2
s. AN ELECTRIC FAN	1	2
t. A COMPUTER	1	2
u. FISHING NET	1	2

26.	In general, would you say that you/your household has: 1=MORE MONEY THAN YOU NEED 2=JUST ENOUGH MONEY 3=LESS MONEY THAN YOU NEED	☐	

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27.	Who is the primary source of income for this household? 1=HEAD OF HOUSEHOLD 3=BOTH SHARED EQUALLY (HEAD AND SPOUSE) 2=PARTNER 4= A DIFFERENT MEMBER OF THE HOUSEHOLD 8=OTHER(SPECIFY).....	
28.	What is the present holding/tenancy arrangement of this dwelling? 1=OWNING 2=RENTING 3=RENT FREE 4=PERCHING 5=SQUATTING 6=OTHER (SPECIFY)	
29.	Who owns this dwelling? 1=OWNED BY HH MEMBER 5=PRIVATE EMPLOYER 2=BEING PURCHASED (e.g., Mortgage) 6=OTHER PRIVATE AGENCY 3=RELATIVE NOT HH MEMBER 7=PUBLIC/GOVERNMENT OWNERSHIP 4=OTHER PRIVATE INDIVIDUAL 8=OTHER SPECIFY	
30.	How many rooms does this household occupy? **(COUNT LIVING, DINING, BEDROOMS BUT NOT BATHROOMS ,TOILET & KITHCEN)**	**NO. OF ROOMS**
31.	How many of the rooms are designed primarily for sleeping?	**NO.**
32.	How many household members sleep outside the designated sleeping rooms? **CODE 00 IF NO HOUSEHOLD MEMBER SLEEPS OUTSIDE**	**NO.**
33.	What type of dwelling does this household occupy? **RECORD OBSERVATION** 01=SEPARATE HOUSE 04=ROOMS 07=KIOSK 02=SEMI-DETACHED HOUSE 05=SEVERAL HUTS/ BUILDING 08= CONTAINER 03=FLAT/APARTMENT 06=TENT 09= ATTACHED TO SHOP 10= COMPOUND HOUSE 96=OTHER (SPECIFY)_____	
34.	What is the main material of the floor? **RECORD OBSERVATION** 01=EARTH/SAND 04=WOOD 10=VINYL TILES 07=WOOLEN CARPET 02=BURNT BRICKS 05=WOOD PLANKS 08=LINOLEUM/RUBBER CARPET 03=CEMENT/CONCRETE 06=TERRAZO 09=CERAMIC TILES/PORCELAIN GRANITE/MARBLE 10=VINYL TILES 11=STONE96=OTHER (SPECIFY).....	
35.	What is the main material of the roof? **RECORD OBSERVATION** 01=THATCH/PALM LEAF/SOD 06=ROOFING SHINGLES 02=RUSTIC MAT 07=ASBESTOS/SLATE ROOFING SHEETS 03=CARDBOARD 08=PALM/BAMBOO 04=METAL SHEETS 09=WOOD 05=BRICK TILES 10=CEMENT 96=OTHER (SPECIFY).....	
36.	What is the main material of the wall? **RECORD OBSERVATION** 01=CANE/PALM/TRUNKS 08=MUD BRICKS 02=BAMBOO WITH MUD 09=STONE WITH MUD 03=WOOD 10= PLYWOOD 04=CARDBOARD 11=BAMBOO 05=LANDCRETE 12=CEMENT BLOCKS/CONCRETE 06=BURNT BRICKS 07=METAL SHEETS/SLATE/ASBESTOS 96=OTHER (SPECIFY).....	

END TIME FOR INTERVIEWHOURS MINS

Thank you very much we have come to the end of the interview. Do you have any questions for me?

RESPONDENT: Comments/Questions.....

INTERVIEWER: Comments/Observations?.....

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Appendix 2: Individual Questionnaire

The Built Environment And The Risk Of Obesity Among The Urban Poor In Accra, Ghana

INDIVIDUAL QUESTIONNAIRE

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IDENTIFICATION

LOCALITY NAME* _____ ☐

E.A. BASE _____

NAME OF HOUSEHOLD HEAD _____

E.A. /EDL NUMBER ☐☐

STRUCTURAL NUMBER ☐☐

HOUSEHOLD NUMBER ☐☐

GREATER ACCRA 0 3

ROUND 0 2

* **CODES FOR LOCALITY NAME:** 1=AGBOGBLOSHIE 2=JAMES TOWN 3=USSHER TOWN

INTERVIEWER VISITS

	1	2	3	FINAL VISIT
DATE				DAY ☐☐ MONTH ☐☐ YEAR 2011
INTERVIEWER'S NAME				INT. CODE ☐☐
RESULT*				RESULT ☐
Next visit: Date				TOTAL NO. OF VISITS ☐
Time				

NAME AND LINE NO. OF RESP. FROM HH QUEST. _____ ☐☐

RESPONDENT INTERVIEWED IN ROUND 1 **1=YES** **2=NO** ☐

***RESULT CODES:**

1 COMPLETED
2 PARTLY COMPLETED
3 NO HOUSEHOLD MEMBER AT HOME OR NO COMPETENT RESPONDENT AT HOME AT THE TIME OF VISIT
4 ENTIRE HOUSEHOLD ABSENT FOR EXTENDED PERIOD OF TIME
5 POSTPONED
6 REFUSED
7 DWELLING VACANT OR ADDRESS NOT A DWELLING
8 DWELLING DESTROYED
9 DWELLING NOT FOUND
10 OTHER (SPECIFY) _____

LANGUAGE

LANGUAGE OF QUESTIONNAIRE: **ENGLISH**
LANGUAGE OF INTERVIEW** _____ 1
NATIVE LANGUAGE OF RESPONDENT** _____ ☐
WAS TRANSLATOR USED? (YES=1, NO=2) ☐
****LANGUAGE CODES**:
1 ENGLISH 2 AKAN 3 GA 4 EWE 5 DAGBANI 6 HAUSA
7 OTHER (SPECIFY) _____

SUPERVISOR ☐☐	FIELD EDITOR ☐☐	KEYED BY ☐☐
NAME _____	NAME _____	
DATE _____	DATE _____	

START TIME FOR INTERVIEW HOURS ☐☐ MINS ☐☐

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SECTION 1: RESPONDENT BACKGROUND AND MOBILITY

Now, I would like to ask you some background information about yourself.

