

**UNIVERSITY FOR DEVELOPMENT STUDIES**

**SELF-REPORTED FOOD INSECURITY AS SIGNIFICANT PREDICTOR OF ILL-  
HEALTH AMONG GHANAIAN HOUSEHOLDS**

**PHILEMON TETTEH-ADDO**

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HEALTH AMONG GHANAIAN HOUSEHOLDS**

**BY**

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## DECLARATION

### Student

I, hereby declare that this thesis is the result of my own work and that no part of it has been presented for another degree in this University or elsewhere.

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We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies

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## ABSTRACT

Food insecurity and ill-health have become topical issues that both researchers and development agents are concerned about. Food consumption directly links agriculture to health outcomes. Achieving zero hunger as enshrined in SDG 2 requires interventions that target those families and individuals experiencing food insecurity. In Ghana, food insecurity differs across regions and the socioeconomic status of households and individuals. Moreover, very little is known about the distribution of food insecurity and its effect on health outcomes. This study reveals the extent of food insecurity and the nexus that exists between food insecurity and ill-health as well as ill-days in the Ghanaian context. We used secondary data from the Ghana Living Standard Survey (GLSS) round seven and a sample size of 14,009 households which was further restricted to 13,818. The empirical models were analyzed in STATA 14. Eight sets of questions were used to measure self-reported food insecurity and an exploratory factor analysis was used to further transform the measurement into an index. The determining factors of the response variables and reverse causality between the endogenous variables were assessed first with the 2SLS estimator for separate equations given suitable instruments. We however proceeded with the 3SLS estimator for more efficient estimations. Region fixed effects and heterogeneity analysis (class of expenditure) were introduced. The incidence of food insecurity is very high in the order of Upper East, Northern, Upper West, Central, and Western Regions. However, the regions with a high prevalence of food insecurity also reported very high ill-health. Contrary to the expectation of the negative impact of extension service on food insecurity as revealed by literature, access to extension service is rather positively significant implying the

need to intensify extension services. Food insecurity within Greater Accra was found to be 60% less as compared to the western region which makes sense that wealthier households are less likely to experience food insecurity however, food security programs should target food insecurity pruned areas. The issue of irrigation, impassable roads and lack of accessible financial institutions should be addressed.

Keywords: Food insecurity, ill-health, ill-days, expenditure quartiles, region fix effect, Three Stage Least Square

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## **DEDICATION**

I dedicate this work first of all to God Almighty and also to my family, especially my late Dad, Cosmos K. Quarshie



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## **LIST OF ACRONYMS**

2SLS	Two Stage Least Square
3SLS	Three Stage Least Square
AOR	Adjusted Odd Ratio
ARR	Adjusted Related Risk
CCHIP	Community Childhood Hunger Identification Project
CFSVA	Comprehensive Food Security and Vulnerability Analysis
COPD	Chronic Obstructive Pulmonary Disease
EA	Enumeration Area
FAO	Food and Agriculture Organization
FIML	Full Information Maximum Likelihood
FRAC	Food Research and Action Center
GDP	Gross Domestic Product
GLSS	Ghana Living Standards Survey
GSS	Ghana Statistical Service
IV	Instrument Variable
NHANES	National Health and Nutrition Examination Survey
OLS	Ordinary Least Square
PSC	Paediatric Symptom Checklist
SD	Standard Deviation
SDG	Sustainable Development Goals
SSA	Sub-Sahara Africa

UN	United Nations
UNDP	United Nations Development Program
USA	United States of America
USDA	United State Department of Agriculture
WFP	World Food Program
WHO	World Health Organization

## CHAPTER ONE

### 1.0 INTRODUCTION

#### 1.1 Background

Food is critical and a very important requirement for human life. The quantity and quality of food for all people are essential attributes that receive attention in national and international development policies. The absence of sufficient and quality food has long-run undesirable consequences on health and body development. Persistent consumption of insufficient food that is deficient in the essential nutrients often can cause loss of lives (Sila & Pellokila, 2007). Given this, any intervention that addresses challenges in food production, supply, and distribution channels is likely to impact positively on household nutritional and health outcomes.

After the World Food Summits held in 1996 and 2001 decreasing hunger and food insecurity has become very critical components of the international development agenda. Statistics from the Food and Agriculture Organization (FAO) show that the number of people who experienced acute hunger requiring urgent food, nutrition, and livelihood assistance was estimated to be 113 million people across 53 countries in 2018 (FAO, 2019). Per the FAO (2019) reports, the 113 million people suggests slight improvement over the estimated number of hungry people for 2017, which was 124 million people in 51 countries.

In 2018, the following countries were faced with severe food crises in decreasing order; Yemen, the Democratic Republic of Congo, Afghanistan, Ethiopia, Syrian Arab Republic, Sudan, South Sudan and North Nigeria. However, the eight countries alone



represent two-thirds of the total number of people facing acute food insecurity, which approximated 72 million persons in 2019 (FAO, 2019). The improved food insecurity statistics between 2017 and 2018 over the two previous years is largely attributed to changes in climate shocks such as severe drought, floods, erratic rains and high temperatures brought about by the El Nino in 2016-2017 (FAO, 2019).

Generally, there are four dimensions of food security including availability, access, utilization, and stability (Ashby et al., 2016). Failing to achieve any of these four dimensions results in food insecurity. Thus, food insecurity is multidimensional, measuring the lack of protected access to sufficient, safe and nutritious food to achieve normal growth and development, and active and healthy life (FAO, 2019). Food insecurity also relates to the physical and economic access to sufficient, safe and nutritious food over time (Jones et al., 2013). Hunger denotes an escalating form of food insecurity (Coates et al., 2006; Jones et al., 2013). Studies by Wilde and Peterman (2006) and Yaemsiri et al. (2012) have associated food insecurity with low nutrient intake and poorer diets. The primary consequences of inadequate food and insufficient nutrient intakes are undernutrition and malnutrition. More generally, recent literature supports the impression that food insecurity is a key determinant of ill health, including obesity among adults (Caspi et al., 2017).

Food insecurity in this study focuses on the lack of or shortage of food in the household as a result of inconsistent financial resources to purchase relevant food items in the consumption bundle. In other words, this study assesses a household's inability to access food due to inconsistent resources for food purchases. For instance, there are

several occasions that household members become anxious about having enough food to eat because of a lack of money or other resources. There have also been times that household members skipped, at least, a meal within the day because there was not enough money or resources to get food within a specific period. At other times, the household would have to reduce the kinds of food items they consume within a specified period because they lack money or other resources to acquire a more diverse food items. All these constitute or are indicators of, food insecurity. The medium to long-term implications of these practices on health outcomes among children, youth, and adult members of the household often draw attention to the policy..

The linkage between food insecurity and health outcomes is important because if people do not have money to feed themselves, they can hardly attend to their health needs. But then lack of money for proper nourishment can itself trigger health problems such as sicknesses and malnutrition. Health issues that arise from inadequate and quality food as a consequence of limited resources include both nutrition and non-nutritional outcomes (Franklin et al., 2012; Gundersen & Garasky, 2012).

In 2015, the United Nations put forward the 17 sustainable development goals (SDGs) to transform the world's food situation in particular, for which reason the second goal aims at achieving zero hunger (UNDP, 2015) and promoting sustainable agriculture in developing countries (FAO, 2018). This goal is in the right direction and comes at the right time because a persistent challenge faced by developing countries in Sub-Saharan Africa (SSA) has been their inability to feed the ever-increasing population on the

subcontinent. So, tackling the problems of malnutrition, hunger and food insecurity in all its forms prominently features in the United Nations SDGs of the 2030 Agenda.

About 90% of the rural population in SSA have agriculture as their main source of income even though it has not been able to sufficiently eliminate the difficulties of food insecurity and malnutrition because of low productivity and unfavourable climatic factors (Kotir, 2011). Development organizations have therefore proposed several other approaches for reducing food insecurity, especially among the rural poor. For instance, Barrett et al. (2001) have advocated that making available non-farm work in rural areas, would have a positive impact on household welfare and reduce food insecurity incidences by providing opportunities to engage in wage-earning jobs. Promoting non-farm work is a way of providing rural households a potential escape route from poverty because non-farm work is less affected by weather variability and climate change. Extra income in the rural economy resulting from increased productivity can create demand for other goods and services, thus starting a system in which agriculture and rural off-farm activities grow and sustain each other (Stamoulis & Zezza, 2003).

However, WFP (2009) indicates that 5% or 1.2 million individuals of the Ghanaian population, the majority of whom resides in rural setting, are food insecure. However, two million people are estimated to be vulnerable and are likely to become food insecure (Darfour & Rosentrater, 2016). The situation of food insecurity in Ghana is intense in rural areas and slums in the cities. The majority of the Ghanaian rural population persistently suffer from cumulative poverty in more severe situations than the urban dwellers, thus making them more susceptible to food availability challenges (Aidoo et

al., 2013). Poor market distribution and the lack of well-structured financial institutions have led to high levels of food insecurity (Whitehead, 2006).

Food insecurity a multifaceted and complex phenomenon (Ippolito et al., 2019) is a significant but under-acknowledged determinant of the inequalities in healthcare access and health outcomes among susceptible populations (Vaccaro & Huffman, 2017; Whittle et al., 2015). On the other hand, there is enough evidence in the literature regarding the relationship between household food insecurity and diet, weight gain, increased risk of cardiovascular ailments and the development of chronic diseases (Franklin et al., 2012; Ke & Ford-Jones, 2015). Food insecurity is noted to be a tenacious social and public health problem of low- and middle-income countries. It is allied with poorer health care outcomes (Ashiabi & O'Neal, 2007a), self-rated health status (Ashiabi & O'Neal, 2007b), unhappiness and anxiety (Hadley et al., 2008; Sorsdahl et al., 2011), reduced micronutrient intake, fruits and vegetable consumption (Rao et al., 2001), obesity and overweight (Adams et al., 2003), stunted child growth and birth defects (Mutisya et al., 2015).

Food insecurity is also allied with increased hospitalisation and emergency unit use, and postponing required medical care and medication (Bhargava & Lee, 2017). This study focused on assessing self-reported food insecurity as a result of a lack of financial resources to access food within the Ghanaian context as indicated by household heads. The study also examines the effect of self-reported food insecurity ill-health among Ghanaian households.

## **1.2 Problem Statement**

Food insecurity is a principal cause of public health crises in the world and especially in developing countries where a several issues persist. Adequate knowledge about the extent of food insecurity and its effect on public health as well the use of this knowledge cannot be overemphasised. About 50 million people are food insecure due to uncertainty or inability to acquire enough food, which leads to serious negative outcomes (Gundersen & Garasky, 2012). FAO (2019) notes that the worsening food insecurity situation in developing countries can be linked to several years of recurrent natural shocks and declining agriculture production. For households to survive, they must therefore be able to store, cook, prepare and share major food items and also be able to withstand the volatility of food prices, which affects the very poor and poor households.

For people to be considered food secure, food must be available consistently and individuals must have adequate financial resources to access the food in a manner that has progressive nutritional impact (FAO, 2019). The United Nations, however, estimated that the demand for food will exceed 50% in the next 20 years whereas yields from rain-fed agriculture in Africa were projected to decrease by 50% by end of 2020 as a result of the changing climatic condition (Boko, 2007). Such increased demand coupled with low production would lead to higher food prices. With the incidence of the coronavirus (Covid-19) pandemic, the rate of yield decline and food price upsurge may even be higher than projected.

Ghana had its fair share of the global financial crisis accompanied by higher food prices from 2006. Prices of commodities such as rice and other staple crops in Ghana increased by 20% to 30% between late 2007 and early 2008 (Woden & Zaman, 2008). As a result of the increase in food prices, about 18% of the population with income less than the cost of the minimum food basket became extra prone to food insecurity (WFP, 2009). Moreover, the existence of climate change and dependence on rain-fed food production in Ghana pose a critical food security problem. Although there is an ideology that urban populations are better off in terms of food security than their rural counterparts, the increase of global food prices and financial crises have highlighted the problem of urban food insecurity in developing countries (Gebre, 2012) including Ghana. Food security dialogues are gradually moving from an overly rural focus to the inclusion of the urban contexts as a result of increasing urban poverty, stemming from increasing urbanization (Crush & Frayne, 2011).

The impact of food insecurity on nutrition status, growth, and human development are well established (Cook et al., 2013; Laraia, 2013; Nord et al., 2014). However, there is limited information about the non-nutritional impact of food insecurity (Weaver & Hadley, 2009). This is important because global food availability does not mean food security in any particular country is guaranteed since what is offered at the global market may not necessarily be accessible to affected households in developing countries in sub-Saharan Africa. For instance, most of these affected persons may be in the remotest areas of the country and may therefore not be able to access imported food items. Moreover, even if these imported food items get to rural communities, exorbitant transaction costs

may increase the prices of those food items to the extent that they become inaccessible to the extremely poor.

This study hypothesizes that nutrition and health outcomes are linked through hospitalisation of household members. The understanding of the impact of negative health outcomes that stem from food insecurity is of importance to health care professionals, policymakers and development practitioners in charge of improving health and well-being. There is evidence in the literature on the effect of food insecurity on ill-health among young adults. For instance, some of such studies have shown that food insecurity is connected to decreased nutrient intakes, increased rate of mental health problems and depression (Whitaker et al., 2006), diabetes (Seligman et al., 2010), hypertension (Stuff et al., 2004) and hyperlipidaemia (Seligman et al., 2010), worse health outcomes (McIntyre et al., 2003).

World Bank and FAO have started debates on how close to or far off from achieving a world free from hunger and food insecurity (SDG2) which is an underlying cause of ill-health. The first step in reducing food insecurity is to obtain an enhanced understanding of its effects on household livelihood and health outcomes. Food insecurity has also been associated with a variety of health outcomes including undernutrition, iron deficiency (anaemia), multiple chronic conditions, obesity and poor self-rated physical and mental challenges (Carter et al., 2010; Gucciardi et al., 2009). Franklin et al. (2012) has also indicated that many studies have aimed at summarizing the impact of food unavailability and accessibility challenges on child and adolescent health, individual well-being, obesity (Daniel, 2016) and mental health, among others. Very little has been

done with regards to the non-nutritional health outcome effects of food insecurity as a result of a lack of resources to purchase food (Caspi et al., 2017).

Poverty and hunger are rampant in Ghana especially in the three northern regions with about 28% of households in the Upper East Region suffering severe food insecurity, while 10% in the Northern Region and 16% of households in the Upper West Region suffer the same (Program & Service, 2012). In Ghana, food insecurity differs across regions and socioeconomic status, but little is known about the distribution of food insecurity, as well as its relationship with ill-health among Ghanaian households. Given this knowledge gap, this study focused on examining the relationship between self-reported food insecurity and health outcomes among Ghanaian households.

### **1.3 Research Questions**

The main question this study seeks to address is ‘how does food insecurity resulting from lack of money to finance household food purchases (henceforth referred to as self-reported food insecurity) affect ill-health among Ghanaian households? In addressing the main research question, the following specific research questions are derived:

1. To what extent does self-reported food insecurity exist among Ghanaian households?
2. What are the factors that affect self-reported food insecurity and ill-health and to what extent?
3. What is the relationship between food insecurity and ill-health among Ghanaian households?



#### **1.4 Research Objectives**

The main objective of this study was to examine the effect of food insecurity on ill-health among Ghanaian households. The specific objectives are to:

1. Quantify and compare the extent of self-reported food insecurity among Ghanaian households.
2. Examine the factors that influence food insecurity and ill-health among Ghanaian households.
3. Assess the relationship between food insecurity and ill-health among Ghanaian households.

#### **1.5 Justification**

The persistence of food insecurity also presents ill-health burden to household members, which is a cost to families, societies, and the nation as a whole. Therefore, understanding the relationship between perceived food insecurity and ill-health from this study would help to provide policy advice to all stakeholders concerned with food security and improvement in health outcomes among households in Ghana. This study enriches the stock of existing but limited knowledge and literature on food insecurity, especially in the Ghanaian context and the repercussions on health outcomes, and thus can serve as reference material for policymakers, academicians and researchers. Most significantly, this study gives a better understanding of food insecurity conditions resulting from the unavailability of resources that makes households unable to have access to food and how health outcomes of these households could be improved. Though food insecurity

has four dimensions of availability, access, utilization, and stability, existing literature does not fully address the issue of accessibility of food by households. Moreover, even though there is a cumulative worldview and global concern of improving food security in developing countries including Ghana, the scope and extent of food insecurity within the context of Ghanaian households (both urban and rural areas) is not well documented.

### **1.6 Limitations of the Study**

Though this study used secondary data, some difficulties were encountered in the course of data processing and analysis. The chief challenge had to do with dropping several households because of incomplete information or data recording errors on the part of the enumerators. Although 14,009 households were interviewed out of 15,000 total samples, the data was further restricted to 13,818 households after incomplete observations were eliminated. Also, data were not available for utilisation of financial institutions, so the study resorted to the presence of the closest financial institution as a proxy. The indicators used in measuring food insecurity only captured the access dimension of food insecurity. Therefore, food insecurity as used in the context of this study is largely captured by food access, and less on availability, utilization, and stability.

### **1.7 Organization of Study**

The foregoing chapter (Chapter one) introduced the study by highlighting the background and problem of the research. The background provided a general overview of the issues of food shortages caused by limited financial resources and how they relate to household health outcomes. Also, the chapter enlisted the research questions and the

corresponding objectives guiding the study. The chapter concluded by providing justification for the study, demonstrating the potential societal and scientific relevance of the study findings.

Chapter two followed with a literature review on food insecurity and various measurements of food insecurity as discussed in previous studies, application of food insecurity within development context, determinants of food insecurity and their effects on ill-health (both incidence of ill-health and ill-days), determinants of ill-health and the relationship between food insecurity and ill-health.

Chapter three discussed the study area and the research methodology employed in the study. The chapter elaborated on the distribution of the sample across the former ten (10) regions of Ghana. The chapter also highlights the research design, data collection and data analysis techniques employed, including the data source and type, sampling techniques and sample size, methods of data collection, and analytical methods employed to achieve the objectives of the study. Chapter four presented and discussed the study findings. First, the chapter described the socioeconomic and demographic characteristics of respondents across the former ten (10) regions of Ghana. Then followed a presentation and discussion of the determining factors of food insecurity and ill-health, as well as the nexus that exists between food insecurity and ill-health.

Chapter five summarized the main findings, drew conclusions based on the findings and provided recommendations for policies geared towards improving food security by reducing food insecurity among Ghanaian households.

## CHAPTER TWO

### 2.0 LITERATURE REVIEW

Chapter two reviews the relevant literature related to this study. In section 2.1 the world view of food insecurity, including the various measurements of food insecurity are discussed. Section 2.2 presents how food insecurity relates to development. Section 2.3 discusses the implications of food insecurity on welfare outcomes, while 2.4 presents the nexus between food insecurity and ill-health and ill-days. The empirical literature on the determinants of food insecurity is discussed in section 2.5, while that of ill-health is reviewed in section 2.6.

#### 2.1 The Concept of Food Insecurity

During the 1996 World Food Summit, food security was defined as a state in which *“all people, at all times have physical and economic access to sufficient, safe and nutritious food that meet their dietary needs and food preferences for an active and healthy life”* (FAO, 2005).

Food insecurity is defined by the Food and Agriculture Organisation as the interruption of eating patterns as a result of a lack of money and other resources (FAO, 2010). To many analysts, food insecurity is a multidimensional concept, comprising the lack of economic and physical access to sufficient, safe, and nutritious foods over some time (Jones et al., 2013). Food insecurity is also defined by the U.S. Department of Agriculture (USDA) as the *“limited or uncertain availability of nutritionally adequate and safe food or uncertain ability to acquire acceptable food in socially acceptable ways”* (Bickel et al., 2000).

So far, there is an agreement on four main scopes of food insecurity, which are availability, access, utilization, and stability. While availability requires a sufficient supply of healthy food options, access denotes affordability of and proximity to food. Utilization advocates a household's ability to derive benefit from the available kinds of food that are healthy, given the cooking and feeding practices of its members. Stability also require that all of the first three dimensions are sustainable with time.

Food insecurity has also been categorized into one of two ways. The first category is low food security, in which the quality and variety of the diet are reduced and there are problems with food purchase, but food intake and meal frequency are occasionally affected. The second category is very low food security, in which food intake is inadequate and eating patterns are disrupted. Several factors can contribute to or prolong food insecurity. Such factors include high food prices, joblessness, adverse economic policies, and lack of social protection, such as health care and education. Distance from a healthy food outlet further intensifies the risk and severity of food insecurity, especially once transportation burden is a household concern.

The USDA uses an 18-item scale to assess household food insecurity with and without hunger (which is a severe form of food insecurity, but not a necessary condition for food insecurity) (Garg et al., 2015). Other studies also use selected items from the USDA food security module to assess food hardship (Bickel et al., 2000; Nelson, 2004). The Radimer-Cornell measure of hunger and food insecurity has also been created to measure food hardship (Wolfe et al., 1998). The Community Childhood Hunger Identification Project (CCHIP) also measures food insecurity using an eight-item model

which determines whether household members, both adults and children, are affected by food shortages, food insufficiency, or deferred food intake as a result of resource constraints (Wehler et al., 2004). Several studies have linked food insecurity with low nutrient intake and poorer diet (Nord et al., 2014; Seligman et al., 2010).

Food insecurity is usually computed by the 18-item USDA measure and though this kind of measurement is all-inclusive and suitable, the limitation is that it poses a high participant burden especially for large community surveys (Garg et al., 2015). However, very few studies have their measurements emphasising poor food access, for instance, food insecurity situations which primarily occurs as a result of inconsistent financial resources required by households to purchase food (FAO, 2010), food insufficiency (Dixon et al., 2001; Okechukwu et al., 2012) and other psychological challenges about food access (Laraia, 2013; Yaemsiri et al., 2012).

Food insecurity is a critical household-level socioeconomic condition where it is perceived that there is a limited or unreliable availability of sufficient, safe, and nutritious food or restricted ability to purchase required foods in a generally acceptable way (Bickel et al., 2000). Food insecurity is a pertinent but underreported cause of inequalities in health care accessibility and poor health outcomes among vulnerable populations (Vaccaro & Huffman, 2017; Weiser et al., 2009; Whittle et al., 2015).

In the Ghanaian context, food insecurity is echoed by the general poverty situation where regions that are considered poor are also food insecure. For instance, the savannah north which is characterized by high poverty levels also experiences more

food insecurity challenges than the regions in the rainforest south. However, about 55% of the estimated 1.2 million people are predominantly farmers, value chain actors especially processors, agro-pastoralist, or untrained labourers.

Food insecurity has also been conceptualised in many ways. For example, the U.S Department of Agriculture conceptualized food insecurity as the “*limited or uncertain availability of nutritionally adequate and safe foods or limited ability to acquire acceptable foods in socially acceptable ways*”(Bickel et al., 2000).

## **2.2 Food Insecurity and Development**

Food is critical in human life and having adequate food in terms of both quality and quantity for all individuals is essential for national development. Inadequate food leads to starvation and severe hunger that can cause loss of lives, implying that having enough food is a necessary condition for a well-nourished household (Sila & Pellokila, 2007). There are over one billion undernourished people in the world with about 98% of them living in underdeveloped countries (FAO, 2008). These countries, including Ghana, are unable to provide adequate food for their growing urban population characterized by perpetuating food insecurity and the prevalence of poverty.

However, the agenda of the United Nations is aware of these challenges thus enshrined and make provision for a road map that is transformational in the Sustainable Development Goals (SDGs) to overcome the problems of food insecurity among these nations (Easterly, 2015).

Population rise and urbanisation are coupled with several other challenges including the growing demand for food which must be overcome for the world to attain a world free from hunger and food unavailability. The incidence of food crises in recent times as a result of food price inflation has underscored the need to also enhance the governance and network of governmental and non-governmental programs that align with the often poor nature of international food and nutrition security systems (FAO, 2011).

Africa has records of the high occurrence of food insecurity compared with other regions though it is estimated, according to the SDG indicators, that the prevalence of both severity and moderation has reduced marginally (FAO, 2019). However, the fight against rural poverty in Africa is problematic to policymakers (Martey et al., 2021) and development agencies. The population growth between 2013 and 2017 also outshined the reduction of overall incidence of poverty leaving more people poor (GSS, 2018) and food insecure (Martey et al., 2021). Ghana's structural adjustment policies overlooked the Savannah North, thus creating a negative effect on the region because the region was poor lacking some crops suitable for exports and the area's peripheral status (Songsore & Denkabe, 1995).

### **2.3 Implication of Food Insecurity on Welfare Outcomes**

The absence of safe food increasingly and seriously impacts the most susceptible population groups such as the unemployed or the employed with perilous working conditions, the uneducated, low income earning individuals, and the aged. The United States Department of Agriculture (USDA) has a comprehensive objective of decreasing the incidence of food insecurity among households with low income through Food



Stamp Programs and other programs that assist household nutrition (Nord & Parker, 2010). DePolt et al. (2009) studied the relationship between these food aid programs and household food hardship using longitudinal data from a three-city study in the US asserted that the association between food stamp receipt and self-reported food insecurity and insufficiency scales, has been more misleading. The unreserved relationship that exists between food stamp participation and food hardship is most intensely positive. For instance, the latest national food insecurity report estimates that among households with income below 130% of the poverty line, 49% of food stamp recipient households reported the presence of food availability problems while 25% of non-recipient households reported this condition. Food insecurity is a severe and current public health issue in many countries, including the United States for two reasons. First, the magnitude of the problem is overwhelming because, 14.5% of Americans were food insecure and uncertain of being able to access sufficient food because they had insufficient money or other resources (Coleman-Jensen et al., 2011). Secondly, there are some negative health consequences related to food insecurity challenges among household children, including anaemia, lower nutrient intake, and greater cognitive problems. USDA reports that 41.2 million US residents, including 12.9 million children, experienced food insecurity in 2016, though prevalence varies widely from state to state. Food insecurity has been linked to some negative outcomes, ill-health among children, lower academic performance, and depression (Oberholser & Tuttle, 2004). Increased food insecurity poses an impending problem for recipients of welfare benefits such as food aid programs. Such families are likely to be exposed to variations in benefits and resources as a result of welfare reforms (Slack & Yoo, 2005).

In developing countries, food-insecure households that do not receive any form of food program support require extra income to be able to level up in terms of welfare with their counterparts with adequate food access and receiving support (Akpalu et al., 2018). Increasing productivity in the food systems however does not only increase the ability of households to access food but also increases their incomes, and such broad-based growth is critical and as important as increasing food availability. The chronic food insecurity prevailing in developing countries is a silent killer that leads to increased morbidity and mortality, energy loss among populations, reduced cognitive ability of malnourished children as well declining economic growth (Steiner et al., 2019).

#### **2.4 The Relationship between Food Insecurity and Ill-Health**

Poverty and food insecurity are social determinants of health and are associated with some of the most severe and costly health problems in the world. The health effects of food insecurity include, but are not limited to obesity, diabetes, hypertension, low birth weight, depression and anxiety (Adams et al., 2003).

The elimination of food poverty from the African continent is a big challenge for development policy and practice in the new millennium and development experts must understand the complex and dynamic vulnerability situation and livelihood strategies of rural people to enhance the formulation of strategies that address poverty (Hesselberg & Yaro, 2006). Food insecurity is usually linked to households' inability to meet basic food needs and their insufficient access to nutrition (Nord et al., 2014). However, food insecurity has been argued to be a determinant of a series of negative health outcomes (Alaimo, 2005; Cook et al., 2013). Citizens in Portugal, women, the aged, and unmarried

subjects have higher food insecurity problems because self-reported ill-health and poor self-rated health outcomes were found to be also associated with food insecurity (Alarcão et al., 2020). Generally, households that report food insecurity also report lower nutrient intake and greater levels of mental health problems as well as chronic diseases (Seligman et al., 2010; Whitaker et al., 2006; Ziliak et al., 2008).

Children from food-insecure households are mostly overwhelmed and faced with the consequences of food insecurity including physical symptoms such as hospitalization (Cook et al., 2004), headaches and stomach aches (Alaimo et al., 2001), obesity (Kuku et al., 2011), behavioural problems (Huang et al., 2010) or lower psychosocial health (Fiese et al., 2011; Huang et al., 2010).. There is evidence of an increasing portion of literature that focuses on the relationship between food insecurity and diet, weight loss, high risk of cardiovascular disease and development of other chronic diseases (Ford, 2013; Franklin et al., 2012; Laraia, 2013).

In 2016, approximately 28.3 million adults (11.5% of all adults) and 12.9 million children (17.5% of all children) in the United State lived in food-insecure households (FRAC, 2017). Food insecurity, even marginal food security (a less severe level of food insecurity) (Cook, 2013) is associated with some of the most common and costly health problems and behaviours, especially in the US which most people perceived as a food-secure country. Research shows that food insecurity is damaging to the health, development, and well-being of children both in the short and long term, however food insecurity has direct and indirect effects on the physical and mental health of people of all ages, (CCPCN & Nutrition, 2015; Gundersen & Ziliak, 2015). The American

Academy of Paediatrics' Policy stated that *“After multiple risk factors are considered, children who live in households that are food insecure, even at the lowest levels, are likely to be sick more often, recover from illness more slowly, and be hospitalized more frequently. Lack of adequate healthy food can impair a child’s ability to concentrate and perform well in school and is linked to higher levels of behavioural and emotional problems from preschool through adolescence”* (CCPCN & Nutrition, 2015). Table 2.1 details some of the health conditions and behaviours associated with food insecurity problems.

**Table 2.1 Health conditions and behaviours associated with food insecurity among children and adults**

<b>Children</b>	<b>Adults</b>	<b>Older Adults</b>
Asthma	Arthritis	Asthma
Behavioral and social-emotional problems (e.g., Hyperactivity)	Asthma	Congestive heart failure
Birth defects	Cancer	Depression
Developmental risk	Chronic kidney disease (especially among those with either diabetes or hypertension)	Diabetes
Iron deficiency anaemia	Chronic obstructive pulmonary disease (COPD)	Gum disease
Less physical activity	Cigarette smoking	History of a heart attack
Low birth weight	Coronary heart disease	Hypertension
Lower bone density in boys	Depression (including maternal depression)	Limitations in activities of daily living
Lower health status	Diabetes	Lower cognitive function
Lower health-related quality of life	Functional limitations	Lower intakes of calories and key nutrients (e.g., protein, iron, calcium, vitamins A and C)
Lower physical functioning	Hepatitis	Obesity (primarily among women)

Mental health problems (e.g., depression, anxiety, suicidal ideation)	Higher levels of C-reactive protein (a marker of inflammation)	Osteoporosis
More frequent colds and stomach-aches	Hyperlipidaemia and dyslipidaemia	Peripheral arterial disease
Poor dietary quality	Hypertension	Poor or fair health status
Poor educational performance and academic outcomes	Insufficient sleep or poor sleep outcomes	
Untreated dental caries (i.e., tooth decay)	Less physical activity	
	Mental distress	
	Obesity (primarily among women)	
	Poor dietary intake	
	Poor or fair health status	
	Pregnancy complications (e.g., gestational diabetes, iron deficiency)	
	Stroke	
	Suicidal ideation	

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Source: FRAC 2017, according to Food Research and Action Center (2017),

Studies that examine the relationship between food insecurity problems and health among adults have considerable variation in the ages of those included in the study. Many studies emphasize on adults under 65 years, while others include all adults over 18 or 20 years of age. However, this study looks at the effect of self-reported food insecurity and ill-health in a household in general.

The Food Research and Action Center (FRAC, 2017) concluded that the health and well-being of children, adults, and older adults are at the mercy of poverty, food insecurity, and poor nutrition leaving vulnerable individuals and households at great risk for chronic disease and poor mental health. Beyond the consequences for individuals and families, these consequences also have costly implications for the economy and healthcare systems. Olson (1999) assessed nutrition and health outcomes associated with food insecurity and hunger concentrating on women within the reproductive age and school-age children. The argument therein revealed that hunger is allied with the pediatric symptom checklist (PSC) outcome beyond differences accounted for by poverty. Also, the relationship of hunger and food insecurity to the psychological welfare of children may or may not be mediated through nutritional status. Though these discoveries require confirmation with more diverse groups of children and better measures of poverty and socioeconomic status, they are nonetheless intriguing.

The National Health and Nutrition Examination Survey (NHANES) revealed that family food insufficiency is positively associated with visits to psychiatry among children between the age of 6 and 11 years old. Reid (2000) also hypothesised using

USDA Food Security Module that firstly, food hardship and hunger are likely to result in biological reactions in children, such as anxiety, irritability, or fatigue which directly influence behaviours. The second hypothesis is that food hardship may occur simultaneously with parental characteristics such as depression and stress that result in child behaviour problems in respect of parent-child interaction. They, however, revealed that the longer periods of food insecurity among children are both greater levels of child behavioural problems. Reid (2000) also found that there is a stronger relationship between food insecurity and externalizing behaviours among children that are 12 years and younger, than food insecurity and internalizing behaviours. Results of multivariate analysis in the study showed that regulating indicators such as poverty, food hardship is associated with behaviour problems in children.

Gunderson and Ziliak (2015) in their assessment of food insecurity and health outcomes theorized that food unavailability as a result of financial constraints is associated with dangers of some birth defects, anaemia, fewer nutrient intakes, cognitive difficulties, aggression, and anxiety in children. Food hardship can also be linked to a high risk of hospitalization and poorer general health conditions including asthma, behavioural problems, unhappiness, suicide ideation, and worse oral health. For instance, relative to children in food-secure households and also depending on the age of the child, children in food-insecure households had 2.0 - 3.0 times higher odds of having anaemia, 2.0 times higher odds of being in fair or poor health, and 1.4 - 2.6 times higher odds of having asthma. The data cited by Gunderson and Ziliak (2015) from Children's Health Watch, a sentinel study of over 40,000 children under four years in five large urban



hospitals, which began in 1998, point out that compared to children in fully food secure households, those in marginal-food-secure households are more likely to be in fair or poor health and more likely to have a mother who reported one or two substantial concerns about the child's development on the parent's assessment of developmental status.

Seligman et al. (2010) researched on 'Food Insecurity Is Associated with Chronic Disease among Low-Income NHANES Participants' and argued that food insecurity was associated with self-reported hypertension and hyperlipidemia but not diabetes. Furthermore, the study revealed food insecurity's association with laboratory evidence of diabetes though the relationship did not reach significance. The data also revealed an association between food insecurity and cardiac risk factors and therefore recommended policy negotiations regarding health should focus on empowering adults with or at risk for chronic disease to afford high-quality foods.

Cook et al. (2004) did not also mince words when they posited upon their assessment on "Food Insecurity Is Related to Adverse Health Outcomes among Human Infants and Toddlers." They found that some food-insecure children had odds of "fair or poor" health nearly twice as great, and odds of being hospitalized since birth almost a third larger relative to food-secure children. A dose-response association appeared between fair or poor health status and severity of food insecurity. Effect modification occurred between Food Stamps and food insecurity; Food Stamps attenuated (but did not eliminate) associations between food insecurity and fair or poor health. Food insecurity

is thus associated with health problems for young, low-income children. Safeguarding food security may reduce health problems, including the need for hospitalizations.

Looking at the above brief literature, it seems almost all the studies have similar findings. However, all the studies reviewed have occurred at a place where many have the conviction that they are food secured countries, particularly in the U.S. There is also limited information about food insecurity in the Ghanaian context. Therefore, as far as ‘one cap cannot fit all the present study intends to examine first of all the extent of food insecurity in the Ghanaian context and whether there is a substantial relationship between food insecurity and health outcomes in Ghana. Most of the literature also focused on specific health outcomes without investigating the intermediate effects of food hardship such as the occurrence of ill-health challenges as a result of food difficulties.

## **2.5 Determinants of Food Insecurity**

Even though there is a general notion about the urban populations being better off in terms food security than their rural counterparts, recent events have emphasised the reality of urban food insecurity (Gebre, 2012). Gebre (2012) conducted a study on the ‘determinants of food insecurity among urban households in Ethiopia’ using the Foster-Greer-Thorbecke distributional measure of food insecurity and binary logistic regression model. The results exposed that out of 10 key factors included in the model, 6 were significant in determining the possibility of being food insecure at less than a 10% level of significance. These factors included household size, age of household head, household head’s education, access to credit, household asset possession and

access to employment (Gebre, 2012). Previous studies suggest that the risk of household food insecurity is dependent on the available economic resources along with racial and ethnic minority status, marital status, homeownership, education, and age (Nord et al., 2014).

The role of economic resources has been extensively studied using economic pointers such as poverty status, assets liquidity and unemployment to account for the food insecurity in various ways to augment the simple relationship between food insecurity and income. Huang et al. (2016) acknowledged, focusing on the relationship between food insecurity and unemployment that job loss is one of the most important determinants of household food insecurity. This finding is also in line with the assertion from Coleman-Jensen (2011) negative shocks and income volatility as a result of unemployment usually affects household food consumption patterns.

According to Fernandes et al. (2018), several studies have revealed significant information about the determinants and effects of food insecurity, and that the rate at which food insecurity impacts vulnerable population groups such as the unemployed or those with precarious employment conditions and the older population is seriously increasing. In the United States younger, females, Hispanics, non-Hispanic blacks, unmarried and less educated individuals are more likely to be food insecure (Pruitt et al., 2016).

Using 2015-2016 data from the National Food, Nutrition, and Physical Activity Survey, Alarcão et al. (2020) compare immigrants and non-immigrants' food insecurity and how

it affects their health as well as nationwide dietary habits, physical activities, and other dimensions. They employed a chi-squared test and logistic regression model in their study to reveal that self-reported ill-health and poor self-rated health are also aligned with food insecurity and that natives, women, aged and unmarried had higher food insecurity problems.

Endalew et al. (2015) in their study revealed that food insecurity in most developing countries is more related to food availability and it is usually a function of several factors including food stock, food imports in the market, food aid programs, and own food production and the determinants of these factors. In addition to fundamental causes of food insecurity, the literature reveals that education, multiple sources of income, the number of children, single parenting, marital status and household employment status are key determining factors of food insecurity in both developing and developed countries (Carter et al., 2010).

The main cause of food insecurity in Ghana can be ascribed to the proportion of post-harvest losses (Darfour & Rosentrater, 2016). Moreover, Ghanaian peasant farmers are characterised by food insecurity because of inadequate means of production and large household size full of dependent individuals (Aidoo et al., 2013). Food insecurity in Northern Ghana is largely attributed generally to poverty and poor agricultural production. Food insecurity significantly increases as age, land size and access to credit increases whereas the output of staple crops such as maize, and the marital status of household heads reduces the incidence of food insecurity (Mustapha et al., 2016).

Other studies (Mulugeta & Hundie, 2012; Teng & Morales, 2014) also ascribe inadequate access to extension services, inadequate input supplies, and ineffective production technologies as determinants of food insecurity. Hesselberg and Yaro (2006) using data from an in-depth study from the Kassena Nankana District of Northern Ghana and livelihood vulnerability framework argued that multiple income sources, such as non-farm activities are a necessary condition to the reduction of food insecurity, especially smallholder farmers. Moreover, these poor peasant farmers who mostly reside in rural areas in Ghana are characterized by a lack of resources for production and large household sizes and are thus undernourished and exposed to malnutrition. The lack of resources for production and large household sizes make food security in Ghana a topical issue for both academics and policymakers.

Also, several studies have empirically examined and established the importance of remittances in food security (Atuoye et al., 2017; Mabrouk & Mekni, 2018; Regmi & Paudel, 2017).

## **2.6 Determinants of Ill-health**

The USDA, in collaboration with other federal agencies, academics and members of the policy community, developed the food insecurity measure in the United States in part because of the myriad negative health outcomes that were assumed to be associated with food insecurity. Understanding the reality of certain negative health implications that stem from food insecurity is of direct importance to healthcare professionals, policymakers, and health development officers in charge of improving health and well-being (Gundersen & Ziliak, 2015).

Women generally have poorer health than men, however men have a relatively higher age-specific mortality rate as compared to women (Waldron, 2000). Several studies usually overlooked the perspective of gender until in the latter part of the 1980s where research focused on the disparities in men's health according to the social stratification, with the less thoughtfulness of women (Emslie & Hunt, 2009). Recent studies have used different approaches for men with paid work while for women, the effects associated with the difficulty of balancing home and job responsibility which has generated the importance of examining women's health both in terms of their structural position in society and roles within the household (Lahelma et al., 2002).