Q NO.	QUESTION	RESPONSE	SKIP
100.	Sex of respondent 1=FEMALE 2=MALE		
101.	In what month and year were you born? **(CODE 98 FOR MONTH AND/ 9998 FOR YEAR IF DON'T KNOW MONTH AND/YEAR)**	**MONTH** **YEAR**	
102.	How old were you on your last birthday? **COMPARE AND CORRECT 101 AND/OR 102 IF INCONSISTENT**		
103.	Have you ever attended school? 1=YES 2=NO		**IF CODE 2 SKIP TO Q107**
104.	What is the highest level of education you have attained? 0==PRE-SCHOOL 1=PRIMARY 2=MIDDLE/JHS 3= SECONDARY/SHS 4=HIGHER		
105.	What is the highest grade you have completed at that level?	**GRADE**	
106.	Are you currently attending school? 1=YES 2=NO		
107.	Where were you born? Specify name of locality/Country _____ and Region. ***CODES FOR REGION** 01=WESTERN 02=CENTRAL 03=GREATER ACCRA 04=VOLTA 05=EASTERN 06=ASHANTI 07=BRONG AHAFO 08=NORTHERN 09=UPPER EAST 10=UPPER WEST 11=OTHER	***REGION**	
108.	How many years have you been living in this same community continuously? **(CODE 99 IF SINCE BIRTH, CODE 15 FOR LESS THAN ONE MONTH IN MONTH AND CODE 98 IF DON'T KNOW)**	**MONTHS** **YEARS** **SINCE BIRTH**	**IF SINCE BIRTH SKIP TO Q119**
109.	Where did you mostly live during the first 15 years of your life? Specify community/Country_____ and record region in which the community is located? ***CODES FOR REGION** 01=WESTERN 02=CENTRAL 03=GREATER ACCRA 04=VOLTA 05=EASTERN 06=ASHANTI 07=BRONG AHAFO 08=NORTHERN 09=UPPER EAST 10=UPPER WEST 11=OTHER	***REGION**	
110.	Just before you moved to this community, where did you live? Specify community/Country_____ and record region in which the community is located? ***CODES FOR REGION** 01=WESTERN 02=CENTRAL 03=GREATER ACCRA 04=VOLTA 05=EASTERN 06=ASHANTI 07=BRONG AHAFO 08=NORTHERN 09=UPPER EAST 10=UPPER WEST 11=OTHER	***REGION**	
111.	How long have you lived in the current community? **IF LESS THAN ONE MONTH CODE 15**	**MONTHS** **YEARS**	
112.	Why did you move to this community? 01=NO REASON 2=TO LOOK FOR A JOB 3=TO LEARN A TRADE 4=TO ESTABLISH HH 5=TO JOIN PARTNER 6=ACCOMODATION PROBLEM 7=CLOSER TO WORK 8=PROBLEMS WITH FAMILY 9=FAMILY RE-UNION 10=OTHER (SPECIFY).....		

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113.	Do you ever visit your last community? 1 = YES 2 = NO	☐	**IF CODE 2 SKIP TO Q117**
114.	How many times per year do you visit that community?	**TIMES PER YEAR** ☐☐	
115.	Why do you visit that community? 1=VISIT FAMILY 2=VISIT FRIENDS 3=ATTEND FUNCTIONS 4=WORK/TRAINING/SCHOOL 5=UTILISE SERVICE 6=OTHER (SPECIFY).....	☐	
116.	Which do you consider your primary residence? 1= CURRENT COMMUNITY 2=PLACE OF BIRTH 3=BOTH EQUALLY (1 AND 2) 4=A DIFFERENT COMMUNITY	☐	
CHECK HH COL 5: USUAL RESIDENT GO TO Q117 ☐			
117.	At the time you moved here, did you 1=MOVED TO JOIN EXISTING HH 2=MOVED WITH OTHERS TO START HH 3=MOVED ALONE 4=WHOLE HOUSEHOLD MOVED 5=OTHER (SPECIFY)	☐	

118. Who made the decision for you to move to this community? **PROBE: ANY OTHER?**	**YES**	**NO**
a. SELF	1	2
b. SPOUSE	1	2
c. SELF AND SPOUSE	1	2
d. PARENT(S)	1	2
e. CHILD/CHILDREN	1	2
f. OTHER RELATIVES	1	2
g. EMPLOYER	1	2
h. GOV'T RESETTLEMENT	1	2
i. OTHER (SPECIFY) _____	1	2
j. DON'T KNOW	1	2

119.	Are you currently a member of any organization in this community? 1=YES 2=NO	☐	**IF CODE 2 SKIP TO Q121**

120. What type of group do you belong to? What else?	**YES**	**NO**
a. RELIGIOUS (CHURCH, ISLAMIC ETC...)	1	2
a. MOTHER –TO –MOTHER SUPPORT/MOTHERS' CLUB	1	2
b. FATHER'S CLUB	1	2
c. CREDIT ASSOCIATION	1	2
d. MARKET GROUP	1	2
e. BUSINESS COOPERATIVE	1	2
f. OTHER (SPECIFY).....	1	2

121.	Do you plan to move out of this community in the future? 1=YES, JUST MYSELF 3=NOT CERTAIN 2=YES, WHOLE HOUSEHOLD 4=NO 5=OTHER SPECIFY.....	☐	**IF CODE 3 SKIP TO Q129** **IF CODE 4 SKIP TO Q128**
122.	Where do you plan to go? 01=WITHIN THE SAME COMMUNITY 02=ANOTHER COMMUNITY IN ACCRA (SPECIFY) ..... 03=PART OF NON SLUM IN ACCRA (SPECIFY) ..... 04=ANOTHER TOWN (SPECIFY) ..... 05=A VILLAGE (SPECIFY) ..... 06=BOARDING SCHOOL 96=OTHER (SPECIFY).....	☐☐	

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126.	How soon are you planning to move? **(IF LESS THAN A YEAR, ENTER MONTHS AND CODE 00 FOR YEARS. ENTER 98 FOR BOTH MONTHS AND YEARS IF DON'T KNOW/UNSURE) IF LESS THAN A MONTH CODE 15 IN MONTHS**			**MONTHS** ☐☐ **YEARS** ☐☐	
127.	Why do you want to move out? **PROBE: ANY OTHERS? RECORD ALL RESPONSES (TICK MOST IMPORTANT √)**	**YES**	**NO**	**MOST IMPORTANT**	**SKIP TO Q129**
	a. JOB ELSEWHERE	1	2		
	b. NO WORK AVAILABLE HERE	1	2		
	c. RENT TOO HIGH	1	2		
	d. MARRIAGE	1	2		
	e. WHOLE FAMILY MOVING	1	2		
	f. FAMILY PROBLEMS	1	2		
	g. TO ESTABLISH OWN RESIDENCE	1	2		
	h. WAS HERE TEMPORARILY	1	2		
	i. CAN AFFORD BETTER HOUSE	1	2		
	j. TOO MUCH CRIME/DRUGS	1	2		
	k. RETIRED/LOST JOB	1	2		
	l. OTHER (SPECIFY).....	1	2		
128.	What are the main reasons for not wanting to move? **PROBE: ANY OTHERS? REECORD ALL RESPONSES (TICK MOST IMPORTANT √)**	**YES**	**NO**	**MOST IMPORTANT**	
	a. CAN'T AFFORD TO MOVE	1	2		
	b. HAPPY WITH JOB	1	2		
	c. FAMILY LIVES HERE	1	2		
	d. OWN PROPERTY HERE	1	2		
	e. HAVE NOWHERE ELSE TO GO	1	2		
	f. TOO OLD TO MOVE	1	2		
	g. RENT IS CHEAPER	1	2		
	h. JOB RELATED REASONS	1	2		
	i. SECURITY IS GOOD	1	2		
	j. OTHER (SPECIFY).....	1	2		
129.	What is your religion? 01=NO RELIGION 02=CATHOLIC 03=PROTESTANTS 04=PENTECOSTAL/CHARISMATIC 05=OTHER CHRISTIAN 06=ISLAM 07=TRADITIONAL/SPIRITUALIST 08=EASTERN RELIGIONS 96=OTHER (SPECIFY)			☐☐	
130.	What is your ethnic group? 01=AKAN 02=GA-DANGME 03=EWE 04=GUAN 05=GURMA 06=MOLE-DAGBANI 07=GRUSI 08=MANDE 96=OTHER (SPECIFY).....			☐	
131.	What is your current marital status? 01=NEVER MARRIED 02=CURRENTLY MARRIED 03=LIVING TOGETHER 04=DIVORCED 05=WIDOWED 06=SEPERATED			☐☐	
132.	Whom are you living with? 1= ALONE 2=PARENT(S) 3= SPOUSE/PARTNER 4= CHILD(REN) 5=SPOUSE/PARTNER AND CHILDREN 6=FRIEND 7=SPOUSE/PARTNER &/ CHILD(REN) & OTHERS 8=SIBLINS 9=GRANDPARENT(S) 10=OTHER (SPECIFY).....			☐☐	
133.	Are you currently working? 1=YES 2=NO			☐	**IF CODE 1 SKIP TO Q136**

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134.	As you know, some people take up jobs for which they are paid in cash or kind. Others sell things, have small business or work on the family farm or in the family business, others are in school. Are you currently doing any of these things or doing any other work? 1=YES 2=NO		**IF CODE 1, SKIP TO Q137**
135.	What have you been doing for most of the time over the last 12 months? 1=GOING TO SCHOOL /STUDYING 2=LOOKING FOR WORK 3=INACTIVE 4=COULD NOT WORK /HANDICAPPED 8=OTHER (SPECIFY).....	☐	**IF CODE 1 SKIP TO SECTION 2**
136.	Have you done any work in the last 12 months? 1=YES 2=NO	☐	**IF CODE 2, SKIP TO Q145**
137.	During the last 12 months, how many months did you work?	**NO. OF MONTHS** ☐☐	
138.	How long did you do/have you been doing this particular work in the last 12 months? **IF MULTIPLE JOBS ASK ABOUT THE MAIN JOB**	**MONTHS** ☐☐	
139.	How many days do/did you spend on this work each week?	**NO. OF DAYS** ☐	
140.	Do/Did you do this work for a member of your family, for someone else or are you self employed? 1=FOR FAMILY MEMBER 2=FOR SOMEONE ELSE (govt &private) 3=SELF-EMPLOYED	☐	**IF CODE 1, 2 SKIP TO Q141**
141.	Do you usually work at home or away from home? 1=HOME 2=AWAY	☐	
142.	How many work days were you away from work in the past month due to your own illness or injury, or that of other family members? **NOT WORKED IN PAST MONTH, CODE 95**	**NO. OF DAYS** ☐☐	
143.	Do you usually work throughout the year, or do you work seasonally, or only once in a while? 1=THROUGHOUT THE YEAR 2=SEASONALLY/PART OF THE YEAR 3=ONCE IN A WHILE	☐	
144.	Does/Did your employment require you to work at night? 1=ALWAYS 2=SOMETIMES 3=NEVER 4=NOT WORKING	☐	
145.	What is your occupation, that is, what kind of work do you mainly do? **NAME OF OCCUPATION**---------- 01=NO OCCUPATION 02=PROFESSIONAL/TECHNICAL 03=MANAGERIAL 04=CLERICAL 05=SALES 06=AGRICULTURE- SELF EMPLOYED 07=AGRICULTURE 08=HOUSEHOLD AND DOMESTIC 09=SERVICE 10=SKILLED MANUAL 11=UNSKILLED MANUAL 12=OTHER (SPECIFY)..... 98=DON'T KNOW	☐☐	
CHECK 144: IF CODE 1 SKIP TO NEXT SECTION ☐			
146.	Are you paid or do you earn cash or in kind for this work or are you not paid at all? 1=CASH ONLY 2=CASH AND KIND 3=IN KIND ONLY 4=NOT PAID	☐	**IF CODE 3, 4 GO TO SECTION 2**
147.	How much do you earn for this work per month? **RECORD AMOUNT (GH¢) →**	**AMOUNT (GH¢)**	

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SECTION 2: COMMUNITY AND ENVIRONMEMT

Now I am going to ask you questions about your community and the environment

201. When I say the word "community", do you think of an area:

1=WITHIN A FEW MINUTES' WALK FROM YOUR HOME?
2=WITHIN A 10-MINUTE WALK FROM YOUR HOME?
3=MORE THAN 10-MINUTE WALK FROM YOUR HOME?