Borrell et al. (2004) argued in their study that the association between social class position and ill-health is dependent on psychosocial and physical working conditions and job insecurity for men. However, the relationship between the working-class position and health among women is determined by household labour, material wellbeing, and the working conditions at home. The relationship that exist between mortality and educational level can be explained by several factors, including financial difficulties, the status of employment, and house and car ownership (Schrijvers et al., 1999). However, health behaviour does not account for the income effects on mortality (Claussen et al., 2003)

A recent operationalization of energy insecurity which comprises economic, behavioural and physical and why it matters to health describes its association with adverse environmental conditions, social concerns and health implications (Hernández, 2016). The suggested “energy security pathway to diseases and disadvantage” describes

energy insecurity as nexus between the structural condition of disadvantage and firstly environmental experience such as dampness as well as mould and thermal discomfort in the home. Secondly, it the nexus between the structural condition of disadvantage and ill-health outcomes such as respiratory diseases and mental illness; and lastly, social adversities, including stigmatization, household instability and disruption of family routine.

Using a brief indicator of household energy security in a clinical setting and the four validated markers of energy insecurity (including shut-off threats due to non-payment, use of cooking stoves for heat, forgoing heat due to inability to pay bills and experiencing disruption due to non-payment). Cook et al. (2008) examined the association between energy insecurity and child birth and wellbeing. The authors included these indicators in the Children's Sentinel Nutrition Assessment Program, which assessed 9721 children who joined emergency rooms and primary care centers throughout the United States. They realised that high odds of hospitalization from birth, self-reported ill-health, concerns about child development and prevalence of food insecurity after controlling for household characteristics were all related to energy insecurity (Cook et al., 2008). Based on these results, Hernández (2016) used these validated indicators to study the effect of energy insecurity's effect on health in a community-based sample of adults comparing expected and unexpected health outcomes. Using a logistic regression model, the author indicated that energy insecurity may explain existing respiratory and mental health related inequalities in susceptible populations.

Shorter sleep and ill-health, especially viral infections are commonly assumed to be linked. This belief has been validated by studies showing that there is a relationship between sleep period and both adaptive and innate immune system (Majde & Krueger, 2005) particularly for the adolescents (Hansen et al., 2005). Using short-duration laboratory studies, cross-sectional epidemiological studies, and longitudinal studies of chronic illness, several studies have established relationship between less sleep time and ill-health. Complete or partial sleep deprivation has been connected to dysregulation of the immune and endocrine factors (Okun, 2011)

Orzech et al. (2014) examined the relationship between sleep time of individuals and the incidence ill-health, including flu, cold, gastroenteritis and other infectious illness in adolescence during the school period. Using non-parametric regression (multivariate analysis) and structured protocol that included 14 health events questions, incidence of illness and illness-related absenteeism from school were coded for 710 completed interviews, 610 ill-health event and 90 reports of school absenteeism, it was observed that longer sleepers and males reported few incidence of ill-health. Severe incidence of illness was found to be prevalent among adolescents with shorter sleep (Orzech et al., 2014).

Different population groups denotes distinct relationship between food insecurity and obesity. For instance, food insecurity is related more with obsessed women than men (Orzech et al., 2014; Townsend et al., 2001). Other relevant studies also advocate that the relationship that exist between food security and body mass index (BMI) is more seen among certain ethnic groups (Dinour et al., 2007). Caspi et al. (2017) examined



the relationship between food hardship and obesity risk. The study used a multiracial community-based survey of adults living in low-income housing, univariate and bivariate analysis to evaluate the frequency of obesity, and multivariate regression model to determine the relative risk ratio. However, the authors concluded that individuals who were exposed to food hardship problems were more likely to be obese than those not exposed.

## **CHAPTER THREE**

### **3.0 METHODOLOGY**

This chapter discusses the study area, research design and methods used to achieve the research objectives. In section 3.1, the study area is discussed detailing the population, geography and economic activities in Ghana. Section 3.2 details the data and data sources, sampling and sampling procedures. Section 3.3 presents a pictorial concept of the study whereas section 3.4 provides details of methods employed in data analysis.

#### **3.1 Study Area**

This study is conducted in across the former ten regions of Ghana (Central, Western, Greater Accra, Volta, Eastern, Ashanti, Brong Ahafo, Northern, Upper West and Upper East Regions). Ghana is located in West Africa, bordered in the south by the Gulf of Guinea, the west and east by Cote d'Ivoire and Togo respectively, and in the north by Burkina Faso. Ghana lies within latitude 8°00'N and longitude 2°00'W. The total area is 238,533 square kilometres, comprising of 227,533 square kilometres land area and 11,000 square kilometres water area (WHO, 2019).

In 1988, Ghana changed from the local authority system of administration to the district assembly system. In that year, the then existing 140 local authorities were demarcated into 110 districts. In 2004, 28 new districts were created, thus increasing the number of districts in the country to 138 (GSS, 2012). Further additions were made in 2012 bringing the total to 216 districts. Currently, there are 260 total number of municipalities and district assemblies in Ghana and the current population of Ghana is estimated at

over 29 million people (WHO, 2019), with its economy dominated by the service sector contributing 46.3% of National GDP in 2018 compared to 34% for industry and 19.7% for the agriculture sector (GSS, 2019).

GDP estimates for 2018 showed a growth rate of 6.3% compared to 8.1% in 2017. With the industry sector recording the highest growth rate of 10.6%, followed by Agriculture (4.8%) and the Services (2.7%) sectors. The GDP growth rate of the Services sector declined from 3.3% in 2017 to 2.7% in 2018. Two sub-sectors (Information and Communication) of the Services sector recorded double digits (13%) GDP growth rates while the Health and Social Works sub-sectors recorded 22.6% growth rates. The Real Estate (-6.5%) and Finance and Insurance (-8.2%) however experienced a reduction. The highest growing sector (the Industry) with a GDP share of 34.0 percent, had its growth rate declining from 15.7% in 2017 to 10.6% in 2018. This could be the result of the decline in growth rate of the Oil and Gas activities from 80.3% in 2017 to 3.6% in 2018 (GSS, 2019). Mining and Quarrying sub-sector recorded the highest growth of 23.3% and Water Supply, Sewerage, Waste Management & Remediation Activities contracted by 3.6%. The Agriculture sector expanded by 4.8% in 2018 compared to a growth rate of 6.1% in 2017. Its share of GDP declined from 21.1% in 2017 to 19.7% in 2018. Crops is the second largest activity in Ghana with a share of 14.5% GDP. The Fishing sub-sector continued to decline, with GDP growth rate moving to -6.8% in 2018 from a growth rate of -1.4% in 2017. Notwithstanding, the low productivity of the extensive agriculture system, Ghana has recorded the largest reduction of undernourishment in the past 2 decades (Bruinsma, 2017). Large-scale farms and

plantations produce mainly oil palm and coconut and to a lesser extent, staples such as maize, rice and fruits including pineapples and banana. Ghana produces 51% of cereals consumed locally, 60% of fish requirement, 50% of meat and less than 30% of raw materials to feed agro-based industries (Sutton & Kpentey, 2012).

There is evidence of increased poverty, incidence of disease and inequality as a result of the rapid urbanization and rural-urban migration which is continuously exerting pressure on limited urban resources such as water, land and the environment and has led to increased poverty, disease incidence and inequality. Ghana's urban poverty incidence was 10.6% in 2013.

To better demonstrate the situation of self-reported food insecurity and ill-health in Ghana, the study assessed the extent of food insecurity and ill-health across the ten former regions of Ghana. The poverty rates in these regions are also employed to assess the association between self-reported food insecurity and ill-health in terms of poverty.

### **3.2 Data Source and Sampling**

Data for this study is secondary and obtained from the seventh round of the Ghana Living Standards Surveys (GLSS 7). This is a nationally representative household survey conducted over a period of 12 months (from October 2016 to October 2017) by the Ghana Statistical Service (GSS) with support from the World Bank. A two-stage stratified sampling design was employed to sample 15,000 households across the former ten administrative regions of Ghana. In the first stage, 1000 census enumeration areas (EAs) were sampled. The EAs are the primary sampling units stratified into the ten

administrative regions of Ghana based on the existing regional population. In the second stage, 15 households per EA were randomly sampled. Trained enumerators employed by the GSS successfully interviewed and recorded 14,009 households out of the 15000 sampled households. In this study, the sample size is further restricted to 13,818 households given the non-response to some of the food insecurity questions. However, the reduction in the sample is not expected to influence the power of the analysis. Table 3.1 details the regions selected, allocation of EAs and the distribution of households sampled.

**Table 3.1 The ten administrative regions and enumeration areas (EAs)**

<b>Region Name</b>	<b>Allocation of EAs</b>			<b>Allocation of household</b>		
	<i>Urban</i>	<i>Rural</i>	<i>Total</i>	<i>Urban</i>	<i>Rural</i>	<i>Total</i>
<b>Western</b>	41	57	98	615	855	1470
<b>Central</b>	44	50	94	660	750	1410
<b>Greater Accra</b>	100	10	110	1500	150	1650
<b>Volta</b>	32	64	96	480	960	1440
<b>Eastern</b>	43	57	100	645	855	1500
<b>Ashanti</b>	71	48	119	1065	720	1785
<b>Brong Ahafo</b>	42	53	95	630	795	1425
<b>Northern</b>	30	68	98	450	1020	1470
<b>Upper East</b>	20	76	96	300	1140	1440
<b>Upper West</b>	15	79	94	225	1185	1410
<b>Total</b>	<b>438</b>	<b>562</b>	<b>1000</b>	<b>6570</b>	<b>8430</b>	<b>15000</b>

*Source: Ghana Statistics Service, 2018*

The survey captured information on household demographics (gender, age, education and household size), availability and access to infrastructure, remittances, income and

expenditure, agriculture production, household investment decisions, poverty status, household health outcomes and status as well as the situation of food insecurity reported by Ghanaian households, among others. This study focused on the section of the GLSS 7 data that captured the demographics, food insecurity situations and the health outcomes reported by the households as core variables. The health outcome indicators were represented by number of household members who fell ill and the number of days of illness suffered by household members in the year under review. Food insecurity as a variable in this study is a continuous variable generated from a factor analysis using the eight self-reported food insecurity questions that household heads responded to with reference to the last 12 months. The questions are presented in section 2 of appendix.

Ill-health was measured based on a self-reported response from household heads. This comprises of the number of household members who suffered sickness or were hospitalized within a period of 12 months. Ill-days was measured by the number of days household members suffered ill-health or number days household members were hospitalized within the past 12 months.

### **3.3 Conceptual Framework**

According to Miles and Huberman (1994) and Robson (2011) a conceptual framework is defined as a set of concepts, assumptions, expectations, beliefs and theories that support and informs the research design of the study. In social research a conceptual framework explains the relationship that exist among variables usually starting from a simple model to a complex one. Miles and Huberman (1994) and Hines (1989) explain conceptual framework to be a visual or written product, one that “*explains, either*

*pictorially or in narrative form, the main things to be studied; key factors, concepts or variables and the expected relationships that exist among them”.*

Figure 1 represents the conceptualization of the study. Here, Ghanaian households are conceptualized to be characterized by certain factors that determine their food insecurity situation. These characteristics range from household socio-economic, institutional and other factors. Socio-economic factors expected to influence household food insecurity include household size, age of the household head, educational status of household head, economic activities of household head, home ownership, household assets owned, land security, remittances and household cultivated land area. Institutional factors expected to influence food insecurity include access to extension services, access to markets, access to irrigation facilities and access to financial institutions.

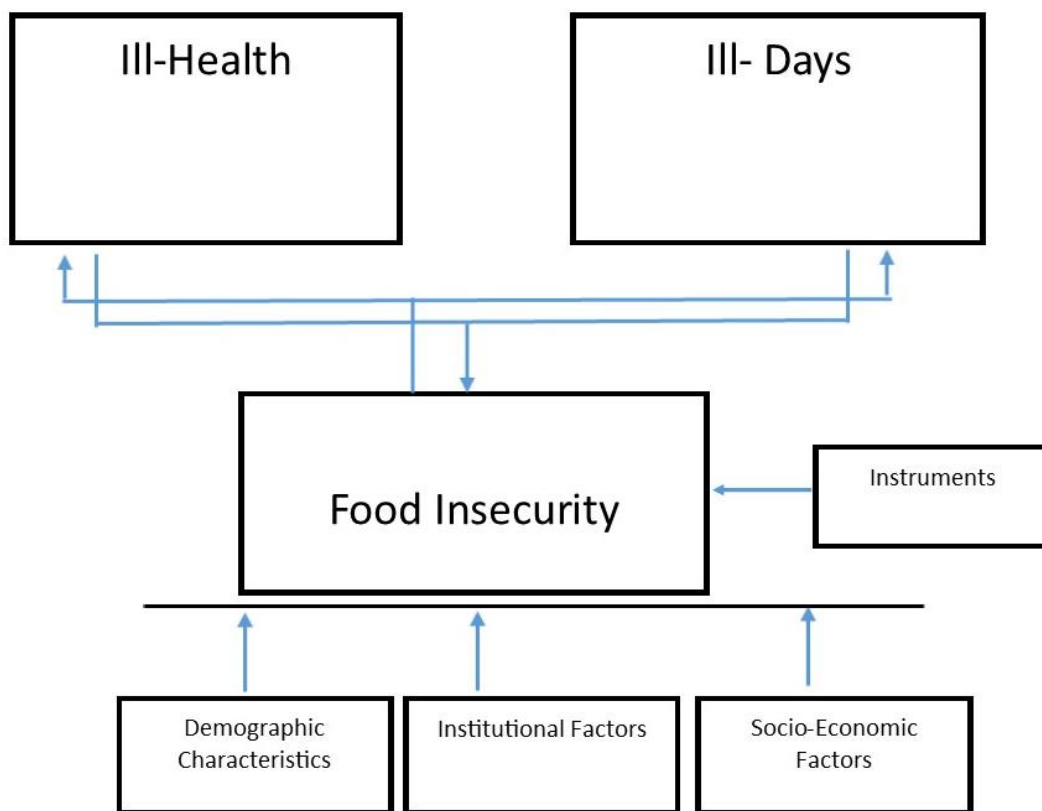


Figure 1: Conceptual framework of food insecurity and ill-health outcome

Food insecurity reported by households is also expected to significantly influence ill-health and ill-days. Number of household members that suffered ill health and the number of days hospitalised were used as proxies for health outcomes. These institutional factors and socio-economic factors are also expected to influence the health outcomes indirectly through food insecurity. The relationship between food insecurity and the health outcome variables is more likely to be two-way causality.



### **3.4 Method of Data Analysis**

#### **3.4.1 The Empirical Models**

The study adopted firstly the two-stage least squares (2SLS) estimator for separate equations and then proceeded by the three-stage least squares (3SLS) estimator which treats equation (1) and (2) as a system. The 2SLS estimation was used to help address the simultaneity bias between endogenous food insecurity and ill-health variables, which could lead to inconsistent parameters. In the 2SLS estimation, the endogenous food insecurity and ill-health variables were regressed on the unique exogenous variables (per capita household cultivated area, form of work of household heads and proximity to health facility) in a standard OLS procedure. In the second stage, the predicted endogenous variables in the reduced form equations were used in the structural equations to estimate their effects on the dependent variables (food insecurity, ill-health and ill-days). The 3SLS system estimator was however used to estimate the model more efficiently since the system has the same asymptotic distribution as the full information maximum likelihood (FIML) for normal distribution of the error terms (Greene, 2012). The empirical models were analysed using the STATA 14 software.

##### **3.4.1.1 Causality**

Causality has been an interesting area in most research works (Pearl et al., 2016). Considering health and the need to place into evidence the determinants of ill-health, Hill (1965) listed not less than nine elements that should be examined before being able to conclude that a relationship is causal. Presently there is a consensus around three absolutely necessary conditions for a relationship to be causal (Kenny, 1979; Shadish et

al., 2002). These are: (i) there must be association between food insecurity and ill-health, (ii) temporality and (iii) the absence of a concurrent explanation of the effects. In specific terms, to establish that there is a causal relationship between two variables or phenomena A and B, assumed to be the cause and the observed effect respectively, firstly, A and B must be reliably associated; secondly, A must precede B; and lastly, there must be no other phenomenon that could also valuably explain the variation observed in B. However, while the consent follows that association between A and B is not synonymous of causality but a necessary condition for causality to be established, the first two conditions above can realistically be established but the notion of concurrent explanations is mostly difficult to establish for causal claims (Antonakis et al., 2014).

In the context of this study, self-reported food insecurity is obviously associated with ill-health and the underlining assumption is that food insecure households are prone to hospitalisation and are likely to spend more days recovering from ill-health. There is also evidence of causality with ill-health being the cause and of self-reported food insecurity being the observed effect (Beveridge et al., 2019). Consequently, hospitalised household member especially heads would not be productive enough to lead the members out of the incidence of food insecurity.

#### **3.4.1.2 Endogeneity (Simultaneity bias) and Instruments**

Simultaneity has always been sought after in almost all scientific fields (Beebe, 2014; Pearl et al., 2016). A major challenge that can emerge when conducting a regression analysis is the inconsistency of the parameters of interest to be estimated, that is, the

non-convergence of the estimates towards their exact but unknown values as the sample size moves to infinity. This difficulty is caused by endogenous explanatory variables or, in other words, explained by the predictors that correlates with the error term (the part of the dependent variable that is not explained by the predictors) of the regression. Endogeneity in the relationship that exist between a presumed cause and its effect can originate from a large variety of issues including omitted selection of variables, simultaneity (when the explanatory variable and the explained variables influence each other), measurement errors or common-method variance (Antonakis et al., 2014). In the presence of endogeneity, the classical ordinary least square (OLS) estimation becomes inconsistent.

In this study the issue of endogeneity is a result of plausible simultaneity. Self-reported food insecurity and health outcomes are likely to influence each other. Estimations using OLS will result in biased and inconsistent estimates due to correlation between food insecurity variables and the error term in the ill-health equation due to simultaneity.

$$y_1 = f(Y_2 \text{ control variables, identifying variables}) \quad (1)$$

$$y_2 = f(Y_1 \text{ control variables, identifying variables}) \quad (2)$$

Given the specification of the structural models (1) and (2) above, they could have been estimated separately with OLS but considering the simultaneity of the relationship between food insecurity and ill-health and the tendency of these variables influencing each other, any change in the error term in Eq. (1) may influence  $y_2$  which may influence  $y_1$  in Eq. (2) positively or negatively depending on the direction of the relationship

between  $y_1$  and  $y_2$ . The issue of simultaneity arises because food insecurity likely influences ill-health and alternatively ill-health also influences food insecurity. In such situation, Instrumental Variable (IV) approach is employed as the best substitute for estimation of consistent and efficient results instead of the OLS approach (Stock & Watson, 2015). On the contrary, if we apply these alternative methods when there is no simultaneity problem, these methods will generate coefficients that are consistent but not efficient (i.e., with larger variance).

The IV approach requires an inclusion of an exogenous variable in the model to control for the endogenous covariate. In this study, per capita area cultivated is used as an instrumental variable for the endogenous food insecurity variable while proximity to health facility is used as an instrument for ill-health. In this section, a thorough explanation of why the IV estimation and more precisely the 2SLS regression procedure solves the problem of endogenous explanatory variables (bias and inconsistency) is provided. The 3SLS estimator was further used for efficiency gains in parameter estimates. Though the sample size was large 3SLS was used for the estimations as it has properties of asymptotic distribution.

Consider a simple OLS regression model with a dependent variable  $y$  and independent variable  $x$ ,  $i$  denotes index for observations, ( $i = 1, \dots, n$ )

$$y_i = \beta_0 + \beta_1 x_i + u_i \quad (3)$$

where  $\beta_0$  and  $\beta_1$ , are the parameters to be estimated and  $u$  is the error term following a  $N(0,1)$  distribution (Cameron & Trivedi, 2005). The OLS estimator,  $\beta$  is given by:

$$\widehat{\beta}_{ols} = \left( \sum_{i=1}^n x_i x_i' \right)^{-1} \sum_{i=1}^n x_i y_i \quad (4)$$

Going ahead to estimate with OLS despite the endogeneity problem (in the case of this study; simultaneous equation bias) will result in biased and inconsistent  $\widehat{\beta}_{ols}$  (Cameron and Trivedi, 2005, Gujarati 2004). Algebraically endogeneity can be represented as

$$y_1 = \beta_0 + \beta_1 y_2 + \beta_2 z_2 + u_1 \quad \text{corr}(xu) \neq 0 \quad (5)$$

Consider the structural equation (5) above where the observation subscripts have been suppressed. The  $y$  variables are endogenous while  $z$  is exogenous. The endogenous nature of the variable  $y_2$  suggests that if that if the equation above is estimated by OLS, the point estimates will be inconsistent and biased, as the error term will be correlated with  $y_2$  (Wooldridge, 2010). The endogenous nature of the  $y$ 's suggests that  $y_2$  correlates with  $y_1$  such that changes in one will result in changes in the other. We therefore need an instrument for  $y_2$ : a variable that correlates with  $y_2$  but does not correlate with  $u$ . The inclusion of the instrument is demonstrated below:

$$y_2 = \pi_0 + \pi_1 z_2 + \pi_2 z_2 + v \quad (6)$$

To eliminate the simultaneous bias problem in the equations the estimation of the two structural equations was done simultaneously. A necessary condition in the estimations is to ensure that the equations are identified and thus the inclusion of identifying variables. Identification in a system is important for sufficient information about

variables of interest in the model for a resultant consistent estimate. For the equation to be identified we ensure that the number of exogenous variables excluded from a particular equation is greater than or equal to the number of endogenous variables (Gujarati et al., 2012).

$$y_1 = f(Y_2 \text{ control variables, identifying variables}) \quad (1)$$

$$y_2 = f(Y_1 \text{ control variables, identifying variables}) \quad (2)$$

Now depending on the validity of the instrument employed, the 2SLS is able to deal with the endogeneity problem and provide parameters that are free from bias and inconsistency. By running an auxiliary regression of the reduced form equation (5), the predicted values of this regression,  $\widehat{y}_2$  will be an instrument for  $y_2$  and this auxiliary regression represents the first stage of the 2SLS. The second stage will then use the IV estimator which algebraically represents the 2SLS estimator. The 2SLS estimator always yields a matchless set of parameters for a given instrument list. Both endogenous variables (food insecurity and ill-health) needs at least one exogenous variable with a non-zero coefficient in their respective structural models to satisfy the rank condition for identification, which is the so called exclusion restriction principle (Wooldridge, 2010). Meeting the rank condition means that the structural equation is both necessary and sufficient for consistent estimation.