☐

202. On a scale of 1 (low) to 5 (high), how much of a problem are the following in your community:

		SCALE				
a.	DETERIORATION AND POOR SANITATION	1	2	3	4	5
b.	POVERTY	1	2	3	4	5
c.	CRIME	1	2	3	4	5
d.	LACK OF EMPLOYMENT	1	2	3	4	5
e.	DRUG SELLING OR USE	1	2	3	4	5
f.	EXCHANGING SEX FOR MONEY	1	2	3	4	5
g.	UNSAFE SEXUAL PRACTICES	1	2	3	4	5
h.	INSUFFICIENT HEALTH CARE	1	2	3	4	5
i.	GROUPS OF TEENAGERS OR ADULTS CAUSING TROUBLE	1	2	3	4	5
j.	TRUST IN LOCAL POLICE	1	2	3	4	5
k.	DIFFERENT SOCIAL GROUP WHO DO NOT GET ALONG WITH EACH OTHER	1	2	3	4	5
l.	THE POLICE NOT PATROLLING THE AREA OR RESPONDING TO CALLS IN THE AREA	1	2	3	4	5
m.	OTHER (SPECIFY).....	1	2	3	4	5

203. For each statement, tell me whether you:

1=STRONGLY DISAGREE 2=DISAGREE 3= AGREE 4=STRONGLY AGREE

		SCALE			
a.	THIS IS A CLOSE-KNIT COMMUNITY	1	2	3	4
b.	PEOPLE IN THIS COMMUNITY ARE WILLING TO HELP EACH OTHER	1	2	3	4
c.	PEOPLE IN THIS COMMUNITY CAN BE TRUSTED	1	2	3	4
d.	PEOPLE IN THIS COMMUNITY WATCH OUT FOR EACH OTHER	1	2	3	4
e.	PEOPLE IN THIS COMMUNITY WOULD WORK TOGETHER IF THERE WAS A SERIOUS PROBLEM	1	2	3	4

204. How many out of ten adult neighbours do you know by name? ☐☐

205. About how many minutes per week would you say you spend talking to neighbours? **NO. OF HOURS** ☐☐

206. How likely are you to **ask** for help from a neighbour if you needed it

1=VERY LIKELY 2= SOMEWHAT LIKELY 3= NOT VERY LIKELY 4= NEVER

		SCALE			
a.	TO BORROW A SMALL AMOUNT OF MONEY	1	2	3	4
b.	A SMALL AMOUNT OF FOOD	1	2	3	4
c.	SOMEWHERE TO SPEND THE NIGHT	1	2	3	4
d.	MEDICINE OR MEDICAL CARE	1	2	3	4
e.	TO TALK ABOUT SOMETHING WORRYING YOU	1	2	3	4

207. How likely do you think you would be able to **receive** help from a neighbour if you asked:

1=VERY LIKELY 2= SOMEWHAT LIKELY 3= NOT VERY LIKELY 4= NEVER

		SCALE			
a.	TO BORROW A SMALL AMOUNT OF MONEY	1	2	3	4
b.	A SMALL AMOUNT OF FOOD	1	2	3	4
c.	SOMEWHERE TO SPEND THE NIGHT	1	2	3	4
d.	MEDICINE OR MEDICAL CARE	1	2	3	4
e.	TO TALK ABOUT SOMETHING WORRYING YOU	1	2	3	4

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208.	How likely are you to **help** a neighbour who needed: **1=VERY LIKELY 2= SOMEWHAT LIKELY 3= NOT VERY LIKELY 4= NEVER**	**SCALE**	
	a. TO BORROW A SMALL AMOUNT OF MONEY	1 2 3 4	
	b. A SMALL AMOUNT OF FOOD	1 2 3 4	
	c. SOMEWHERE TO SPEND THE NIGHT	1 2 3 4	
	d. MEDICINE OR MEDICAL CARE	1 2 3 4	
	e. TO TALK ABOUT SOMETHING WORRYING THEM	1 2 3 4	
209.	How likely are you to get help from a friend or relative **outside** the community if you needed: **1=VERY LIKELY 2= SOMEWHAT LIKELY 3= NOT VERY LIKELY 4= NEVER**	**SCALE**	
	a. TO BORROW A SMALL AMOUNT OF MONEY	1 2 3 4	
	b. A SMALL AMOUNT OF FOOD	1 2 3 4	
	c. SOMEWHERE TO SPEND THE NIGHT	1 2 3 4	
	d. MEDICINE OR MEDICAL CARE	1 2 3 4	
	e. TO TALK ABOUT SOMETHING WORRYING YOU	1 2 3 4	
210.	Read each question and enter the most appropriate response. Enter only **ONE** of the following answers for **EACH RESPONSE**: **1=NEVER 2=JUST ONCE OR TWICE 3=SEVERAL TIMES 4=ALWAYS 8=DON'T KNOW**		
	a. FEARED CRIME IN YOUR OWN HOME?	☐	
	b. HAD YOUR HOME BROKEN INTO WITH SOMETHING STOLEN?	☐	
	c. BEEN PHYSICALLY ATTACKED?	☐	
	d. EXPERIENCED DOMESTIC VIOLENCE?	☐	
	e. HAD SOMETHING STOLEN FROM YOU?	☐	
	f. BEEN RAPED?	☐	
	g. FEARED WALKING IN YOUR OWN NEIGHBOURHOOD?	☐	
	h. BEEN A VICTIM OF WITHCRAFT	☐	
	i. RECEIVED THREATS ON YOUR LIFE	☐	
	j. RECEIVED WARNINGS OF PLANNED ARMED ROBBERY OF YOUR HOME	☐	
211.	How many friends would you say you have close relationship(s) with in this community?	☐☐	
212.	Consider the economic status of the residents in your community, where the people at the top (5) have the highest economic standing in the community and people at the bottom (1) have the lowest standing. Which number (1 to 5) best represents where you stand at this time in your life, relative to other people in this **current** community?	☐	

SECTION 3: PHYSICAL ACTIVITY

301.	Are there places **IN THIS COMMUNITY** where you can engage in physical activity outside of your home? [**For interviewer** e.g. parks] 1=YES 2=NO	☐	**IF CODE 2 SKIP TO Q303**
302.	How long does it take to walk at a normal pace from your house to the nearest physical activity space in this community? .....**minutes**		
303.	How would you rate your community as a place to be physically active? 1=VERY CONDUCIVE (PLEASANT) 2=SOMEWHAT CONDUCIVE (PLEASANT) 3=NOT VERY CONDUCIVE (PLEASANT) 4=NOT AT ALL CONDUCIVE (PLEASANT)	☐	
304.	Are there any physical activity groups **IN THIS** community? (e.g., keep fit club) 1=YES 2=NO 8= DON'T KNOW	☐	**IF CODE 2, 8 SKIP TO Q306**
305.	Are you a member of a group **IN THIS** community that engages in regular physical activity [**For interviewer** e.g. keep fit club]. 1=YES 2=NO	☐	

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306.	Are you a member of any physical activity group which **IS NOT** in this community? 1=YES 2=NO	☐	**IF CODE 2 SKIP Q309**
307.	How often do you join [this group] to participate in physical activities? 1=..... TIMES A WEEK 2=TIMES IN TWO WEEKS 3=..... TIMES A MONTH/FOUR WEEKS 4=[OTHER], SPECIFY.....	☐	
308.	What types of physical activity does your group engage in? Types of activity Duration of activity .... Hours ..... Minutes .... Hours ..... Minutes .... Hours ..... Minutes		
CHECK 150: IF CODE 1 GO TO 1017 ☐		**IF CODE 2 SKIP TO 1022** ☐	
309.	Does your work involve **vigorous-intensity** activity that causes large increases in breathing or heart rate [like digging, heavy lifting] continuously? 1=YES 2=NO	☐	**IF CODE 2 SKIP TO Q312**
310.	In a typical week, on how many days do you do **vigorous-intensity** activities as part of your work? **..... Days**		
311.	How much time do you spend doing **vigorous-intensity** activities as part of your work in a typical day? **[1] ..... Hours [2] ..... Minutes**		
312.	Does your work involve **moderate-intensity** activity that cause small increases in breathing or heart rate like carrying light loads, cleaning, cooking or washing for at least 10 minutes continuously? 1=YES 2=NO	☐	**IF CODE 2 SKIP TO Q315**
313.	In a typical week, on how many days do you do **moderate-intensity** activities as part of your work? **..... Days**	☐	
314.	How much time do you spend doing **moderate-intensity** activities at work on a typical day? **[1] ..... Hours [2] ..... Minutes**		
315.	In a typical week, on how many days do you travel in a motor vehicle like a car, bus, 'trotro' or taxi? **1=..... Days per week 2=No travelling in a motor vehicle**	☐	**IF CODE 2 SKIP TO Q1025**
316.	How much time do you usually spend on one of those days travelling in a car, bus, trotro or taxi? **1=..... Hours per day 2=..... Minutes per day**	☐	
NOW I WOULD LIKE TO ASK YOU ABOUT SPORTS, LEISURE AND RECREATIONAL ACTIVITIES			
317.	Do you do any **vigorous intensity** sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate [like running or playing football], for at least 10 minutes continuously? 1=YES 2=NO	☐	**IF CODE 2 SKIP TO Q320**
318.	In a typical week, on how many days do you do **vigorous intensity** sports, fitness or recreational (leisure) activities? **..... Days**		
319.	How much time do you spend doing **vigorous intensity** sports fitness or recreational activities on a typical day? **1=..... Hours 2=..... Minutes**		
320.	Do you do any **moderate-intensity** sports, fitness or recreational (leisure) activities that cause a small increase in breathing or heart rate [such as brisk walking, gardening for at least 10 minutes at a time? 1=YES 2=NO	☐	**IF CODE 2 SKIP TO Q323**

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321.	In a typical week on how many days do you do **moderate-intensity** sports, fitness or recreational (leisure) activities? **..... Days**		
322.	How much time do you spend doing **moderate-intensity** sports, fitness or recreational (leisure) activities on a typical day? **1=..... Hours 2=..... Minutes**		
This section is about some of the physical activities you typically do around your home, like housework, gardening, yard work and caring for your family.			
323.	Think about only those activities that you did for at least 10 minutes at a time. In a typical week, on how many days do you do **vigorous-intensity** physical activities like heavy lifting and chopping wood? **1=..... Days per week** 2=**No vigorous activity**	☐	**IF CODE 2 SKIP TO Q325**
324.	How much time do you usually spend on one of those days doing **vigorous-intensity** physical activities in the garden or yard? **1=..... Hours per day 2=..... Minutes per day**		
325.	Once again, think about only those activities that you did for at least 10 minutes at a time. During the last seven days, on how many days did you do **moderate-intensity** activities like carrying light loads, washing clothes, scrubbing floors and sweeping inside your home? **1=..... Days per week 2=No moderate activity inside home**	☐	**IF CODE 2 SKIP TO Q327**
326.	How much time do you usually spend on one of those days doing **moderate-intensity** physical activities inside your home? **..... Hours per day ..... Minutes per day**		
327.	The following question is about sitting or reclining at work, at home, getting to and from places or with friends including time spent [sitting at a desk, sitting with friends, travelling in a car, "trotro", reading, playing cards or watching television but do not include time spent sleeping. How much time do you usually spend sitting or reclining on a typical day **..... Hours ..... Minutes**		
328.	Which **ONE** of the following describes you best for the last 7 days? **Read *all five* statements before deciding on the *one* answer that describes you** 1=All or most of my free time was spent doing things that involve little physical effort 2=I sometimes (1 — 2 times last week) did physical things in my free time (e.g. played sports, went running, swimming, bike riding, did aerobics) 3=I often (3 — 4 times last week) did physical things in my free time 4=I quite often (5 — 6 times last week) did physical things in my free time 5=I very often (7 or more times last week) did physical things in my free time	☐	
COMMUNITY PERCEPTION OF BODY SIZE			
329.	**SHOW CARD TO RESPONDENT AND WRITE NUMBER** How do you perceive your own body size?	☐	
330.	What do you think people in this community perceive as the ideal body size for		
	a. YOUNG MEN		
	b. OLD MEN		
	c. YOUNG WOMEN		
	d. OLD WOMEN		