In this study, household specific variables were used to identify each equation in the 2SLS approach. It is assumed that ill-health is likely to cause food insecurity and obviously the reverse is true. People with ill-health are less likely to be productive and hence unable to move household out of food insecurity challenges. Therefore, if we

estimate the causal effect of ill-health on food insecurity in the food insecurity equation using OLS we will have endogeneity bias due to reverse causality. However, considering the simultaneity between these variables suggests that one may have influence on the other and the residuals in equation (1) are likely to influence  $y_2$  and in turn influence  $y_1$ . This also means that as  $y_2$  correlates with the residuals in equation (1), and  $y_1$  also correlates with the residuals of equation (2). This however violates the Gauss-Markov's assumptions for OLS estimation and will lead to biased and inconsistent estimations of the coefficients of  $y_1$  and  $y_2$  (Gujarati 2004). In the food insecurity equation, per capita household cultivated area and the form of work of household heads were used as instrumental variables. In the health outcome equation, proximity to health facility was considered as the instrument. In the food insecurity equation, the identifying variables include access to extension, access to irrigation, access to market and per household cultivated area and form of work of household heads. The empirical structural models are represented by equation (7) and (8) below

$$y_1 = b_0 + b_1y_2 + b_2x_1 + b_3x_2 + b_4x_3 + b_5x_4 + b_6x_5 + b_7x_6 + b_8x_6 + b_9x_7 + b_{10}x_9 + b_{11}x_{10} + b_{12}x_{11} + b_{13}x_{13} + b_{14}x_{15} + b_{15}Region(10) + e_1 \quad (7)$$

$$y_2 = \alpha_0 + \alpha_1x_1 + \alpha_2x_2 + \alpha_3x_3 + \alpha_4x_4 + \alpha_5x_5 + \alpha_6x_6 + \alpha_7x_7 + \alpha_8x_8 + \alpha_9x_{11} + \alpha_{10}x_{14} + \alpha_{11}y_1 + \alpha_{12}Region(10) + e_2 \quad (8)$$

A two-step activity was undertaken in the 2SLS approach to ensure that the estimated parameters were free from bias and inconsistency. First and foremost, a regression of the endogenous variables (food insecurity and health outcomes) on a set of instrumental

variables (exogenous variables) was done to generate residual errors, that encompass the potential bias (Dhar et al., 2003). This is the so-called reduced form model. During this stage the residual errors, comprising the potential bias were eradicated by predicting the endogenous variable from the resultant reduced form regression. However, during the second stage, the predicted endogenous variable, free from endogeneity bias, was used in the structural equation to model its effect on the dependent variable. In the 3SLS, a third stage comprising of adjusting the cross correlation among equation errors was done to improve efficiency in the estimates (Greene, 2012). The Darbin-Wu-Husman tests for endogeneity were conducted to compare the parameters of the structural model of the OLS estimator and system estimators. However, in both instances the null hypothesis of exogenous independent variables were rejected at 1% level of significance.

### **3.4.2 Welch's T-Test**

The Welch Test approach was employed to test the hypothesis that food secured households and their counterpart who reported incidence of food insecurity have equal mean. The basic assumption is that both groups are part of a population that follow a normal distribution, but both groups do not have the same variances. Typically, the standard deviation for these two samples are not the same and thus the degree of freedom for Welch's t-test will be the same for the usual Student's t-test.

### **3.4.3 Definition of Variables**

This research focused on the determinants of self-reported food insecurity as significant predictor of ill-health outcomes among Ghanaian households. For emphasis, the



conceptual framework in figure 2 highlights that food insecurity situations are due to socio-economic determinants such as household heads, educational status, economic activity, household ownership, household assets owned, remittances and household per capita area cultivated. However, also relevant are key institutional factors such as access to extension services, access to markets, access to irrigation facilities and access to financial institutions.

A major assumption in this study is that per capita area cultivated by the household influences the probability of household facing food insecurity situation, all other things being equal. Households with large farm sizes and with title deeds are able to liquidate their assets in times of food hardship situations which can reduce the probability of household going hungry to the extent that it results in ill-health. Next is the discussion of how the variables included in this study are measured, and how the independent variables are expected to influence food insecurity and ill-health.

**Food Insecurity ( $y_1$ ):** Food insecurity is an index variable generated through factor analysis using eight food insecurity measurement questions which depicts households' food unavailability or scarcity as a result of lack of money or other resources to access food. Households with index close to 1 are food insecure whereas households with indices that tend toward zero are food secured. It is expected that food insecure households will experience high incidence of ill-health. The food insecurity question employed are indicated in the second section of the appendix.

**Ill-health ( $y_2$ ):** Ill-health is a continuous variable that measures the number of household members hospitalised within the previous 12-month period.

**Ill-Days ( $y_3$ ):** ill-days is also a continuous variable that represents the number of days household members suffered ill-health within the period of 12 month when they were hospitalised.

**Age of Household Head ( $X_1$ ):** Age of household head is measured by the number of completed years of life at the time of data collection. The relationship between age and food insecurity is expected to be either positive or negative. Older household heads are assumed to have more household members which may translate into increased food expenditure. However, the large household size could also imply that household income could be good enough (especially contribution from economically active members) to cater for household food expenditure thereby reducing the incidence of food insecurity. In a comparable way, the relationship between age of household head and ill-health as well as ill-days is expected to be either positive or negative. Older household heads are more sensitive to ill-health situations and thus may report increased ill-health. Nevertheless, younger household heads who form a major part of labour force are also quite sensitive to ill-health situations and ill-days.

**Sex of Household Head ( $X_2$ ):** Sex was coded as 1 for male household heads and 0 for female household heads. The direction of the sex variable is uncertain; thus a positive or negative coefficient could be expected. The direction of sex of household head in the food insecurity equation (7) above could be a reflection of the head's sensitivity to food

shortages within the household. Most households in Ghana have male heads who are mostly the breadwinners of the families. However, the provision of food and water are sometimes the role of the females within the household hence female heads could be expected to influence household food insecurity situation. In the same way the variable sex could also reflect the sensitivity and vulnerability of household head to ill-health instances in the household. Males in households form major part of the labour supply economic activities and are more likely to be sensitive to health outcomes.

**Household Size ( $X_3$ ):** It is reasonable to expect that large households are more likely to report food insecurity, and so a positive effect is expected. The assumption is that food expenditure is dependent on household size. However, if more of the household members fall within the economically active bracket where they work to earn money, the household will be less likely to report food insecurity; hence a negative effect could be expected. On the contrary, few household members do not guarantee food security hence a positive effect could also be expected. Similarly, the direction of household size in terms of ill-health is not certain hence a positive or negative effect could be expected. The direction of household size in terms of reported ill-days is expected to be positive.

**Education of the Household Head ( $X_4$ ):** Education is measured as a dummy variable and coded 1 for an educated household head and 0 if the head is not educated. Education is expected to be a mechanism to improve household food security. Educated household heads are expected to be more creative and diversified in terms of skill and knowledge and should be able to generate streams of incomes to better address household needs.

Literate household heads are also able to better manage household resources which in turn reduce food unavailability situations. It is therefore reasonable to expect a negative relationship between education and food insecurity. In the same way, education and ill-health as well as ill-days should have a negative relationship. Household heads that are educated will be able to put in measures that address or prevent incidences of ill-health and prolonged ill-days within the household.

**Economic Activities of Household Members ( $X_5$ ):** Economic activity is measured as a dummy where 1 represents household head within the economically active bracket and 0 if the household head is not economically active. One would expect that household heads within the economically active bracket would suffer less from food insecurity. The relationship between this variable and food insecurity is thus expected to be negative. However, the relationship between economic activity of household heads and ill-health incidences is indeterminate and it is reasonable to expect a negative or positive relationship. The direction of this relationship could be a reflection of household head's sensitivity to ill-health and ill-days.

**Household Assets ( $X_6$ ):** Household asset is measured as the total value of assets (GH¢) owned by households. This comprises of assets such as machinery, equipment, vehicles, housing and building plots, and consumer assets, among others, as reported by the household head. Generally, households with many valuable assets are considered to be wealthier and able to afford basic needs for survival. However, in situations of food insecurity one would expect that households would be able to liquidate their assets to address food shortages within the households. It is therefore reasonable to expect a

negative sign between household assets and food insecurity. However, the direction of the relationship between assets owned by households and ill-health as well as ill-days is indeterminate *a priori*, so a positive or negative effect can be expected.

**Access to Financial institution and Services ( $X_7$ ):** Access to financial services is measured as a dummy variable where 1 represents household with access to financial services in the community or at least at the district level and 0 if they did not have access to financial services. House-holds with access to financial institutions are better off in terms of their financial capacity and financial investments are able to generate extra income that increases their ability to purchase food thereby improving household food security. Households that are able to access credit and loans for their small-scale businesses are expected to be food secured by escaping food insecurity than their counterparts who do not have access. It is therefore expected that access to financial institution will have a negative effect on food insecurity.

**Remittances ( $X_8$ ):** Remittance is a continuous variable measuring the amount of money (GH¢) received by household from migrant members of the family. Higher remittances inflows tend to be associated with minimized poverty levels and improvement in human capital within the households. Although remittance is usually supposed to improve poverty situation through increased investments by recipients, it may not be sufficient to minimize the food insecurity situation in both rural and urban areas. However, the effect of remittances on food insecurity in this study is indeterminate, thus a negative or positive effect is expected. Moreover, remittance is expected to reduce prevalence of

ill-health as household expenditure including health investments increases. The effect of remittances on ill-health and ill-days is expected to be negative.

**Irrigation Facility ( $X_9$ ):** Access to irrigation for farming is also a dummy, coded 1 if household had access to irrigation facility or irrigation fields within the community and 0 if household had no irrigation access in their community. Achieving food security through increased food production can be attained through intensification of irrigation. Food prices are influenced by the performance of irrigation farmers and households within irrigation scheme areas are more likely to escape from food insecurity. Access to irrigation is expected to influence food insecurity negatively.

**Access to Extension Services ( $X_{10}$ ):** Agricultural dependent households can access extension programs and activities that serve as a conduit of improved farm technologies, technical support and managerial skills. It is reasonable to expect that agricultural extension access would increase productivity of farm households, improve household level of income and reduce food insecurity. The direction of the relationship between extension service access and food insecurity is expected to be negative.

**Impassable Road ( $X_{11}$ ):** Impassable Road is a dummy variable where 1 represents household exposed to impassable road within the community and 0 if otherwise. Natural disasters, especially floods, have detrimental effects on road networks which results in significant impact on economic and food security issues including increased food prices and transportation difficulty. Households faced with the challenge of impassable roads are expected to have their food insecurity problems compounded since it may be

difficult for them to access markets from other communities or district and regional markets. The relationship between food insecurity and impassable road is expected to be positive while the expectation regarding the relationship between impassable road and ill health is also positive.

**Access to Market ( $X_{12}$ ):** Access to market is coded as a dummy variable, with 1 indicating household had access to markets in the community and 0 if the household did not have access to market within the community. Access to food is usually dependent on access to market. Local markets are however characterized by price volatility and inefficient supply especially during lean seasons where demand for food exceeds the supply. The relationship between food insecurity and access to market in this study, which is measured by the presence of a regular or rotational market in the various communities, is indeterminate. However, a positive or negative effect could be expected.

**Per Capita Household Cultivated Area ( $X_{13}$ ):** Per capita cultivated area is measured as a continuous variable denoting the number of hectares under cultivation by household members. Population growth in rural areas determines the average farm size available for agriculture purposes in proportion to total land size. Although most farming households are engaged in nonfarm activities, a mix of these activities vary across regions. The per capita household cultivated area has a considerable influence on agriculture productivity and thereby improving household welfare and food security. It is expected that per capita household cultivated area will influence food insecurity negatively.

**Proximity to Health Facility ( $X_{14}$ ):** Proximity to health facility is measured as a continuous variable in terms of hours of time required for household members to arrive at the nearest facility to access healthcare. Medical canthers including infrastructure and health personnel are often concentrated in urban areas and as such proximity can facilitate good quality healthcare at lower cost. It is therefore expected that households that are closer to these facilities will eventually have better access to healthcare and reduce the incidence of ill-health and ill-days.

**Form of Work of Household Head ( $X_{15}$ ):** Household head's form of work is measured categorised in to employed, own use production work, unpaid trainee work, voluntary work and no work. Obviously household heads that are gainfully employed are expected to be food secure.

Table 3.2 summarizes the variables described above using their symbols and the expected signs.



**Table 3.2 Variables description and a prior expectation**

<b>Variable</b>	<b>Definition of measurement</b>	<b>Symbol</b>	<b>Food insecurity</b>	<b>Ill-health</b>	<b>Ill-days</b>
<b>Ill-health</b>	Number of household members who suffered ill-health (count)	$y_3$	+		
<b>Ill-days</b>	Number of days individuals suffered ill health	$y_3$	+		
<b>Food insecurity</b>	Factor analysis based on food insecurity questions for extent of food hard	$y_1$		+	+
<b>Age</b>	Age in of household head in years	$x_1$	-/+	-/+	-/+
<b>Sex</b>	1 if male, 0 if female	$x_2$	-/+	-/+	-/+
<b>Household size</b>	Total number of household members	$x_3$	-/+	-/+	+
<b>Education</b>	1 if educated , 0 if uneducated	$x_4$	-	-	-
<b>Economic activities of HH</b>	1 if economically active, 0 if otherwise	$x_5$	-	-/+	-/+
<b>Asset</b>	Log of Total value (GH¢) of household assets	$x_6$	-/+	-	-/+
<b>Financial institution</b>	1 if had access to financial institution, 0 if otherwise	$x_7$	-	-	-
<b>Remittances to Household</b>	Total amount of remittance	$x_8$	-/+	-	-
<b>Irrigation</b>	1 if access to irrigation facility, 0 if otherwise	$x_9$	-		
<b>Extension Service</b>	1 if extension office is stationed in community, 0 if otherwise	$x_{10}$	-		

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<b>Impassable road</b>	1 if household has impassable road, 0 if otherwise	$x_{11}$	+	-	-
<b>Access to Market</b>	1 if access to market, 0 if otherwise	$x_{12}$	-/+		
<b>Per capita area cultivated</b>	Area cultivated by household members in hectares	$x_{13}$	-		
<b>Proximity to health facility</b>	Distance from household to nearest health facility in hours	$x_{14}$		-/+	-/+
<b>Form of work of HH</b>		$x_{15}$		+	+

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## **CHAPTER FOUR**

### **4.0 RESULTS AND DISCUSSIONS**

This chapter presents the results of the data analysis as well as discussion of these results. Section 4.1 discusses information relating to household socio-demographic characteristics such as age, sex, education, economic activity, among others. Section 4.2 discusses the role of key institutional and economic factors that influence the self-reported food insecurity and ill-health variables among Ghanaian households. Also, section 4.3 summaries the statistics of key variables that were included in the empirical estimations. Section 4.4 examines the mean differences between selected variables. Section 4.5 details the results of the exploratory factor analysis used to measure food insecurity situation among Ghanaian households. Section 4.6 discusses the issues of endogeneity and the endogeneity test results. Section 4.7 then discusses the results on factors that influence self-reported food insecurity among Ghanaian households. Section 4.8 alternatively provides results on factors that determine ill-health among Ghanaian households. Finally, section 4.9 discusses the factors that determine the number of days households suffer ill-health (i.e., ill-days).

#### **4.1 Demographic and Socioeconomic Characteristics of the Study Sample**

This section provides information on demographic characteristics involved in the study. Information on sex, age, household size and education were reported for 13,818 households in Ghana that had complete information for the analysis.

#### **4.1.1 Age and Household Size**

A household was defined in this study in consistency with the GSS as a person or group of persons, who live together in the same house or compound and share the same housekeeping arrangements (GSS, 2016). Consequently, household size is defined as the number of persons living in a particular household. Table 4.1 highlights the distribution of age and household size of the respondents. The average age of household heads was estimated to be 46 years, with the youngest and oldest household heads reporting 15 years and 99 years, respectively. Approximately 36% of household heads were aged between 30-44 years while 5.55% fell within the 75-89 age range. Unsurprisingly, only 0.48% of the household heads were above 90 years, since the majority of the Ghanaian household heads are youth (i.e., less than 60 years of age). The average household size was reported to be 4 with minimum and maximum of 1 and 28 people per household, respectively. Also, 3% of the households interviewed had between 1-5 members, whereas 0.07% of the household had between 21 -25 members.

**Table 4.1 Age and household size distribution**

<b>Variable</b>	<b>Percentage (%)</b>	<b>Mean</b>	<b>SD</b>	<b>Min.</b>	<b>Max.</b>
<b><i>Age</i></b>					
15-29	14.85	46.23	15.91	15	99
30-44	36.07				
45-59	27.57				
60-74	15.50				
75-89	5.55				
90-104	0.48				
<b>Total</b>	<b>100.00</b>				
<b><i>Household Size</i></b>					
1-5	72.77		28	4.00	3.00
6-10	24.18				
11-15	2.54				
16-20	0.43				
21-25	0.07				
26-30	0.02				
<b>Total</b>	<b>100.00</b>				

#### **4.1.2 Sex and Education**

About 69% of the sample was male. Education plays a critical role in the socio-economic development of a country as it provides individuals with the necessary knowledge and skills to fully contribute towards the development of society. Table 4.2 reveals that whereas 53% of the household heads were educated, 46% had no formal form of education.

**Table 4.2 Distribution of sex and education status of household heads**

<b>Variable</b>	<b>Percentage (%)</b>
<i>Sex</i>	
Male	68.80
Female	31.20
Total	100.0
<i>Education</i>	
Educated	53.60
Non-educated	46.40
<b>Total</b>	<b>100.00</b>

#### **4.1.4 Economic Activities**

Economic activities of household heads interviewed is reported in Table 4.3. The results show that about 80% of the household heads interviewed had at least one member falling within the economically active class, whereas 20.30% of household heads fell outside the economically active bracket. In terms of regional distribution, the results revealed that about 86% of household heads interviewed in the Western Region were economically active. Moreover, about 87% of household heads in the Brong Ahafo Region also fell within the economically active bracket. It is not surprising that Upper West and Upper East Regions recorded the least proportion of households with the head falling within the economically active bracket because they are located within the poor savannah regions of Ghana.

**Table 4.3 Economic activity of household heads**

<b>Variable</b>	<b>Mean</b>	<b>SD</b>	<b>Min.</b>	<b>Max.</b>
Economic Activity (all)	0.7970	0.4022	0	1
Western Region	0.8576	0.3496	0	1
Central Region	0.8406	0.3661	0	1
Greater Accra	0.8069	0.3949	0	1
Volta Region	0.8563	0.3509	0	1
Eastern Region	0.8117	0.3911	0	1
Ashanti Region	0.8219	0.3827	0	1
B. Ahafo Region	0.8657	0.3411	0	1
Northern Region	0.8151	0.3883	0	1
Upper East Region	0.6664	0.4717	0	1
Upper West Region	0.6266	0.4838	0	1

#### **4.1.5 Forms of Work**

Table 4.4 details the forms of work engaged by the household heads. It is expected that households with heads that are gainfully employed will have the opportunity to escape food insecurity through the income earned by household heads. About 78% of household heads were recorded to be employed with salaries, 6.61% were engaged in own use production. However about 12% of household heads had no form of work at all which leaves such households very vulnerable to food insecurity and its repercussions.