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331.	How do you compare your body size to the community perceived ideal body weight? 1=SMALLER 2=SAME 3=LARGER	☐	
332.	Are you now trying to lose weight, gain weight, stay about the same or are you not trying to do anything about your weight (please check the best response) 1=LOSE WEIGHT 2=GAIN WEIGHT 3=STAY ABOUT THE SAME 4=DO NOTHING	☐	
	DIETARY PATTERNS		
333.	How often do you or someone else in your home prepare your meals at home? 1=NEVER [SKIP TO NEXT SECTION] 2=1 DAY/WEEK 3=EVERYDAY 4=WEEKENDS 5=3-4 DAYS/WEEK 6=ONLY ON SUNDAYS 7=2-3 DAYS/WEEK 8=ONLY ON SATURDAY 9=OTHER SPECIFY_____	☐	
334.	If you cook your meals, what kinds of cooking methods do you use? (Check **all** that apply)	**YES** / **NO**	
	a. FRYING	1 / 2	
	b. STEAMING	1 / 2	
	c. BAKING	1 / 2	
	d. GRILLING/BARBEQUE	1 / 2	
	e. BOILING	1 / 2	
	f. Roasting	1 / 2	
335.	Which method do you use **most often**? 1=FRYING 2=Roasting 3=STEAMING OVER WATER, WITHOUT OIL 4=STEWING 5=BAKING 6=GRILLING/BARBEQUE 7=BOILING	☐	
336.	How often do you add salt to your meals at the table? 1=NEVER 2=RARELY 3=OCCASIONALLY 4=VERY OFTEN	☐	
337.	Do you do anything on a regular basis to control your salt intake? 1=YES 2=NO	☐	**IF CODE 2 SKIP TO Q339**
338.	**If yes** to **Q1045**, what do you do? 1=AVOID/MINIMIZE CONSUMPTION OF PROCESSED FOODS 2=LOOK AT THE SALT OR SODIUM LABELS ON FOOD 3=DO NOT ADD SALT AT THE TABLE 4=DO NOT ADD SALT WHEN COOKING 5=USE SPICES OTHER THAN SALT WHEN COOKING 6= AVOID EATING OUT 7= OTHER (SPECIFY) _____	☐	
339.	What types of cooking oil do you usually use for frying/stewing at home? 1=PALM OIL 2= VEGETABLE OIL 3=SOYA BEAN OIL 4=OLIVE OIL 5=GROUNDNUT OIL 6= COCONUT OIL 7=PALM KERNEL OIL 8=LARD/ANIMAL FAT 9=CORNFLOUR OIL 10=SUNFLOWER OIL 11=DO NOT USE OIL AT ALL	☐	
340.	At what time of day do you usually eat your biggest/heavy meal? 1=MORNING 2=MIDDAY/AFTERNOON 3=EVENING	☐	

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Now I would like us to talk about the foods you ate in the last 7 days, the number of times you ate them and where you got them from

341.	Food List	No. of times eaten in the last 7 days	Frequency of sources of food				
			Home	Chop bar	Street vendor	Fast food joint	Restaurant
	CEREAL-BASED PORRIDGES						
	Millet koko (Housa Koko)						
	Maize koko						
	Ricewater						
	Oats						
	Other (specify)_____						
	CEREAL-BASED STAPLES						
	Rice-balls						
	Banku/Akple/TZ/kenkey						
	Plain rice						
	Jollof rice						
	Fried rice						
	Waakye						
	Other(specify)_____						
	TUBER & PLANTAIN BASED STAPLES						
	Fufu (all kinds)						
	Ampesi (yam, cocoyam, plantain)						
	Fried tubers (yam, plantain, cocoyam)						
	Roasted tuber (yam, plantain, cocoyam						
	Gari (*soakings, eba, or with beans*)						
	Other (specify)_____						
	SOUPS						
	Palm soup						
	Light soup						
	Groundnut soup						
	Kontomire soup						
	Okro soup (fresh)						
	Okro soup (dry)						
	Other (specify)_____						
	STEWS/SAUCES						
	Tomatoes stew						
	Palava sauce						
	Garden egg stew						
	Okro stew						
	Beans stew *(with or without plantain)*						
	Shito						
	Ground pepper						
	Other (specify)_____						
	FATS & OILS						
	Red palm oil						
	Vegetable (frytol, soy bean)						
	Butter						
	Margarine						
	Lard & animal fat						
	Other (specify)_____						