**Table 4.4 Forms of work of household heads**

<b>Variable</b>	<b>Percentage (%)</b>
Form of work	
Employed	79.70
Own use production	6.61
Unpaid Trainee work	0.77
Voluntary work	0.90
No work/activity	12.01
<b>Total</b>	<b>100</b>

## **4.2 Summary of Institutional and Socio-economic Factors**

Table 4.5 details the summary statistics of key variables included in the model estimation. The summary statistics reported are the mean values and standard deviations.

### **4.2.1 Institutional Factors**

Four institutional factors were considered in this study; access to financial institutions, extension services, irrigation facilities and market access. Table 4.5 details the summary statistics of these variables. Information on institutional factors were measured as dummy variables; one, if they had access to any of the institutions and zero if otherwise. The type of financial institutions available in the localities or ecological zones for household members to access included commercial banks, mobile money and community banks (GSS, 2018). Whereas 26.81% had access to financial institutions,



the remaining 73.19% did not have access whatsoever. About 16% of the respondents indicated that they had access to extension services. However, it was revealed by the study that these households had extension offices stationed in their communities or close to their communities. In terms of access to markets, the result shows that 21.19% of the respondents had access to permanent markets in their communities. This could be because most of the rural settings in Ghana have rotational markets that do not operate on daily basis. Out of 13,818 households in the estimation sample, only 6% had access to irrigation facilities in their communities.

#### **4.2.2 Socio-economic Factors**

Table 4.5 also details summary statistics of three major socio-economic variables considered in the study as determinants of self-reported food insecurity by Ghanaian households. These include the total value of household's assets (including sewing machines, stoves, fridge, fan, radio, television, camera, mobile phones and computer within the period of data collection), remittances received by households within the past 12 months, per capita household cultivated area measured in hectares and the form of work of household heads. Table 4.5 details the summary statistics of these variables. The mean remittance received by households is about GH¢ 411 per year. Remittances received by financially constrained household can help reduce the incidence of self-reported food insecurity as the extra credit could form part of resources used to acquire food. The mean per capita household cultivated area is 2.7 hectares. Land holding, represented by per capita household cultivated area, is likely to reduce the incidence of food insecurity. Households who own portions of land can liquidate or mortgage the

property for extra income to cater for consumption expenditure and other investment activities as long as the land could be offered as collateral to access the financial market (Rammohan & Pritchard, 2014). The mean value of household assets owned by household was GH¢ 6.69.

**Table 4.5 Summary Statistics of key variables**

<b>Variables</b>	<b>Definition of measurement</b>	<b>Mean</b>	<b>SD</b>
Ill-health	Number of household members who suffered ill health	0.5968	1.0054
Ill-days	Number of days individuals suffered ill health	3.2427	6.3228
Food insecurity	Factor analysis based on food insecurity questions for extent of food scarcity due to lack of money/ other resources	0.0001	0.9685
Age	Age in of household heads in years	46.2283	15.9104
Sex	1 if male, 0 if female	0.6878	0.4634
Household size	Total number of household members	4.2084	2.8695
Education	1 if educated, 0 if uneducated	0.4640	0.4987
Economic activities	1 if economically active, 0 if otherwise	0.7970	0.4022
HH ownership	1 if own house, 0 if otherwise	0.5202	0.4996
Asset	Log of Total value of household assets	6.8909	2.3571
Access to financial Inst.	1 if had access to financial institution, 0 if otherwise	0.2681	0.4430
Remittances	Total amount of remittance	411.8546	2027.158
Access to Irrigation	1 if access to irrigation facility, 0 if otherwise	0.0614	0.2378
Access to Extension service	1 if extension office is stationed in the community, 0 if otherwise	0.1518	0.3589
Impassable road	1 If household had Impassable road, 0 if otherwise	0.2450	0.4301

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Access to market	1 if access to market, 0 if otherwise	0.2119	0.4087
Per capita area cultivated	The area cultivated by household members in Ha	2.7696	6.0680
Proximity to health facility		0.3382	1.2914
Form of work	1 if household is household head is gainfully employed and 0 if otherwise	1.7091	1.6363

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**N=1318**

#### **4.3 Factor Analysis and Measurement of Self-reported Food Insecurity**

Table 4.6 presents the results of the exploratory factor analysis approach employed to compute self-reported food insecurity, given the self-reported responses to eight questions which measured the incidence of food insecurity among the households mainly due to lack of money and access to other resources to purchase food items. The exploratory factor analysis was used to reduce the number of indicators measuring food insecurity among Ghanaian households to one index measure. The indicators consist of information on availability of enough and healthy food, the quantity of meal served and coping strategies usually employed in cases of food shortage. This technique was employed to generate an index for food insecurity and also to eliminate the multicollinearity problem in the models. The index obtained is explained by 91.15% of the variance in the indicators with an eigenvalue of 4.988.

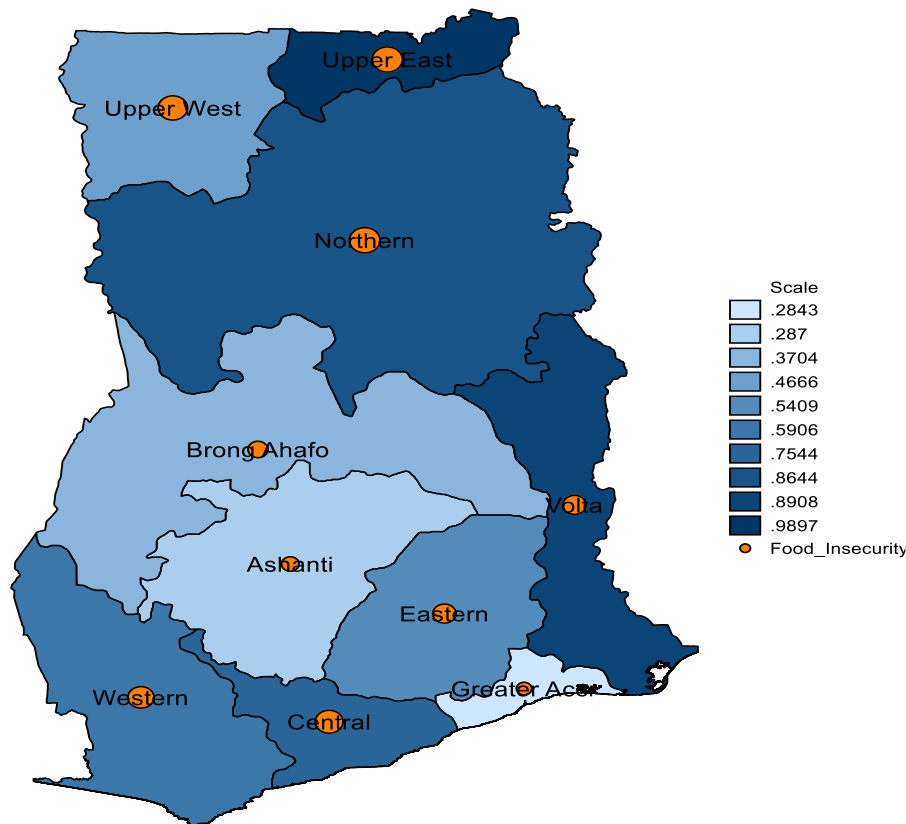
**Table 4.6 Factor analysis**

<b>Food insecurity indicators</b>	<b>Factor</b>	<b>Uniqueness</b>
Not enough food	0.8255	0.2839
Unable to eat healthy food	0.8274	0.2585
Few kinds of meal	0.8546	0.2346
Skip a meal	0.8601	0.2019
Ate less food	0.8799	0.2221
Run out of food	0.8184	0.1800
Hungry but didn't eat	0.7521	0.2440
Whole day without eating	0.4020	0.6563
<b>Eigenvalue</b>	<b>4.9884</b>	
<b>Proportion of variance explained by the factor</b>	<b>0.9115</b>	
<b>(%)</b>		

#### **4.4 Distribution of Food Insecurity and Ill-health**

In creating a measure for food insecurity, factor analysis was used to generate scores. These scores were used to profile food insecurity situation in Ghana and how it links to poverty and ill-health. Figure 2 shows the map of Ghana indicating regions exposed to various levels of food insecurity and ill-health as revealed by the size of the ball and colour on the map, respectively. The bigger the ball, the higher the incidence of food insecurity, while the deeper the colour the more prevalent the levels of ill-health. From Figure 2, Northern Region reported the highest food insecurity problem (77% of

households reported food insecurity) thus having the biggest ball followed by Upper East Region (76%) and Upper West Region (71%). However, food insecurity in Greater Accra is represented by the smallest ball with 19% of households reporting food insecurity.



**Figure 2: A distribution of food insecurity in the 10 former regions of Ghana.**

*Note: Scale represents the range of values for health outcomes,*

*Source: Author's own construction*

From Figure 2, Upper East, Northern and Volta Regions show highest prevalence of ill-health (with deeper colours) whereas Ashanti and Greater Accra Regions show less

prevalence of ill-health among households. Based on the map, one could predict a positive relationship between food insecurity and ill-health since the size of the ball tends to match with the intensity of the colour. It remains to be confirmed through appropriate causal econometric modelling or analyses.

#### **4.5 Mean Comparison of Key Variables**

This section examines the differences between selected variables in the study sample. Main interests are the households that reported to be food secure, and those that reported incidences of food insecurity. These are discussed next.

##### **4.5.1 Mean Comparison of Dependent Variables**

Table 4.7 shows the mean differences and the statistical tests of significant differences between food secure households and food insecure households. The mean difference of ill-health between food secured households and households who experienced food insecurity is approximately (-0.3) and is statistically significant at 1% level. This implies that households who reported food insecurity reported 0.3 more ill-health cases than food secured households. In the same way ill-days mean difference between food secured households and households that reported food insecurity is (-1.62) and is statistically significant at 1% significance level. This also implies that households that reported food insecurity experienced extended ill-days (1.62 more) as compared to food secured households. Households who experience food insecurity to the extent where they lack food energy may lead to diverse negative health outcomes including prolonged ill-days due to nutritional deficiencies.

**Table 4.7 Mean comparison food secured households and households that experienced food insecurity.**

Variable	Food secured		Food insecure		Mean difference
	Mean	SD	Mean	SD	
HH suffered illness	0.4495	0.8708	0.7482	1.1070	-0.2987***
Number of days suffered	2.4453	5.4393	4.0628	7.0246	-1.6175***

*Welch t test* \*\*\* \*\* p<0.01, \*\* p<0.05, \* p<0.1

#### **4.5.2 Mean Comparison of Dependent Variables and Poverty Rate Based on Regions**

Table 4.8 details the mean self-reported food insecurity, the number of persons who reported ill-health and the number of days household members suffered ill-health. The results revealed that the Northern Regions is more prone to food insecurity with a corresponding poverty rate of 51.68%. Similarly, Upper East was found to have the highest food insecurity mean score (0.6025) and a corresponding ill-health of 98.97% and a poverty rate of 52.65%. Northern Region followed with a food insecurity score of 0.5997 with a corresponding ill-health of about 86.44% and a poverty rate of 51.68%. Similarly, Upper West Region reported food insecurity mean score of 0.6025 and a corresponding ill-health of 46.66% and a poverty rate of 63.35%. It is therefore reasonable to make the assertion that policies and interventions that are aimed at improving food security and ill-health should target regions in northern Ghana.



Greater Accra recorded a food insecurity mean score of -0.6631 implying about 66 % of the households in the region are food secured, meaning that self-reported food insecurity is relatively minimal in the region with a corresponding ill-health of 28.43% and a poverty rate of 1.31%. Households in the Greater Accra Region are more resilient to food insecurity and are more able to absorb and survive shocks such as high food prices, delayed harvests and harsh weather that leads to the incidence of food insecurity. On account of these statistics one can conclude that the majority of households in Greater Accra are food secured, even though other statistics report pockets of food insecure households. Some villages that lie in the region are considerably diversified in terms of farming practices, crops grown and education levels (Nata et al., 2014). This is also a confirmation of the assertion that food insecurity within household is dependent on the education level of household members and their level of production in terms of agriculture. The region has relevant capacity to attract migrants and business activities which stimulate productivity and demand for labour supply.

Households within the Ashanti Region had a food insecurity mean score of -0.5482 indicating that about 55% of the households in the Ashanti Region are food secured with a corresponding ill-health of 28.70% and 7.39% poverty rate. However, it is also plausible to present that more than half of the households in Ashanti Region are food secure with relatively minimal ill-health conditions. Brong Ahafo Region was found to have a food insecurity mean score of -0.3734 with a corresponding ill-health of 37.04% and a poverty rate of 19.75%. This means about 37% of the households are food secured with underlining ill-health challenges Volta Region recorded a mean food insecurity

score of -0.1191 implying that only about 11% of households in the region are food secured with the remaining unable to absorb the shocks of food insecurity. Volta Region also recorded a corresponding ill-health of 89.08% and a poverty rate of 26.10%. We therefore assert that self-reported food insecurity might not be the only or the major underlining cause of ill-health in the Volta Region.

**Table 4.8: The extent of food insecurity and ill-health in the former ten administrative regions**

<b>Region</b>	<b>Food Insecurity</b>	<b>Ill-health</b>	<b>Ill-Days</b>	<b>Poverty rate (%)</b>
Western	0.0744	0.5906	3.0789	15.09
Central	0.2606	0.7544	3.8930	10.39
Greater Accra	-0.6631	0.2843	1.7187	1.31
Volta	-0.1191	0.8908	5.5609	26.10
Eastern	-0.1579	0.5409	3.0467	11.84
Ashanti	-0.5482	0.2870	1.5087	7.39
Brong Ahafo	-0.3734	0.3704	2.0123	19.75
Northern	0.5997	0.8644	4.2662	51.68
Upper East	0.6025	0.9897	5.3262	52.65
Upper West	0.4619	0.4666	2.4080	63.35

#### **4.5. 3 Mean Comparison of Socio-Demographic Variables and Food Insecurity**

According to Table 4.9, the mean age difference between food secure household heads and those who reported household food insecurity is -2.246 and is statistically significant at 1% significance level. This implies that households that reported food

insecurity are relatively older than their food secured counterparts. The household size mean difference of food secured households and households who reported food insecurity is -0.894 and is statistically significant at 1% significance level. This implies that households that reported food insecurity had larger household sizes than their food secured counterparts.

The mean difference in the education of food secured households and households who reported food insecurity is 0.315 and is statistically significant at 1% level of significance. This implies that food secured households are more likely to be educated than households that reported food insecurity. The economic activity mean difference between households that were food secured and those that reported food insecurity is 0.095 and is statistically significant at 1% level of significance, indicating that food secured households are more likely to be more economically active than households who reported food insecurity.

The mean difference in terms of household home ownership is -0.210 and is statistically significant at 1% level of significance. This implies that self-reported food insecure households are more likely to be owners. Moreover, the mean difference in terms of remittances received between food secured households and their counterpart who experienced food insecurity was 253.074 and is statistically significant at 1% level of significance. This implies that food secured households are more likely to have received more remittances to address their household needs, especially for food. The mean difference between food secured households and households in terms of per capita household cultivated area is -1.247 and is statistically significant at 1% level of

significance. This implies that food secured households were involved in other economic activities other than farming.

**Table 4.9 Mean comparison of demographic factors used in the models**

Variables	Food secured (0)		Food insecure (1)		Difference (0-1)
	Mean	SD	Mean	SD	
Age	45.1213	15.2035	47.3669	16.5300	-2. 2455***
Sex	0.6993	0.4586	0.6760	0.4680	0. 2324**
Household size	3.7676	2.5898	4.6616	3.0660	-0. 8940***
Education	0.6195	0.4856	0.3042	0.4601	0. 3153***
Economic activities	0.8438	0.3630	0.7488	0.4337	0. 0950***
HH ownership	0.4168	0.4931	0.6265	0.4838	-0. 2098***
Asset	7.4902	2.1459	6.2745	2.4053	1. 2156***
Remittances	536.6149	2689.75	283.5414	929.0264	253. 0735***
Per capita land area	2.1549	5.4487	3.4017	6.5859	-1. 2468***

*Welch t test* \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

#### 4.5.4 Mean Comparison of Institutional Variables and Food Insecurity

Information on institutional variables included access to financial institutions, irrigation facilities, permanent markets and extension services are presented. Table 4.10 details the mean comparison of these factors. The mean differences between food secured households and household who reported food insecurity in terms of access to financial institution is 0.129 and is statistically significant at 1% level of significance. This implies that households that had access to financial institutions are more likely to be food secured. The mean difference of food secured household and their counterparts in terms of access to market was 0. 078 and significant at 1% level of significance. This

implies that household access to market is a contributing factor to household food security. However, the mean difference in terms of access to extension services was 0.015 and is significant at 10% level of significance. This means that households who had access to extension services are more likely to be food secured. Generally, access to financial institution, extension services and markets are hypothesized to improve food security situation among Ghanaian households.

The impassable road mean difference between food secured household and their counterparts that experienced food insecurity is -0.093 and is statistically significant at 1% significance level. This suggests that the availability of impassable road is a significant determinant of food insecurity situation.

**Table 4.10 Mean comparison of institutional factors used in the model**

Variables	Food secured		Food insecurity		Difference (0-1)
	Mean	SD	Mean	SD	
Access to financial Institution	0.3316	0.4708	0.2027	0.4021	0.1288***
Access to Irrigation	0.0634	0.2437	0.0567	0.2314	0.0066
Access to market	0.2504	0.4332	0.1723	0.3777	0.0780***
Access to extension	0.1590	0.3657	0.1445	0.3516	0.0146*
Impassable road	0.1991	0.3994	0.2921	0.4548	-0.0930***

*Welch t test \*\*\* 1% level of significance; \*\*5% level of significance; \*10% level of significance*

#### 4.6 Results of tests for Endogeneity

Table 4.11 details the results of Durbin Wu-Hausman test for endogeneity. Both the Durbin and Wu-Hausman test resulted in a very low p-value (0.0000) which means that the null hypothesis that the variables are exogenous could be rejected. Thus, the variables ill-health and ill-days are both endogenous in the food insecurity equation and estimation of such a model using the OLS approach would be biased and inconsistent.

**Table 4.11 Test for endogeneity results**

Endogeneity test	Durbin (score) chi2	Wu-Hausman F(1,13804)
Ill-health	156.523	158.156
Ill-days	52.4833	52.63
P-Value(s)	0.0000	0.0000

$H_0$ : Variables (Ill-health and Ill-days) are exogenous

#### 4.7 Determinants of Food Insecurity

The model estimation was done with both the 2SLS and 3SLS procedures. The estimates were similar except that the 3SLS estimates were slightly more efficient than the 2SLS since the 3SLS is a system estimator. Estimates from 3SLS and OLS are presented in Table 4.10, with the dependent variables being food insecurity, ill-health and ill days. Region-level controls are included in the model to account for spatial differences in food insecurity and ill-health outcomes. The first column of Table 13 reports the OLS estimates while the second column shows results from 3SLS estimation. This is to

demonstrate the consistency and efficiency of the 3SLS estimations over the OLS estimates.

Households were also categorized into expenditure quantiles. The first quartile represents the very poor Ghanaian households, whereas the fourth quartile represents the very rich households. This categorization is based on household's total expenditure collected in the survey, and the rationale is to examine the effect of the independent variables on the dependent variables for different class of households in the Ghanaian population.

The most noticeable effect of ill-health is the direct suffering of the person who becomes ill or injured and the sympathetic grief of his or her household members. Ill-health is expensive and has the tendency of significantly affecting household consumption, including food. The results revealed that the number of household members who suffered ill-health was statistically significant in determining self-reported food insecurity among Ghanaian households at 5% level of significance. An increase in ill-health by 1 person, *ceteris paribus*, results in 0.04 standardized unit increase in food insecurity. This is expected because of increased household's health expenditure. Money and other resources for food are diverted to healthcare expenses in the case the household members suffered ill-health. However, the case is not the same for households within the first expenditure quantile.

Poor households reported a 0.07 standardized unit increase in food insecurity in response to an increase in the number of ill-health, *ceteris paribus*. Findings from Wang

et al. (2006) revealed that ill-health which is denoted by the incidence of hospitalization and diagnosed chronic disease in a household and hospital expenditure, decreases the investment in human and physical capital required for farm production, and other consumption patterns. The authors asserted that the ill-health effect on consumption patterns are more significant in households with low income levels than in high-income households. This is in contrast to the findings from this study. Comparatively, this study observed that rich households reported a 0.11 standardized unit increase in food insecurity if the number of household members reporting ill increased by one more member.

However, very rich households reported a 0.15 standardized unit increase in food insecurity in response to an increase in the number of persons falling ill by one member, when all other factors remain constant. Due to the escalation of healthcare expenditure and lack of insurance coverage among many rural people, medical payments often cause financial challenges for many rural households (Liu et al., 2003). Several studies show that ill-health leads to anxiety of the disease leaving households with no choice than to pay for what is demanded by healthcare service providers even if it is not affordable. Ill-health does not only affect individual's quality of life or life expectancy, but also has a significant effect on resource allocation in the household which could threaten both long- and short-term welfare of households and lead households into incurring debts, selling off productive assets and trading off proportion of resources allocated for other consumptions such as food expenditure (Wang et al., 2006; Whitehead, 2006).



Household size was found to be a positive and statistically significant factor in determining food insecurity among Ghanaian households at 1% level of significance. Keeping all other factors constant, an increase in household size by one person results in a 0.03 standardized unit increase in self-reported food insecurity. This is expected to be so because of increasing household food expenditure and per capita food consumption ensuing from the increase in the household size. The effect was seen evidently within the very poor households. An increase in household size by one more member, *ceteris paribus*, for the very poor household results in a 0.07 standardized unit increase in food insecurity. Ndobu and Sekhampu (2013) reported that households with larger sizes are associated with a negative food security status as these households require massive food expenditures and competition for inadequate resources. Results from this study also agree with Tefera and Tefera (2014); using binary logistic regression model, they assert that household size is negatively associated with food security status and that households with large family sizes are food insecure than those with small numbers. However, in three multivariate models, Wilde and Peterman (2006) concluded that though household size was associated with greater risk of food insecurity; holding household size constant their study revealed that having relatively more children in the household was associated with fewer reports of food insecurity problems. This could be possible because children probably might not consume greater proportion of food available to households. Presence of children might also force the household to put in other mechanisms that lead to lower incidences of food insecurity. An increase in the size of household members means more individuals to feed which indirectly shrinks income per head, expenditure per head and per capita food

consumption, thus resulting in increased demand for food (Aidoo et al., 2013). The demand generated by the large household size is generally unmatched with food supply from own production, thereby households are unable to escape food availability challenges (Sikwela, 2008).

All other things held constant, households with an economically active household head lead to income gains making household food availability more assured. However, adults with low income are usually at high risk of occupational injury and illness, which impedes their meagre activities negatively, significantly explaining the incidence of food insecurity among some Ghanaian households. From the results, it was observed that households that have more of their members within the economically active bracket reported 0.27 standardized unit decrease in the incidence of food insecurity, *ceteris paribus*. This is also expected because the economically active members usually finance Ghanaian household expenditure. Economically active members who are stable economically and financially may be able to create and accumulate wealth and secure food for their households than the economically inactive household members. Households diversify their income sources by engaging in daily activities such as formal labour employment, petty trading, and artisanship. However these activities enable households, especially farming households, to modernize their production and reduce risk of food shortage and making food more available even during seasons of unexpected crop failures (Aidoo et al., 2013). On the other hand, lack of income as a result of unemployment increases the household's inability to meet basic food needs and nutrition requirement (Alaimo, 2005). Consequently, very rich households reported

a 0.25 standardized unit less food insecurity while very poor households reported 0.06 standardized unit less food insecurity if the economically active members increase by one more. This is consistent with studies in Ethiopia, asserting that households with access to employment (in this case economically sound) are less prone to food insecurity (Gebre, 2012). Huang et al. (2016) also revealed that 15% of unemployed household heads reported the lack of the ability to meet the food required by their families. They concluded that unemployed heads experiencing this hardship had more disadvantaged socioeconomic backgrounds than those without these food challenges, lower education, income and more likely to own a house but a higher probability to receive nutrition assistance.

The education status of the household head was found to be significant and negatively related with food insecurity among Ghanaian households at 1% level of significance. Ghanaian households with educated heads reported approximately 0.3 standardized unit decrease in food insecurity, *ceteris paribus*. Higher education means that household head has more opportunities to be engaged in more lucrative and higher paid jobs. However, the higher income from these forms of employment can be used to supplement food supply within the household making household less prone to food insecurity. More so, the effect is more evident within the expenditure quantiles. The very rich educated household heads reported 0.28 standardized unit decrease in food insecurity *ceteris paribus*, whereas the rich households with educated heads reported 0.26 standardized unit decrease in food insecurity, holding all other factors constant. Comparatively, the

poor households with educated heads reported 0.22 standardized unit less food insecurity, *ceteris paribus*.

The forgoing results on education is expected as enhanced literacy means households are more diversified and creative in increasing household income to better address household needs for food and other expenditure. Another explanation to this is that literate household heads are better able to contribute to social development of other members affording them also a better chance of escaping the food insecurity situation that households usually face. This is also consistent with what had been found by Gebre (2012) and Ojogho (2009). Both studies make the assertion that literate households are more food secured. Educated household heads, for instance, are able to increase their means of generating income in order to drag out of the food insecurity situation and lead a quality life. Literate household heads are also assumed to have better management skills, which can enable them to secure a year-round supply of diversified and even preferred food (Idrisa et al., 2008; Makombe et al., 2010). This study's finding is also consistent with observations from the study conducted by Tefera and Tefera (2014). They observed that educational achievement of household heads, keeping other factors constant, improves the likelihood of such households being food secured.

The sex of the household heads was found to be significantly associated with food insecurity at 5% level of significance. Being a male household head is associated with a 0.04 standardized unit decrease in self-reported food insecurity. This means that female household heads were more likely to report more cases of food insecurity than their male counterparts. Men are more endowed with the use and control of resources

for production and valuable assets compared to women. This makes men more adaptive and resilient to exogenous shocks that deplete food availability. This finding agrees with the findings that argue that the effect of gender inequality on household food insecurity is largely due to the difference in available resources and decision making power within communities (Agidew & Singh, 2018; Kassie et al., 2015). Furthermore, poor households with male heads reported a 0.17 standardized unit decrease in food insecurity. Mango et al. (2014) assert that gender of household heads reveals the head's orientation to food. Horrell and Krishnan (2007) argue that male-headed households are a better source of labour, especially on-farm labour than their female counterparts. It is therefore expected that male-headed Ghanaian households will be less prone to food insecurity due to their participation in the labour market that brings them income.

The age of household head affects the household food insecurity situation negatively in the sense that an increase in the age of household head by one more year, holding other factors constant, results in a 0.002 standardized unit decrease in self-reported food insecurity. This is significant at 1% level of significance. Thus, older household heads tend to be food secured as they grow, though their productivity may decline, they benefit from insurance, remittances and gifts from other sources. On the contrary, though the extra sources of income augment the supply of food within households, when not enough will leave households food insecure. Another explanation could be that older household heads could have more members within the economically active bracket, giving the household an opportunity to escape food insecurity. Children also may grow and leave the household hence reducing household membership. This also could be

supported by the assumption that as household head ages they are expected to be more productive and economically stable and accumulate resources to secure food for households. This observation supports that assumption that aged household heads are expected to be stable and accumulate wealth, experience and food secure than younger heads because they are able to engage in off farm activities to generate extra income to improve household food security status (Tefera & Tefera, 2014). The finding however contrasts that of Gebre (2012), who asserted that older household heads have more members, implying that their limited resources are distributed among many members resulting in food insecurity tendencies.

The value of household assets owned was revealed to be a statistically significant determinant of self-reported food insecurity among Ghanaian households at 1% level of significance. An increase in household assets by one, *ceteris paribus*, results in 0.09 standardized unit decrease in food insecurity. The negative relationship suggests that Ghanaian households with assets such as machinery, equipment, vehicles, houses and plots and consumer assets among others are associated with lower levels food insecurity. This is much more evident in the quantile results. An increase in household assets by one, *ceteris paribus*, results in 0.04 standardized unit reduction in food insecurity in the very poor households. An increase in household-owned assets by one more among poor households reduces food insecurity by 0.07 standardized unit, *ceteris paribus*. Comparatively, an increase in household-owned assets by one for the rich households decreases the incidence of food insecurity by 0.08 standardized unit, holding all other factors constant. In the same way, among the very rich households an increase in the

value of household owned assets by 1GH¢ reduces self-reported food insecurity by 0.09 standardized unit, *ceteris paribus*. In the event where there is food shortage, some of these assets could be liquidated to drag the household out of the possible food insecurity.

It is expected that access to financial institutions would increase food security situations of households by first increasing their financial capacity and power to purchase which affords them the chance to escape food insecurity. Access to financial institutions was significant but negatively associated with self-reported food insecurity, implying that households that had access to financial institutions reported minimal food insecurity. Ghanaian households that have access to financial institution reported 0.08 standardized unit decrease in food insecurity. This is consistent with *a priori* expectation. Farming households that have access to financial institutions and credit for that matter are able to build capacity to produce more through the use of improved varieties and technologies (Aidoo et al., 2013).

**Table 4.12 Results of OLS and 3SLS estimations of food insecurity and ill-health (number of ill-health reported)**

VARIABLES	OLS Pooled		3SLS Pooled		3SLS 1st Expenditure Quartile		3SLS 2nd Expenditure Quartile		3SLS 3rd Expenditure Quartile		3SLS 4th Expenditure Quartile	
	Ill-health	Food insecurity	Ill-health	Food insecurity	Ill-health	Food insecurity	Ill-health	Food insecurity	Ill-health	Food insecurity	Ill-health	Food insecurity
Ill-health		0.0628*** (0.0073)		0.0445** (0.0204)		0.0116 (0.0252)		0.0706* (0.0407)		0.1111** (0.0558)		0.1460** (0.0695)
Food insecurity	0.0789*** (0.0092)	\	0. 2864*** (0.1047)		-0.0045 (0.1889)		0.0664 (0.2743)		0. 4742*** (0.1853)		0.3932** (0.1856)	
Sex	-0.0340** (0.0172)	-0.0356** (0.0159)	-0.0287 (0.0178)	-0.0370** (0.0160)	-0.0715 (0.0538)	-0.1667*** (0.0320)	0.0524 (0.0379)	-0.0055 (0.0334)	-0.0135 (0.0346)	-0.0558* (0.0323)	-0.0407 (0.0249)	-0.0242 (0.0288)
Age	-0.0001 (0.0005)	-0.0015*** (0.0005)	0.0002 (0.0005)	-0.0016*** (0.0005)	-0.0017 (0.0012)	-0.0014* (0.0008)	0.0005 (0.0012)	-0.0015 (0.0009)	0.0017 (0.0011)	-0.0027*** (0.0010)	0.0005 (0.0008)	-0.0018** (0.0009)
Household size	0.0835*** (0.0029)	0.0297*** (0.0028)	0.0771** * (0.0044)	0.0317*** (0.0034)	0.0726*** (0.0066)	0.0159*** (0.0051)	0.1166*** (0.0067)	-0.0023 (0.0081)	0.0898*** (0.0074)	0.0017 (0.0093)	0.1035*** (0.0068)	-0.0063 (0.0114)
Economic Activity	-0.0144 (0.0197)	-0.2693*** (0.0350)	0.0145 (0.0247)	-0.2653*** (0.0344)	-0.0585 (0.0549)	-0.1810*** (0.0302)	-0.0306 (0.0626)	-0.1889*** (0.0740)	0.0448 (0.0424)	-0.1970** (0.0852)	-0.0063 (0.0342)	-0.2460** (0.0999)
LogAsset	0.0103*** (0.0035)	-0.0882*** (0.0032)	0.0288** * (0.0099)	-0.0880*** (0.0032)	0.0049 (0.0109)	-0.0445*** (0.0051)	-0.0143 (0.0216)	-0.0710*** (0.0072)	0.0372** (0.0160)	-0.0751*** (0.0075)	0.0316* (0.0186)	-0.0926*** (0.0075)
Remittance	0.0008	-0.0000***	0.0000	-0.0000***	0.0000	-0.0675***	0.0001	-0.0000*	0.0000	-0.0000	-0.0000	-0.0000



	(0.0037)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0216)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Education	-0.0388**	-0.2948***	0.0257	-0.2957***	-0.0115	-0.0573	-0.0906	-0.2230***	0.0550	-0.2623***	0.0030	-0.2783***
	(0.0175)	(0.0160)	(0.0370)	(0.0160)	(0.0523)	(0.0360)	(0.0741)	(0.0319)	(0.0612)	(0.0309)	(0.0678)	(0.0324)
Access to Finance Institution	-0.0318*	-0.0896***	-0.0186	-0.0817***	-0.0422	-0.0788	-0.0657	-0.0916**	-0.0536	-0.0740*	0.0005	-0.0120
	(0.0177)	(0.0210)	(0.0192)	(0.0208)	(0.0618)	(0.0550)	(0.0406)	(0.0454)	(0.0318)	(0.0388)	(0.0240)	(0.0321)
Access to Extension		0.0652***		0.0554***		0.1235***		0.0583		-0.0171		0.0333
		(0.0220)		(0.0215)		(0.0457)		(0.0455)		(0.0369)		(0.0365)
Access to Market		0.0460**		0.0385*		0.0701		0.1220***		0.1321***		-0.0441
		(0.0216)		(0.0210)		(0.0508)		(0.0468)		(0.0395)		(0.0310)
Access to Irrigation		-0.1079***		-0.1205***		-0.3130***		-0.0691		-0.0703		-0.0897
		(0.0298)		(0.0290)		(0.0572)		(0.0691)		(0.0532)		(0.0560)
Impassable road	-0.0005	0.0427***	-0.0121	0.0432***	-0.0075	-0.0194	0.0012	0.0252	-0.0071	0.0208	0.0316	0.0334
	(0.0185)	(0.0171)	(0.0197)	(0.0171)	(0.0404)	(0.0282)	(0.0392)	(0.0338)	(0.0394)	(0.0375)	(0.0345)	(0.0384)
Central Region	0.1523***	0.1943***	0.106**	0.1983***	0.2521**	-0.1314	0.1735**	0.1374**	0.0418	0.3644***	-0.0679	0.3296***
	(0.0349)	(0.0322)	(0.0424)	(0.0323)	(0.1243)	(0.0865)	(0.0834)	(0.0615)	(0.0976)	(0.0601)	(0.0813)	(0.0588)
Greater Accra Region	-0.1618***	-0.4942***	-0.4742	-0.4995***	-0.4175	-0.8085***	-0.3339	-0.5904***	-0.0135	-0.4051***	-0.0837	-0.2017***
	(0.0351)	(0.0324)	(0.6769)	(0.0326)	(0.3053)	(0.1823)	(0.2137)	(0.1038)	(0.1053)	(0.0606)	(0.0652)	(0.0548)
Volta Region	0.2878***	-0.2261***	0.3349**	-0.2176***	0.3782**	-0.4942***	0.3739***	-0.2346***	0.3667***	-0.3074***	0.0179	-0.0147
	(0.0344)	(0.0324)	(0.0423)	(0.0328)	(0.1363)	(0.0693)	(0.0890)	(0.0610)	(0.0855)	(0.0632)	(0.0616)	(0.0718)
Eastern Region	0.0267	-0.2052***	0.0699*	-0.2038***	-0.1817	-0.4168***	0.0294	-0.2262***	0.1840***	-0.1671***	-0.0017	-0.0281
	(0.0339)	(0.0313)	(0.0408)	(0.0312)	(0.1382)	(0.0802)	(0.0916)	(0.0596)	(0.0661)	(0.0572)	(0.0504)	(0.0579)
Ashanti Region	-0.1350***	-0.5202***	-0.0216	-0.5235***	-0.2897**	-0.5136***	-0.1784	-0.6052***	0.0927	-0.5041***	-0.0381	-0.2724***
	(0.0331)	(0.0303)	(0.0662)	(0.0305)	(0.1577)	(0.0885)	(0.1857)	(0.0624)	(0.1134)	(0.0556)	(0.0780)	(0.0554)
Brong Ahafo Region	-0.1469***	-0.4613***	-0.0492	-0.4622***	-0.3331**	-0.5518***	-0.1295	-0.5873***	0.1025	-0.4772***	-0.0384	-0.2213***
	(0.0348)	(0.0321)	(0.0605)	(0.0323)	(0.1472)	(0.0731)	(0.1740)	(0.0614)	(0.1150)	(0.0594)	(0.0712)	(0.0646)

Northern Region	-0.0098	0.3324***	-0.0776*	0.3347***	-0.1324	0.1919***	0.1470	0.2490***	0.0897	0.3050***	-0.0983	0.3547***
	(0.0348)	(0.0322)	(0.0492)	(0.0322)	(0.0953)	(0.0626)	(0.0993)	(0.0622)	(0.0935)	(0.0743)	(0.0939)	(0.0779)
Upper East Region	0.1658***	0.3198***	0.1005*	0.3267***	0.0003	0.1811***	0.3029***	0.2970***	0.3752***	0.2162***	0.1171	0.1831**
	(0.0351)	(0.0329)	(0.0485)	(0.0332)	(0.0929)	(0.0637)	(0.1066)	(0.0642)	(0.0916)	(0.0831)	(0.0821)	(0.0869)
Upper West Region	-0.2286***	0.2370***	-0.2725** *	0.2170***	-0.3016***	0.0585	-0.0807	0.0520	0.0050	-0.0860	-0.0805	-0.1576
	(0.0354)	(0.0327)	(0.0422)	(0.0332)	(0.0889)	(0.0635)	(0.0770)	(0.0669)	(0.0871)	(0.032)	(0.0893)	(0.0960)
Per capita cultivated area		0.0092***		0.0095***		0.0117***		0.0064**		0.0089***		0.0069***
		(0.0012)		(0.0012)		(0.0037)		(0.0026)		(0.0021)		(0.0019)
Form of work		-0.0349***		-0.0333***		-0.0309**		-0.0067		-0.0267*		-0.0379**
		(0.0086)		(0.0084)		(0.0127)		(0.0180)		(0.0191)		(0.0217)
Proximity to Health facility	0.2621***		0.2596** *		0.3547***		0.2715***		0.2145***		0.1460***	
	(0.0058)		(0.0060)		(0.0127)		(0.0138)		(0.0129)		(0.0102)	
Constant	0.8269***	1.0266***	-0.0377	1.0242***	0.4798*	1.1367***	0.0887	0.9981***	-0.2431	0.9058***	0.0860	0.7955***
	(1.1487)	(0.0568)	(0.1077)	(0.0564)	(0.2563)	(0.0866)	(0.2960)	(0.1203)	(0.1783)	(0.1247)	(0.1433)	(0.1415)
Observations	13,817	13,817	13,817	13,817	3,455	3,455	3,454	3,454	3,454	3,454	3,454	3,454
R-squared	0.2565	0.3215	0.2290	0.3212	0.2707	0.1877	0.2656	0.2097	0.1150	0.2218	0.1135	0.2015

Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The access to extension services is a significant determinant of self-reported food insecurity among Ghanaian households at 1% level of significance. Ghanaian households with access to extension services reported 0.06 more food insecurity incidence. This is contrary to *a priori* expectation. One would expect that access to extension services would increase agricultural productivity, and in turn give households opportunity to escape from food insecurity. This result raises the question of whether it is sufficient to look simply at access to extension services or better to measure the quality of extension information received by farmers. This study argues that access to extension services is not sufficient, but rather must be enhanced through timely engagement of officials and the provision of adequate logistics. Future studies could explore the frequency of contacts household members have with extension officers, and more importantly the quality of services or advices they receive. Previous research in Asia has found that extension officers spend most of their time on administrative activities other than the real extension work (Hu et al., 2004; Hu et al., 2006). There is the need for agricultural extension technicians to visit farmers' fields and provide extension services that meet the diverse technology and market information needs of smallholder farmers at the village level (Chen & Shi, 2008; Hu et al., 2006). Moreover, extension service delivery in most developing countries faces critical challenges, including improper design of extension programs. More so, many smallholders do not make use of them even where agricultural extension services are available, because most of these programs are not tailored to meet their specific needs and the tailored programs are not followed by some farmers in most cases. In the light of this, many smallholders

are not incentivized to seek extension services (Siddiqui & Mirani, 2012; Swanson & Rajalahti, 2010).