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341	**Food List**	**No. of times eaten in the past 7 days**	**Frequency of sources of food**				
			Home	**Chop bar**	**Street vendor**	**Fast food joint**	**Restaurant**
	ANIMAL SOURCE FOODS						
	Livestock (goat, sheep, beef, pork)						
	Poultry (chicken, duck, guinea fowl)						
	Fish (tuna, herrings, salmon)						
	Shell-fish (crab, lobster, shrimp, etc.)						
	Bush meat (grass cutter, antelope, etc.)						
	Egg						
	Sausage						
	Other (specify)_____						
	BAKED/ROASTED/BOILED SNACKS						
	Bran/wheat bread						
	Sugar/tea/butter bread						
	Meat pie						
	Cakes						
	Cashew nut						
	Roasted groundnuts						
	Roasted maize						
	Other (specify)_____						
	FRIED SNACKS						
	Doughnut						
	Chips (plantain , potato)						
	Koose						
	Chofi (Turkey tail)						
	Other (specify)_____						
	SOFT DRINKS						
	Minerals (Fanta, Sprite coca cola)						
	Malt drinks (Malta Guiness, vita malt)						
	Fruit juices (Ceres, Pure heaven)						
	Energy drinks (e.g. Lucozade, Blue Jeans etc.)						
	Sweetened (Tampico, Kalyppo)						
	Other (specify)_____						
	ALCOHOLIC DRINKS						
	Beers (Star, Club, Gulder)/Guinness						
	Spirits (whiskey, gin)						
	Wines						
	Homebrews (palm wine, pito, akpeteshie)						
	Bitters (e.g. Alomo, Agya Appiah, etc.)						
	Other (specify)_____						
	MILK AND DAIRY PRODUCTS						
	Milk						
	Yoghurt/Fanmilk						
	Butter						
	Cheese/Wagashie						
	Other (specify)_____						

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341	Food List	No. of times eaten in the past 7 days	Frequency of sources of food				
			Home	Chop bar	Street vendor	Fast food joint	Restaurant
	FRUITS						
	Orange						
	Pineapple						
	Banana						
	Pawpaw						
	Watermelon						
	Mango						
	Apple						
	Grapes						
	Avocado pear						
	Coconut						
	Other (specify)_____						
	VEGETABLES						
	Green leafy vegetables (e.g. kontomire, aleefu, ayoyo etc.)						
	Cabbage						
	Carrots						
	Eggplant (all varieties)						
	Okro						
	Tomatoes						
	Onion						
	Other (specify)_____						

342.	When you eat cooked food that you did not prepare at home, do you usually get it from this community or outside this community? 1=IN THIS COMMUNITY 2=OUTSIDE THIS COMMUNITY 3=DON'T EAT FOOD OUT OF HOME COOKED FOOD	☐
343.	On average how many servings of fruits do you eat on a typical day? **..... Servings per day**	
344.	On average how many servings of vegetables do you eat on a typical day? **..... Servings per day**	
345.	What time do you **usually** go to sleep? **Time.....**	
346.	How many hours of sleep do you **usually** get at night? **.....Hours**	

Thank you for your time. May I take your measurements?

	HEIGHT	WEIGHT	WAIST CIRCUMFERENCE	HIP CIRCUMFERENCE	
347.	Height in centimetres (cm)	Weight in kilograms (kg)	Waist circumference in cms	Hip circumference in cms	
	☐☐☐.☐	☐☐☐.☐	☐☐☐.☐	☐☐☐.☐	

END TIME FOR INTERVIEW HOURS MINS ☐☐☐☐

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WE HAVE COME TO THE END OF THE INTERVIEW, THANK YOU VERY MUCH FOR TAKING YOUR TIME TO ANSWER THESE QUESTIONS. DO YOU HAVE ANY QUESTION OR COMMENTS FOR ME?

RESPONDENT: COMMENTS/QUESTIONS

.....
.....
.....
.....
.....

INTERVIEWER: COMMENTS/QUESTIONS

.....
.....
.....
.....
.....

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Appendix 3: GPS Data Collection Form

The Built-Environment and the Risk of Obesity among the Urban Poor in Accra, Ghana

GPS DATA COLLECTION FORM (FOOD ENVIRONMENT)

NAME OF FIELD STAFF _____ GPS NUMBER _____

LOCALITY NAME [ ] LOCALITY NO [ ] EA BASE NAME [ ] EA CODE [ ] EA NO [ ]

WAY POINT CODE	N	W	TYPE OF FOOD(S)	DESCRIPTION OF POINT LOCATION	REMARKS

Source: Designed by Author, May 2013

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The Built-Environment and the Risk of Obesity among the Urban Poor in Accra, Ghana

GPS DATA COLLECTION FORM (PHYSICAL ACTIVITY ENVIRONMENT)

NAME OF FIELD STAFF _____ GPS NUMBER _____

LOCALITY NAME [ ] LOCALITY NO [ ] EA BASE NAME [ ] EA CODE [ ] EA NO [ ]

WAY POINT CODE	N	W	TYPE OF PHYSICAL ACTIVITY SPACE	DESCRIPTION OF POINT LOCATION	REMARKS

Source: Designed by Author, May 2013

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Appendix 4: Focus Group Discussion Interview Guide

REGIONAL INSTITUTE FOR POPULATION STUDIES

UNIVERSITY OF GHANA

The Built Environment And The Risk Of Obesity Among The Urban Poor In Accra, Ghana

Qualitative Instrument

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Focus Group Discussion Question Guide

SECTION 1: PHYSICAL ACTIVITY ENVIRONMENT

1.1 Physical activity spaces

1. Are there places in **this community** where people can engage in physical activities like jogging, playing football etc. outside of their home?
2. What are some of such places?
3. Where are they located in **this community**?
4. Are these places conducive for physical activity? State reasons for answer.
5. Which group(s) of people in the community use these places for physical activity?

1.2 Physical activity groups

6. Are there groups in **this community** who come together to engage in physical activity?
7. Which people make up such groups?
8. What kind of activities do these groups engage in?

1.3 General issues

9. What things in the community prevent people from engaging in physical activity?
10. What things in the community encourage people to engage in physical activity using the community physical activity spaces?

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SECTION 2: SOCIAL ENVIRONMENT

1. Are there perceptions about body size in **this community**?
2. What are the perceptions about body size in **this community**?
3. What are the reasons for these body size perceptions?
4. Based on these perceptions what is the community ideal body size for:
    a. Young men
    b. Old men
    c. Young women
    d. Old women

Note: The participants will be asked to choice what the ideal body size is for the various groups from the body size chart which will be provided for them.

5. Do people in **this community** conform to these perceptions?
6. What do people in **this community** do to conform or not conform to the community ideal body size?