Per capita household cultivated area is a significant and positive determinant of self-reported food insecurity among Ghanaian households at 1% level of significance. A unit increase in household per capita cultivated area results in 0.01 standardized unit increase in food insecurity. It is expected that households that are into crop cultivation will be more able to escape the food insecurity situation they are faced with through own production and sale of their produce for money to take care of food expenditure that fall outside the subsistence bracket. This is consistent with findings from Tefera and Tefera (2014). They asserted that farming households with large land size for cultivation have higher probability of producing enough food and sources of cash products than their counterparts with smaller cultivated land. Also, as a result of being able to use this resource these farm households would have high probability of acquiring capital which might enable them to invest in opportunities that can contribute to food security of the households. The 2009 World Summit on food security noted that low income and smallholder farming households are usually faced with unequal access to food supplies and markets (FAO, 2009). Meanwhile, increased per capita cultivated area does not directly translate into cash income due to the seasonal nature of farming, imperfect markets and price fluctuations that characterize agricultural production. However, larger land holding without land security may not also guarantee high productivity given that households may be reluctant to intensify investment in such lands. Households are more likely to engage in long-term investment in land that have no litigation issues, therefore

the result is not surprising given that majority of the respondents do not have security of the land.

Remittances in this study is significant and negatively associated with food insecurity among Ghanaian household at 1% level of significance. Generally, an increase in remittances that comes to household by one Ghana cedi results in 0.01 standardized unit decrease in self-reported food insecurity. The negative relationship implies that households that received some amount of remittances escaped potential food insecurity. Comparatively, an increase in remittances received for the very poor households reduces food insecurity, holding other factors constant. In the same way, an increase in remittances for households that fall within the second expenditure quartile, representing poor households, reduces food insecurity, *ceteris paribus*. Moreover, the receipt of international remittances reduce poverty in Ghana by 88.1% more than internal remittances (Adams et al., 2008) thereby exposing households to food insecurity.

Previous research has shown that remittance-receiving households increase their level of food consumption, food security and other welfare outcomes (Atuoye et al., 2017; Generoso, 2015; Regmi & Paudel, 2017). However, not only are remittances often used to address basic needs such as food and shelter, they are also channelled into sustainable investment (small-scale businesses, livestock farming, education, among others) (Maphosa, 2007). Remittances received by household may be an investment tool and a route to escape from the ‘killer’ food security in the Upper West Region of Ghana (Kuuire et al., 2013). Previous studies have also established that remittances enhance food security in Nigeria (Babatunde & Martinetti, 2011), Mali (Generoso, 2015),

Bangladesh (Regmi & Paudel, 2017). Although remittances are negatively associated with food insecurity they are unable to completely remove the economic shocks that leads to food availability and accessibility challenges (Karamba et al., 2011).

Impassable (or non-memorable) road is significant and positively associated with self-reported food insecurity at 1% level of significance. Households that had impassable roads reported 0.043 more standardized unit of food insecurity among Ghanaian households. This meets *a priori* expectation, since one would expect that impassable roads make it difficult for agriculture-oriented households to participate in the market, thereby reducing their productivity. A study by Boakye-Achampong et al. (2012) in Ghana revealed that generally on the supply side, rural surpluses and scarcity of food in urban areas are caused by inadequate and impassable road linkages between rural and urban areas. Also, in Nigeria Olorunfemi (2018) confirmed that farmers resolve to transport their farm output through other means such as motorcycles because of the poor conditions of roads that make them impassable by vehicles, especially during the rainy season of the year thereby posing threats to agricultural development and food security.

Access to irrigation facilities was found to be statistically and significantly associated with self-reported food insecurity at 1% significance level. The negative relationship implies that households that had access to irrigation facilities reported 0.12 standardized unit less food insecurity. The result is expected, and a possible explanation could be that these households that farm under irrigation are more likely to have increased agricultural productivity. Similarly, the observation was same for the results of the very poor households. Having access to irrigation facilities by these households reduces the food

insecurity situation by 0.31 standardized unit, holding all other factors constant. Access to irrigation has a positive impact on household food security (Sikwela, 2008) .

Access to markets was found to be positively significant in determining food insecurity, at 10% level of significance. Generally, households that have access to market are 0.04 more likely to increase food insecurity *ceteris paribus* relative to households with no access to market. The significance level is 1% for both poor and rich households. Though this finding is contrary to a prior expectation, and the possible explanation could be that only few households had access to markets. Another possible explanation is that most of these markets are faced with limited supply and price volatility which undermines food security especially for poor households. The solution to this is developing an efficient food marketing system.

The regional dynamics of self-reported food insecurity across the regions were also analysed. Households within the Central Region reported a 0.20 standardized unit higher food insecurity as compared to households in Western Region, *ceteris paribus*. Comparatively, poor households in Central Region reported 0.13 more food insecurity situation than poor households in the Western Region. However, rich households in Central Region reported 0.36 more food insecurity challenges than their counterparts in the Western Region. Similarly, the study revealed that very rich households in Central Region reported a 0.33 more food insecurity cases as compared to their colleagues in the Western Region.

Generally, households in Greater Accra Region reported a 0.50 less food insecurity situation as compared to households residing in the Western Region. Comparatively, very poor households in the Greater Accra Region reported 0.81 less food insecurity cases as compared to very poor households who reside in the Western Region. However, poor households in the Greater Accra Region reported 0.59 less food insecurity as compared to poor household who resides in the Western Region. Similarly, rich households reported 0.41 less food insecurity relative to rich households in the Western region, holding all other factors constant. Additionally, very rich households in the Greater Accra Region reported 0.20 less food insecurity *ceteris paribus*, as compared to rich households that reside in the Western Region.

Ghanaian households within the Volta Region reported a 0.22 less food insecurity incidence as compared to their Western Region counterparts. Very poor households in Volta reported 0.49 less food insecurity as compared to very poor households located in the Western Region. However, poor households located in the Volta Region reported 0.23 less food insecurity incidence as compared to their counterparts located in the Western Region. Similarly, the study revealed that rich households in the Volta Region reported 0.31 less food insecurity than rich households located in the Western Region. Largely, households in Eastern Region reported a 0.20 less food insecurity situation as compared to their Western Region counterparts, *ceteris paribus*. However, the case is not different for households in various expenditure quartiles. Comparatively, very poor households in Eastern Region reported 0.42 less food insecurity as compared to very poor households located in the Western Region. In the same way poor households within



the Eastern Region reported 0.23 less food insecurity than their counterparts located in the Western Region. However, rich households in Eastern Region reported 0.17 less food insecurity relative to those located in the Western Region.

In general, households within the Ashanti region were also found to have reported a 0.52 less food insecurity incidence as compared to their Western Region counterpart *ceteris paribus*. Largely, very poor households who reside in the Ashanti Region reported 0.51 less food insecurity as compared to very poor households in Western Region *ceteris paribus*. However, poor households located in the Ashanti Region reported 0.61 less food insecurity incidence than poor households that reside in the Western Region. Comparatively, rich households in the Ashanti region reported 0.50 less food insecurity as compared to rich households located in Western Region holding all other factors constant. In the same way, rich households in the Ashanti region reported 0.27 less food insecurity cases as compared to rich households that are located in Western Region *ceteris paribus*.

Furthermore, households within the Brong Ahafo Region generally reported 0.46 less food insecurity incidence relative to their Western Region counterpart *ceteris paribus*. The very poor households located in Brong Ahafo reported 0.55 less food insecurity situation than their counterparts in the Western region. In the same way, poor households in Brong Ahafo reported 0.59 less food insecurity than poor households located in Western region. Comparatively, rich households in the Brong Ahafo Region reported 0.59 less food insecurity relative to rich households located in Western Region *ceteris paribus*. However, very rich households located in the Brong Ahafo Region

reported 0.48 less food insecurity as compared to very rich households located in Western Region *ceteris paribus*.

Households in the Northern Region reported a 0.34 increase in food insecurity more than households in the Western Region. However, very poor households located in Northern Region reported 0.19 more food insecurity incidence relative to their counterparts located in the Western Region. Moreover, poor households that reside in Northern Region reported 0.25 more food insecurity relative to poor households located in Western Region *ceteris paribus*. Comparatively, rich households that are located in Northern Region reported 0.31 more food insecurity as compared to rich households in Western Region *ceteris paribus*. Also, very rich households located in Northern Region reported 0.35 more food insecurity relative to very rich households in Western Region holding all other factors constant. Largely, households residing in the Upper East Region were found to have reported 0.33 more food insecurity cases than their Western Region counterpart, *ceteris paribus*. Relatively, very poor households in the Upper East Region reported 0.18 more food insecurity incidence than very poor households located in Western Region *ceteris paribus*. Poor household that are located in the Upper East Region reported 0.30 more food insecurity relative to their counterparts in Western Region *ceteris paribus*. Similarly, rich households located in the Upper East Region reported 0.22 more food insecurity than rich households in the Western Region *ceteris paribus* households. Also, very rich households that reside in the Upper East Region reported 0.18 more food insecurity situation as compared to very rich households that are located in Western Region holding other factors constant. Generally, households

residing in Upper West Region reported 0.22 more incidence of food insecurity as compared to their Western Region counterparts.

#### **4.8 Determinants of Ill-Health**

In this section the determinants of self-reported ill-health is discussed and the results from the 3SLS estimation presented. Self-reported health status may be subjectively dependent on social and cultural backgrounds of individuals given an individual's underlining objective health condition. In this study, food insecurity, household size, value of assets owned by households, and proximity to health facility were found to be significantly associated with the incidence of ill-health.

The relationship between food insecurity and ill-health is bi-directional in the sense that food insecure households have more of their members' health compromised. In the same way household members who suffer ill-health were observed to be susceptible to experiencing food insecurity. The results also show that food insecurity is statistically and significantly related to ill-health at 5% level of significance. A one standardized unit increase in food insecurity, holding all other factors constant, results in a 0.32 increase in the number of ill-health reported among Ghanaian households. The positive relationship implies that the households that reported food insecurity are more prone to ill-health. Food insecure households characterised by less serving of fruits, vegetables and milk products than those of food-secure households making their diets poorer in terms of nutritional quality (Mark et al., 2012).

The study revealed that food insecurity has a perceptible impact on health and wellbeing of household members, especially of children both in the short- and long-terms. However, this effect is more evident and statistically significant within the rich (3<sup>rd</sup> quartile) and very rich (4<sup>th</sup> quartile) households. In rich households, an increase in food insecurity by one standardized unit, *ceteris paribus*, results in a 0.51 increase in the number of ill- health reported. Meanwhile, within the very rich households, a standardized unit increase in self-reported food insecurity results in a 0.41 increase in the number of ill-health reported, holding all other factors constant, which is lower than the rich households. This makes sense because households within the very rich households are more likely to be able to absorb the shocks (including high food prices, delayed harvest and unfavourable climatic factors) that are associated with food insecurity thereby reducing the effect of food insecurity on ill-health.

Also household size was found to be significantly and statistically associated with number of ill-health reported at 1% level of significance. An increase in household size by one more member results in a 0.08 increase in the number of ill-health recorded, *ceteris paribus*. The relationship is positive, implying that households with more members experienced more incidences of ill-health compared to those with fewer household members. Comparatively, households within the first expenditure quartile, representing the very poor households, reported a 0.07 increase in the number of ill-health as a result of an increase in the size of household by one more member, *ceteris paribus* as compared with the poor households, where increasing the household size by one more member results in a 0.12 increase in the number of ill-health reported.

Moreover, the case is almost the same for both the rich and very rich households. An increase in the size of household by one more member in rich households results in a 0.09 increase in number of reported ill-health cases, but a 0.10 increase in the number of reported ill-health in the very rich households. This is expected because very rich households are relatively more sensitive to their general health condition and would readily report ill-health.

Household assets was revealed to be positively and significantly associated with ill-health at 1% level of significance. An increase in the value of household assets by GH¢1 results in a 0.03 increase in the cases of ill-health reported by households, *ceteris paribus*. The effect of household owned assets is seen to be more evident in the 3<sup>rd</sup> and 4<sup>th</sup> quartiles. An increase in household assets value by GH¢1 results in a 0.04 increase in the number of ill-health reported within rich households, but a 0.03 increase in the number of ill-health reported for the very rich households. There is logic in these findings. Very wealthy households are more likely to be very sensitive and conscious about their health and more so able to access healthcare services. The inequality in self-reported ill-health tends to favour the wealthy in the sense that the higher the income the better the level of self-assessed health (Humphries & Van Doorslaer, 2000), thus a tendency of recording relatively less number of ill-health. Meanwhile studies have revealed that households that are poor have inexplicably worse health outcomes and even less access to healthcare (Zimmerman et al., 2015).

Households in the Central Region of Ghana reported 0.10 more cases of ill-health than their Western Region counterparts. However, this is more evident in the first and second expenditure quartiles. The very poor households in Central Region reported 0.25 more ill-health than their Western Region counterparts, *ceteris paribus*. The poor households within the Central Region also reported 0.17 more ill-health than their counterparts in the Western Region, *ceteris paribus*. Ghanaian households in the Volta Region reported a 0.34 more number of ill-health than households within the Western Region. Comparatively, the effects are seen more within all the quartiles except the 4<sup>th</sup> expenditure quartile. Very poor households in the Volta Region reported 0.35 more ill-health than their colleagues in the Western Region. Similarly, poor households residing in the Volta Region reported 0.37 more incidences of ill-health than poor households who reside in the Western Region.

Households in Eastern Region that fell within the third expenditure quantile representing rich households showed to have reported 0.19 more incidences of ill-health than the rich households that reside in the Western Region. Households in Ashanti Region that fell within the first expenditure quantile, representing the very poor households, also reported 0.32 less incidence of ill-health as compared to the poor households that reside in the Western Region. In the same way very poor households within the Brong-Ahafo Region were found to have reported 0.37 less incidence of ill-health than very poor households within the Western Region, holding all other factors constant.

Generally, it is observed that households in Northern Region reported 0.09 less incidence of ill-health as compared to their counterparts in the Western Region. However, the observation in Upper East was in contrast to that of the Northern Region. The results revealed that generally households in the Upper East Region reported 0.09 more incidences of ill-health as compared to households that reside in the Western Region. Comparatively, it was observed that poor households that reside in Upper East Region reported 0.30 more incidences of ill-health as compared to poor households within the Western Region. In the same way, rich households also reported 0.37 more incidences of ill-health than their Western regional counterparts. Households that reside in the Upper West Region reported 0.28 less incidence of ill-health as compared to households that resides in Western Region holding all other factors constant. Rather, very poor households in the Upper West Region reported 0.30 less incidence of ill-health relatives to very poor households that reside in Western Region, *ceteris paribus*.

Proximity to health facilities, which represents the distance (in terms of time spent) from household to healthcare facility by foot, was found to be significantly and statistically associated with number of ill-health incidences reported. An increase in minutes of walking to health facility by one-hour results in a 0.26 increase in the number of reported ill-health incidences. The positive relationship implies that households that are far from healthcare facilities suffer more incidences of ill-health. The effect of proximity is evident across the quartiles, but the magnitude is more seen in the first expenditure quartile. Very poor households that experience an increase in walking distance by one hour when traveling by foot, *ceteris paribus*, results in a 0.35 increase in the number of

ill-health reported. Comparatively, an increase in proximity to healthcare facility by one hour, results in a 0.27 increase in the number of ill-health reported by poor households. In the same way, an increase in proximity by one hour for rich households results in a 0.21 increase in the number of ill-health reported *ceteris paribus*. Equally, an increase in proximity by one hour for very rich households, results in a 0.15 increase in the number of ill-health reported.

#### **4.9 Determinants of Ill-Days**

Ill-days in this study implies the number of days household members suffered ill-health or number of days of hospitalization. The duration of ill-days contains more information about ill-health than the mere incidence of the illnesses. The basic assumption here is that illness is considered when it is severe enough to prevent individuals from engaging in habitual activities, thus are incapacitated. To this end, the ill-days variable was also regressed on the same set of explanatory variables to observe how the variables determine the number of ill-days and especially the reverse causality between self-reported food insecurity and ill-days. Again, the effect was also assessed across the four expenditure quantiles. Demographic characteristics and institutional factors included in the model were found to be statistically significant as discussed below. The results of the 3SLS estimates are presented in Table 4.11 where age, household size, economic activity, household assets, access to financial institution and proximity to health facility are all statically significant.

Although self-reported food insecurity is not statistically significant in the ill-day's equation, it makes sense to expect a reverse causality between the two variables. Ill-



days was found to be statistically and significantly associated with food insecurity at 5% level of significance. An increase in the number of ill-days by one day, *ceteris paribus*, results in an increase in household food insecurity by 0.01 standardized units. This is expected and the possible explanation is that food insecurity within the household could emanate from reduced productivity and loss of labour days on the part of hospitalized household members who are consequently cash-strapped and may not have enough financial resources to finance food expenditure. This is consistent with studies conducted by (Bryant et al., 2015) who asserted that most of such incapacitated households are heavily in debt because of their prolonged days of illnesses, and they are more likely to have severely undernourished family members, especially children.

Age is found to be statistically and significantly associated with ill-days at 1% significance level. An increase in household head's age by one year, holding other factors constant, results in a 0.02 increase in the number of ill-days. The positive relationship implies that older household heads experienced prolonged ill-days than younger heads. Elevated levels of residents' health may decline in the face of profound environmental hazards resulting in child and infant morbidity and mortality with ill-health persisting at an older age (Sverdlik, 2011). Age of the household head is likely to be a reflection of household heads sensitivity to ill-health. The effect is more evident in households within the high expenditure bracket. Comparatively, an increase in rich household head's age by a year results in 0.03 increase in ill-days, whereas with very rich households this leads to a 0.01 increase in ill-days, *ceteris paribus*.

Though the relationship is positive household size was revealed to have an interesting association with the number of ill-days at 1 % significance level. An increase in household size by one more member results in 0.4 increase in the number of ill-days. This means that households with large members are more likely to have ill-days prolonged. Households with more membership especially the poor already have difficulty in meeting up their food expenditure because of high per capita consumption. When there is competition between food expenditure and health related expenditure higher earning households are more able to deflate the effect of household size in determining ill-days of sick household members because these categories of households are more able to access and also utilize health facility than their poor counterparts. Also, they are more able to afford the portion of household expenditure that emanates from ill-health thereby reducing ill-days.

Economic activities had an interesting association with ill-days at 1% level of significance. An increase in the number of economically active household members by one person, when other factors are held constant, reduces ill-days by 0.34. However, this could be a reflection of the sensitivity of economically active members of the households to ill-health. This effect is more evident in the 1<sup>st</sup> and 4<sup>th</sup> quartiles implying economically active members within the very poor and very rich households are more sensitive to ill-health. An increase in economically active members by one person in the very poor households reduces ill-days by 0.93. But an increase in economically active individuals in the very rich households reduces the ill-days by 0.74. It is also observed that a present health shocks will, however, induce a worker to reduce or defer economic

activity during ill-days and increase work in subsequent periods when health status has improved.