SECTION 3: FOOD ENVIRONMENT

1. Do people in **this community** usually cook the food they eat at home?
2. When people in **this community** buy cooked food outside of their homes, do they usually buy from this community or from outside of the community?
3. What factors influence whether or not people will buy food that they did not prepare themselves to eat?
4. Do people in **this community** eat a lot of fruits and vegetables?
5. Are fruits and vegetables easily available in **this community**?
6. Are people in **this community** able to buy fruits and vegetables for consumption?

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Appendix 5: Components of the dietary diversity score computed from the foods consumed by the respondents in the last seven days preceding the survey

Starchy Staples (Cereals and white roots and tubers)	Dark Green Leafy Vegetables	Other Vitamin A rich fruits and vegetables	Other fruits and vegetables	Legumes nuts and seeds	Meat and fish	Eggs	Fats and oils	Milk and milk products
Millet koko	Kontomire soup	Palm soup	Fruit juices	Groundnut soup	Livestock	Eggs	Vegetable oil	Milk
Maize koko	Okro soup	Red palm oil	Orange	Cashew nut	Poultry		Butter	Yogurt
Rice water	Green leafy vegetable	Pawpaw	Pineapple	roasted groundnut	Fish		Margarine	Cheese/ Wagashie
Oats		Mango	Banana	Koose	Shell fish		Lard/animal fat	Butter
Rice balls		Carrots	Water melon		Bush meat			
Banku			Apple		Sausage			
Plain rice			Grapes					
Plain rice			Avocado pear					
Jollof rice			Coconut					
Fried rice			Cabbage					
Waakye			Egg plant					
Fufu			Okro					
Ampesi			Tomatoes					
Fried tuber			Onion					
Roasted tuber								
Gari								
Bran/Wheat bread								
Sugar/Tea/Butter bread								

Source: Computed from survey data, November-December 2011

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Appendix 6: Consent Statement

INFORMED CONSENT

Title: The Built Environment and the Risk of Obesity among the Urban Poor in Accra, Ghana
Principal Investigator: Fidelia A. A. Dake
Address: Regional Institute for Population studies
University of Ghana
P.O. Box LG
Legon, Accra - Ghana

General Information about Research

My name is ..... from the Regional Institute for Population Studies (RIPS) at the University of Ghana. We are conducting a research in your community. This study aims at investigating the influence of contextual factors on the risk of obesity in an urban poor community. This research involves the gathering of survey data. You will be asked questions about yourself including your age, level of education, ethnicity, religious affiliation etc. You will also be asked questions about your lifestyle behaviours including whether or not you consume alcohol or smoke, the kinds of food you eat and your level of physical activity. As part of the study, your weight, height, waist circumference and hip circumference will be measured. If you agree to be part of the study, the interview will last approximately 60 minutes. The answers you provide will be recorded in a questionnaire. The information will then be later captured and analysed.

Possible Risks and Discomforts

There are no known physical, social and financial risks or discomforts associated with participating in this study.

Confidentiality

All information you provide for this study will be treated with strict confidentiality. We will protect all information about you to the best of our ability. You will not be named in any reports. Only academic advisers may have access to this research records.

Voluntary Participation and Right to Leave the Research

Participation in this research is voluntary, you have the right to withdraw at any point without any penalty against you, and all information provided will be deleted from the study. Have I explained everything well enough to you? Do you have any questions for me?

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Contacts for Additional Information

For additional information or any concern about this research after the interview, please contact the principal investigator Fidelia A. A. Dake on 0262864839 or 0302500274 at the Regional Institute for Population Studies, University of Ghana, Legon.

Your rights as a Participant

This research has been reviewed and approved by the Institutional Review Board of Noguchi Memorial Institute for Medical Research (NMIMR-IRB). If you have any questions about your rights as a research participant you can contact the IRB Office between the hours of 8am-5pm through the landline number 0302916438 or email addresses: nirb@noguchi.mimcom.org or HBaidoo@noguchi.mimcom.org . You may also contact the chairman, Rev. Dr. Ayete-Nyampong through mobile number 0208152360 when necessary.

VOLUNTEER AGREEMENT

The above document describing the benefits, risks and procedures for the research title ***(The Built Environment And The Risk Of Obesity Among The Urban Poor In Accra, Ghana)*** has been read and explained to me. I have been given an opportunity to have any questions about the research answered to my satisfaction. I agree to participate as a volunteer.

_____ _____

Date Name and signature or mark of volunteer

Thumbprint

If volunteers cannot read the form themselves, a witness must sign here:

I was present while the benefits, risks and procedures were read to the volunteer. All questions were answered and the volunteer has agreed to take part in the research.

_____ _____

Date Name and signature of witness

I certify that the nature and purpose, the potential benefits, and possible risks associated with participating in this research have been explained to the above individual.

_____ _____

Date Name and Signature of Person Who Obtained Consent

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Appendix 7: List of Enumeration Areas

1	KING ALFRED'S LODGE
2	CITY FOOD SUPPLY LTD (GHANA)
3	HOUSE NO D115/2
4	GO AHEAD CHOP BAR
5	PLANNED PARENTHOOD ASSOCIATION OF GHANA
6	ASERE MANTSE WE
7	NII AMARTEIFIO WE
8	GREATER ACCRA DISTILLERS UNION
9	GBESE MANTSE PALACE
10	BUKOM SQUARE
11	SASCO
12	GA MAN-NYE WE
13	NEW JOINT ENTERPRISE
14	NII TEIKU TSURU WE
15	FANTEAKWA LTD
16	USSHER CLINIC
17	M & G PHARMACUETICALS
18	MANTSE HOUSE
19	NII KWEI
20	CITY ENGINEER'S DEPARTMENT
21	OLD BOAH CLINIC
22	OFOSUA HOUSE
23	APOSTOLIC REFORMED CHURCH
24	AKOTEY LAMPTEY PIONEER PRINTING AW.
25	PRESBYTERIAN CHURCH
26	HAPPY CORNER SPOT
27	H/N BLK 12
28	31ST DEC. MARKET