Access to a financial institution is negatively associated with ill-days at 5% level of significance. Households that had access to financial institution reported 0.34 less ill-days as compared to those who did not have access, *ceteris paribus*. Access to healthcare delivery and health facility utilization is mainly dependent on the household's financial strength and as such households with access to financial institution are more able to access health facilities thereby reducing the number of ill-days. According to Gulliford et al. (2002), the opportunity to access health services based availability and adequate supply of the service. However, the extent of access to these services depends largely on finance. The negative relationship between access to finance and ill-days is seen more in very poor households. In very poor households an increase in access to financial institutions by one *ceteris paribus* reduces ill-days by 0.68

**Table 4.13 Results of OLS and 3 SLS estimation for food insecurity and ill-days**

VARIABLES	OLS Pooled		3SLS Pooled		3SLS 1 <sup>st</sup> Expenditure Quartile		3SLS 2 <sup>nd</sup> Expenditure Quartile		3SLS 3 <sup>rd</sup> Expenditure Quartile		3SLS 4 <sup>th</sup> Expenditure Quartile	
	Ill-days	Food insecurity	Ill-days	Food insecurity	Ill-days	Food insecurity	Ill-days	Food insecurity	Ill-days	Food insecurity	Ill-days	Food insecurity
Ill-days		0.0093*** (0.0011)		0.0073** (0.0034)		0.0025 (0.0044)		0.0124* (0.0072)		0.0184** (0.0083)		0.0210** (0.0100)
Food insecurity	0.4722*** (0.0595)		0.6234 (0.6662)		-0.4801 (1.2199)		-0.5375 (1.8283)		1.5807* (1.0958)		0.5672 (1.2759)	
Sex	-0.1371 (0.1117)	-0.0370** (0.0159)	-0.1332 (0.1129)	-0.0340** (0.0160)	-0.3795 (0.3478)	-0.1670*** (0.0319)	0.4280* (0.2514)	-0.0061 (0.0334)	0.0789 (0.2106)	-0.0594* (0.0322)	-0.4119** (0.1595)	-0.0231 (0.0290)
Age	0.0192*** (0.0033)	-0.0017*** (0.0005)	0.0194*** (0.0034)	-0.0020*** (0.0005)	0.0089 (0.0077)	-0.0012* (0.0008)	0.0228*** (0.0077)	-0.0018* (0.0010)	0.0312*** (0.0064)	-0.0032*** (0.0010)	0.0125** (0.0054)	-0.0021** (0.0010)
Household size	0.4049*** (0.0188)	0.0314*** (0.0028)	0.4003*** (0.0278)	0.0331*** (0.0032)	0.4006*** (0.0428)	0.1468*** (0.0051)	0.5646*** (0.0441)	-0.0010 (0.0076)	0.3865*** (0.0436)	0.0050 (0.0084)	0.4718** (0.0437)	-0.0000 (0.0096)
Economic Active	-0.4648*** (0.1275)	-0.2697*** (0.2697)	-0.34439** (0.1673)	-0.1456*** (0.0183)	-0.9251** (0.3546)	-0.2627*** (0.0446)	-0.5326 (0.4162)	-0.1831*** (0.0382)	-0.1228 (0.2507)	-0.1842** (0.0913)	- (0.2189)	-0.2584** (0.1088)
Log Asset	0.0584** (0.0229)	-0.0881*** (0.0032)	0.0718* (0.0632)	-0.0885*** (0.0032)	0.0193 (0.0704)	-0.0444*** (0.0051)	-0.1650 (0.1436)	-0.0708*** (0.0072)	0.1321* (0.0949)	-0.0753*** (0.0075)	0.0496 (0.1268)	-0.0931*** (0.0075)
Remittance	0.0000 (0.0000)	-0.0000*** (0.0000)	0.0000 (0.0000)	-0.0145*** (0.0034)	0.0004* (0.0002)	-0.0000*** (0.0000)	0.1331 (0.1293)	-0.0000* (0.0000)	0.0100 (0.0456)	-0.0105 (0.0069)	-0.0134 (0.0229)	-0.0059 (0.0039)
Education	-0.1356 (0.1135)	-0.2959*** (0.0160)	-0.0887 (0.2355)	-0.2987*** (0.0160)	0.0913 (0.3389)	-0.0561 (0.0360)	-0.6387 (0.4932)	-0.2244*** (0.0318)	0.1229 (0.3833)	-0.2616*** (0.0309)	-0.3546 (0.4259)	-0.2843*** (0.0319)
Access to Financial Inst.	-0.3493*** (0.1146)	-0.0886*** (0.0211)	-0.3397** (0.1221)	-0.0855*** (0.0210)	-0.6813* (0.3989)	-0.0767 (0.0550)	-0.3844 (0.2698)	-0.0973** (0.0453)	-0.4330** (0.1878)	-0.0808** (0.0402)	-0.2826* (0.1535)	-0.0159 (0.0334)
Access to extension		0.0653***		0.0616***		0.1230***		0.0622		-0.0148		0.0427

		(0.0221)		(0.0219)		(0.0458)		(0.0454)		(0.0398)		(0.0406)
Access to Market		0.0463**		0.0407*		0.0754		0.1280***		0.1485***		-0.0396
		(0.0216)		(0.0214)		(0.0509)		(0.0468)		(0.0418)		(0.0345)
Access to irrigation		-0.1074***		-0.1219***		-0.3049***		-0.0577		-0.0520		-0.0475
		(0.0298)		(0.0296)		(0.0572)		(0.0555)		(0.0560)		(0.0626)
Impassable road	-0.0198	0.0429***	-0.0283	0.0470***	-0.3084	-0.0234	0.1088	0.0248	0.2203	0.0197	0.1571	0.0385
	(0.1199)	(0.0171)	(0.1254)	(0.0171)	(0.2609)	(0.0282)	(0.2604)	(0.0338)	(0.2398)	(0.0376)	(0.2215)	(0.0384)
Central Region	0.7062***	0.1972***	0.6728**	0.2020***	1.5611**	-0.1340	1.0029*	0.1386**	0.3258	0.3667***	-0.1486	0.3365***
	(0.2262)	(0.0322)	(0.2695)	(0.0323)	(0.7980)	(0.0865)	(0.5533)	(0.0614)	(0.6095)	(0.0598)	(0.5434)	(0.0588)
Greater Accra Region	-0.5735**	-0.4991***	-0.4901	-0.5011***	-2.1385	-0.8039***	-1.7533	-0.5984***	0.0996	-0.4135***	-0.6891	-0.2057***
	(0.2272)	(0.0324)	(0.4603)	(0.0325)	(1.9709)	(0.1820)	(1.4227)	(0.1032)	(0.6591)	(0.0599)	(0.4329)	(0.0543)
Volta Region	2.3406***	-0.2301***	2.3748***	-0.2191***	2.6122***	-0.4999***	3.0601***	-0.2508***	2.1723***	-0.3195***	0.1460	-0.0251
	(0.2228)	(0.0325)	(0.2689)	(0.0333)	(0.8800)	(0.0700)	(0.5904)	(0.0637)	(0.5056)	(0.0641)	(0.3931)	(0.0723)
Eastern Region	0.3194	-0.2070***	0.3509*	-0.2004***	-0.6299	-0.4251***	0.0696	-0.2266***	1.0264***	-0.1710***	-0.1226	-0.0270
	(0.2197)	(0.0313)	(0.2594)	(0.0312)	(0.8924)	(0.0800)	(0.6094)	(0.0596)	(0.3908)	(0.0573)	(0.3222)	(0.0581)
Ashanti Region	-0.6167***	-0.5234***	-0.5341	-0.5236***	-2.0492*	-0.5152***	-1.3181	-0.6090***	0.4657	-0.5090***	-0.6982	-0.2727***
	(0.2145)	(0.0303)	(0.4213)	(0.0305)	(1.0182)	(0.0884)	(1.2325)	(0.0622)	(0.7154)	(0.0552)	(0.4945)	(0.0551)
Brong Ahafo Region	-0.6497***	-0.4650***	-0.0586	-0.4614***	-1.8804*	-0.5546***	-0.9232	-0.5935***	0.4058	-0.4799***	-0.6243	-0.2258***
	(0.2255)	(0.0321)	(0.3851)	(0.0322)	(0.9503)	(0.0729)	(1.1594)	(0.0611)	(0.6882)	(0.0593)	(0.4686)	(0.0645)
Northern Region	-0.3245	0.3553***	-0.3739*	0.3384***	-0.9321	0.1915***	0.7300	0.2525***	0.4430	0.3118***	-0.3789	0.3629***
	(0.2256)	(0.0330)	(0.3128)	(0.0322)	(0.6152)	(0.0626)	(0.6604)	(0.0619)	(0.5773)	(0.0738)	(0.6220)	(0.0780)
Upper East Region	0.8257***	0.3227***	0.7782*	0.3266***	-0.1760	0.1668***	2.0310***	0.2952***	1.7871***	0.2282***	1.9307**	0.1692**
	(0.2273)	(0.0330)	(0.3226)	(0.0329)	(0.6000)	(0.0639)	(0.7068)	(0.0643)	(0.5416)	(0.0814)	(0.5325)	(0.0887)
Upper West region	-1.3579***	0.2167***	-1.5008***	0.2153***	-1.8881***	0.0477	-0.2976	0.0494	0.2621	-0.0787	-1.0676*	-0.1522
	(0.2290)	(0.0329)	(0.2765)	(0.0332)	(0.5740)	(0.0636)	(0.5110)	(0.0669)	(0.5298)	(0.0826)	(0.5708)	(0.0963)
Per HH cultivated area		0.0092***		0.0094***		0.0108***		0.0064**		0.0089***		0.0076***
		(0.0012)		(0.0012)		(0.0037)		(0.0026)		(0.0022)		(0.0020)

Form of work		-0.0358***		-0.0345***		-0.0322		-0.0059		-0.0247		-0.0429*
		(0.0086)		(0.0086)		(0.0127)		(0.0180)		(0.0209)		(0.0241)
Proximity to health facility	1.5606***		1.5525***		2.0409***		1.5637***		1.3382***		1.0733**	
	(0.0377)		(0.0388)		(0.0821)		(0.0919)		(0.0761)		(0.0655)	
Constant	0.2755	1.0381***	-0.3519	1.0309***	2.1170	1.2558***	0.6583	1.0029***	-1.2889*	0.9134***	1.7747	0.8269***
	(0.3046)	(0.0568)	(0.7363)	(0.0567)	(1.6553)	(0.0977)	(1.9633)	(0.1202)	(1.0543)	(0.1313)	(0.9160)	(0.1487)
Observations	13,817	13,817	13,817	13,817	3,455	3,455	3,454	3,454	3,454	3,454	3,454	3,454
R-squared	0.2115	0.3212	0.2041	0.3210	0.2275	0.1892	0.1873	0.2089	0.1873	0.2228	0.1815	0.1984

Standard errors in parentheses; \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Proximity to health facility was found to be significant in determining the number of ill-days reported among Ghanaian households at 1% level of significance. An increase in proximity, which is the distance in minutes of walking, from household to a health facility by one hour increases number of ill-days by 1.55. This is in line with the assertion that apart from factors such as income, service cost and education that determine health service access and utilization, one most important determinant is distance to health facilities (Buor, 2003).

Asset owned by households is significantly and positively associated with the number of ill-days at 10% significance level. An increase in asset ownership by GH¢1, *ceteris paribus*, results in a 0.07 increase in the number of days ill-health was suffered among Ghanaian households. However, the effect is seen more among households within the 3<sup>rd</sup> expenditure quantile which represents rich households. An increase in households owned assets by GH¢1 holding other factors constant results in a 0.13 increase in ill-days.

Although previous studies found that education is determining factor of the health and death outcomes among Ghanaian households and communities (Alaimo et al., 2001; Patel & Kleinman, 2003), education was found to be statistically insignificant in determining the number of ill-days among Ghanaian households.

Households within the Central Region reported 0.67 more ill-days as compared to households in Western Region *ceteris paribus*. However, very poor households in Central Region reported 1.56 more ill-days as relative to their counterparts in the

Western Region. Poor households in Central Region also reported 1.00 more ill-days than poor households in Western Region *ceteris paribus*. Households in Greater Accra reported 0.20 less ill-days as compared to their Western Regional counterparts. Volta Region residents reported 2.37 more ill-days as compared to their Western regional counterparts. Comparatively very poor households in the Volta Region reported 2.61 more ill-days as compared to their counterparts in the Western Region. Poor households in the Volta Region reported 3.06 more ill-days relative to very poor households in the Western Region. However, households within the third expenditure quartile (representing rich households) reported 2.17 more ill-days as compared their counterparts in the Western Region.

Generally, households in the Eastern Region were found to report 0.35 more ill-days as compared to households within the Western Region of Ghana. Very poor households in the Ashanti Region reported 2.05 less ill-days than those found in the Western Region. Households in the Northern Region reported 0.37 less ill-days than households in the Western Region of Ghana. Moreover, households residing in the Upper East Region reported 0.79 more ill-days as compared to households residing in the Western Region of Ghana. Comparatively members of poor households in the Upper East Region reported 2.03 more ill-days than poor households in the Western Region. Households that fall within the third expenditure quartile in the Upper East Region were found to report 1.79 more ill-days than their counterpart in the Western Region. In the same way very rich households who fall with the 4<sup>th</sup> expenditure quartile in the Upper East Region reported 1.93 more ill-days as compared to those that reside in the Western Region.



Surprisingly, households within the Upper West Region reported 1.50 less ill-days as compared to their Western regional counterparts. Moderately very poor households in the Upper West Region reported 1.50 less ill-days as compared to their counterparts in the Western Region. In the same way very rich households in the Upper West Region reported 0.15 less ill-days relative to very rich households who reside in the Western Region.

In sum, factors that significantly influenced ill-days included age of household head, economic activity of household heads, access to financial institutions, proximity (in terms of time) to health care units and Assets owned by household.

## CHAPTER FIVE

### 5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter presents a summary of the research and the key findings corresponding to the objectives outlined in the study as well as the implications of these findings. Section 5.1 summarizes key findings of the study as guided by the specific research objectives. In section 5.2, conclusions are drawn based on the key findings, which enables policy recommendations to be drawn and outlined in section 5.3.

#### 5.1 Summary of Key Findings

Food insecurity has become a topical issue because of recurrent natural shocks and declining agriculture production and food price volatility making it a leading cause of public health crises in the world and especially developing countries, including Ghana, primarily due to a number of challenges. The absence of sufficient and quality food in the long run engenders undesirable health related effects such as increased mental health problems, decreases nutrient intakes among others. Erasing food insecurity and its effect on health outcomes has become an essential aspect of global development agenda. There is also a perception that regions with urbanised towns like Accra and Kumasi for instance are more food secure than their rural counterparts within the Ghanaian context. In addressing the overall objective of examining the effect of household food insecurity on ill-health outcomes, this thesis quantified and compared the extent of food insecurity among Ghanaian households. This thesis also examined the determining factors of food insecurity and ill-health among Ghanaian households. This study also assessed the relationship between food insecurity and ill-health outcomes. Ill-health (number of

household members hospitalised) and ill-days (number of days household members were hospitalised) are used as proxies for health outcomes. Regional dummies were included in the models to compare the effects across the 10 former regions of Ghana. Data was obtained from GLSS 7 and further processed to suit the objectives of the study. This study also employed both 2SLS and 3SLS models to assess the relationship between self-reported food insecurity and ill-health among Ghanaian households. The discussions were mainly focused on the 3SLS estimations.

First, the 3 former northern regions were found to be more prone to food insecurity. Upper East region was found to have 60.3% of households being food insecure whereas Northern Region and Upper West Regions recorded 60% and 46.2% respectively. Central Region and Western Region also recorded 26.1% and 7% food insecurity. Greater Accra Region recorded 66.3% food secured households whereas Ashanti Region, Volta Region, and Eastern Region respectively recorded 54.8%, 11.9% and 15.8% of household food insecurity.

The mean difference of ill health between food secured households and food insecure households is approximately (-0.3) and is statistically significant at the 1 % level of significance. This implies that food insecure household experienced 0.3 more ill-health cases than food secure households. Similarly, ill-days mean difference between food secured households and households that reported food insecurity is (-1.62) and is statistically significant at 1% significance level. This implies that households that reported food insecurity recorded 1.62 more ill-days than food secured households.

The mean differences between food secured households and household who reported food insecurity in terms of access to financial institution is approximately 0.129 and is statistically significant at 1% level of significance. This implies that household that had access to financial institutions are approximately 0.13 more likely to be food secure.

In the same way it was revealed the mean difference of food secured household and their counterparts in terms of access to market was approximately 0.08 and significant at 1% level of significance. This implies that access to market makes households 0.08 more food secure. Similarly, households that had access to extension services are 0.06 more likely to be food insecure and households that had access to irrigation facility are 0.01 less likely to be food secure. Moreover, impassable road mean difference between food secured household and their counterparts is -0.093 and is statistically significant at 1% significance level. This suggests that the availability of impassable road is a significant determinant of self-reported food insecurity situation in that households that impassable roads are approximately 0.09 more likely to be food insecure.

Ill-health was revealed to be a significant determinant of self-reported food insecurity among Ghanaian households. However, ill-health effect on food insecurity is more evident among households within the second, third and fourth expenditure quartiles, although there is a general effect on food insecurity among Ghanaian households. Household size was found to be a positively and statistically significant determining factor of self-reported food insecurity among Ghanaian households at 1% level of significance. From the results, it was observed that households that have more of their members within the economically active bracket reported 0.15 standardized unit

decrease in the incidence of food insecurity, *ceteris paribus*. The value of household assets owned was also realised to be negatively and statistically significant determinant of self-reported food insecurity among Ghanaian households at 1% level of significance. Access to extension services was observed to be positive and significant determinant of self-reported food insecurity among Ghanaian households at 1% level of significance which is contrary to *a priori* expectation. Per capita household cultivated area, remittances received by households, access to irrigation facility are significant and negative determinants of self-reported food insecurity among Ghanaian households. Impassable road and access to market are also significant and positively associated with self-reported food insecurity. Households in the Greater Accra Region reported about 66% less food insecurity compared to households in the Western Region. Wealthier households reported less food insecurity cases than poorer households, *ceteris paribus*.

This thesis reveal that self-reported food insecurity is statistically and significantly associated with ill-health at 5% level of significance. However, food insecurity effect on ill-health within the fourth quartile is minimal compared to households within the third quartile, which makes sense. Households in the Greater Accra Region reported about 66% less food insecurity compared to households in the Western Region. Wealthier households reported less food insecurity cases than poorer households, *ceteris paribus*. Although 11% of households in the Volta Region reported that they were food secured, the region recorded a corresponding ill-health of 89.08% and a poverty rate of 26.10%. It is key to note that self –reported food insecurity might not be the only or the major underlining cause of ill-health in the region.

## **5.2 Conclusions**

The incidence of food insecurity was observed to be very high in the order of Upper East, Northern, Upper West, Central and Western regions. The report of food insecurity is less prevalent in Greater Accra, Volta, Eastern, Ashanti and Brong Ahafo regions indicating that most households in these areas are relatively food secure.

Self-reported food insecurity among Ghanaian households is influenced by the number of household members hospitalised through increased household health expenditures, ill-days household size, and economic activity of household heads, education of household head, sex of household heads, age of household heads, value of household assets, household access to financial institutions, and access to extension service, per capita household cultivated area, and remittances received, the presence of impassable roads, access to irrigation facility and market. The study also revealed that the number of household members hospitalised (ill-health) among Ghanaian households is influenced by a number factors, including household food insecurity, household size, assets owned by households and proximity to health facilities.

The number of day's household members were hospitalised (ill-days) was found not to be influenced by issues of food insecurity among Ghanaian households though it was expected. Factors that influenced ill-days include age of household heads, household size, being economically active, access to financial institution, proximity to health facility and assets ownership.

There is almost a direct correspondence in the prevalence of ill-health and self-reported food insecurity, such that regions with high food insecurity also recorded high number of household members hospitalised. However, households that reported that they experienced food insecurity reported about 32% more ill-health cases and 47% more ill-days than their food secured counterparts.

### **5.3 Recommendations**

Based on conclusions drawn from this study the following recommendations are made to inform policy. Policies and interventions aimed at improving food security should endeavour to reduce the incidence of food insecurity among Ghanaian households with focus on locations within northern Ghana, Central and Western regions. Policies aimed at improving non-nutritional health outcomes among Ghanaian households must focus on reducing the incidence of self-reported food insecurity households. Policies aimed at improving food security among Ghanaian households should focus on providing irrigation facilities in various communities across the regions in collaboration with Ghana Irrigation Development Authority. This will increase agricultural productivity and reduce food shortages at the community level. Interventions aimed at improving food security among Ghanaian households should focus on making financial institutions more accessible. Access to finance will enable individuals to build their capacity and improve on productivity. The Ministry of Food and Agriculture should reform agricultural extension services to address the service needs of agricultural households to improve agriculture productivity and food security among Ghanaian households. Policies that are geared towards improving food security among Ghanaian households

should focus on improving road networks that link rural settings to urban centres across the country in collaboration with Ministry of Roads and Highways. Policies that are focused on reducing food insecurity should target other regions while sustaining the gains in the Greater Accra Region.



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## APPENDIX

1. Subsection of GLSS 7 Questionnaire. Source is Ghana Statistical Service (2016). Retrieved on 21/1/2020.
2. Self-reported food insecurity computation. The food insecurity index was computed based on the Food Insecurity Experience Scale FIES questions provided in the GLSS 7 Questionnaire.
  - i. Was there a time when you or others in your household worried about not having enough food to eat because of a lack of money or other resources?
  - ii. Still thinking about the last 12 MONTHS, was there a time when you or others in your household were unable to eat healthy and nutritious food because of a lack of money or other resources?
  - iii. Was there a time when you or others in your household ate only a few kinds of foods because of a lack of money or other resources?
  - iv. Was there a time when you or others in your household had to skip a meal because there was not enough money or other resources to get food?
  - v. Still thinking about the last 12 MONTHS, was there a time when you or others in your household ate less than you thought you should because of a lack of money or other resources?
  - vi. Was there a time when your household ran out of food because of a lack of money or other resources?
  - vii. Was there a time when you or others in your household were hungry but did not eat because there was not enough money or other resources for food?
  - viii. Was there a time when you or others in your household went without eating for a whole day because of a lack of money or other resources?