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SOURCE OF HOUSEHOLD DRINKING WATER AND  
DIARRHOEA AMONG CHILDREN UNDER FIVE YEARS IN  
GHANA

BY

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**ACCEPTANCE**

Accepted by the College of Social Science, University of Ghana, Legon in partial fulfillment of the requirement of the Master of Arts Degree (Population Studies).



Supervisor

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Date.....

**DECLARATION**

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



Signed.....

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Date .....

**DEDICATION**

To my late mother, Madam Grace Selina Anani for laying a good foundation of education for me. Without her I could not have grown to a person I am today.

Thank you.



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I wish to extend my sincere gratitude to God Almighty for sustaining me till this time. To my husband Mr John Foster Agyaho and my two daughters Olivia and Grace who provided care and comfortable environment for the preparation of this work successfully.

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## ABSTRACT

Safe drinking water is a basic need for good health as well as for human and economic development. Diarrhoea kills more than HIV and AIDS, and malaria combined. Diarrhoea kills about two million people especially children under five each year. The study investigates the relationship between source of household drinking water and diarrhoea incidence among children under five years in Ghana. A sample of 2,728 women who had given birth in the last five years preceding the survey was drawn from the children's file of the 2008 Ghana Demographic and Health Survey. Selected demographic characteristics of the mother and children under five years were used in the analysis.

The study adopts quantitative analysis employing binary logistic regression methods. The results show that type of place of residence, age of the under-five children and household wealth quintile were strong predictors of diarrhoea incidence among children under five years of age in Ghana. However, type of toilet facility and source of household drinking water were not statistically significant predictors of under-five diarrhoea incidence. This may be due to the fact that water handling processes from the source to the point of use in households were not considered in the analysis because of lack of data.

The study recommends among other things that programmes such as Livelihood Empowerment Against Poverty (LEAP) aimed at reducing poverty should be enhanced to enable more households have the means to be able to take care of their infants by providing them with good drinking water. Further studies should also consider including information on the process of handling water from the source to the point of use in the household which this study could not include for lack of data.

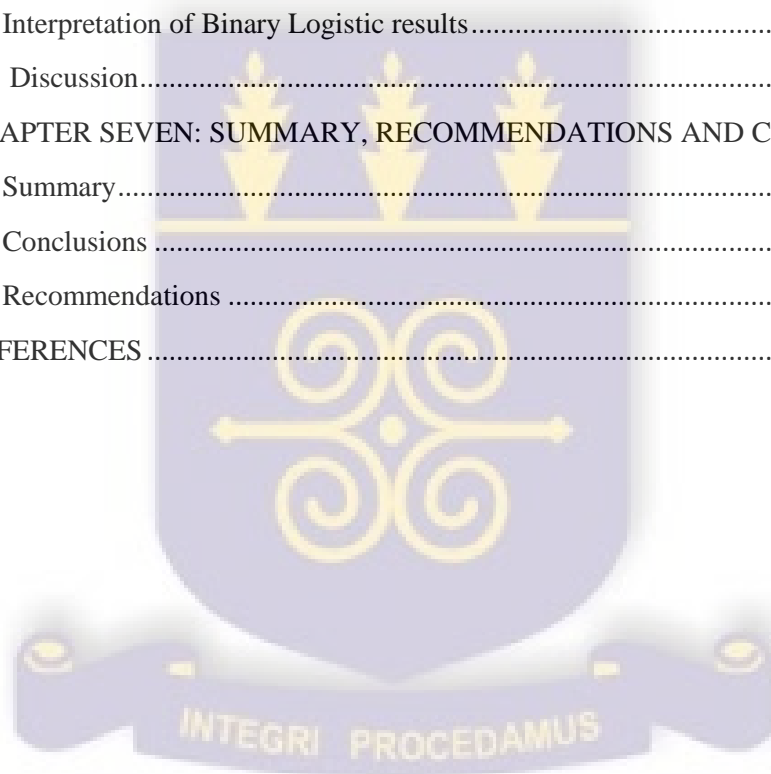


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## CHAPTER ONE

### INTRODUCTION

#### 1.1 Background to the study

The availability of and accessibility to improved drinking water source may, to a large extent, minimize the prevalence of water-borne diseases among household members especially young children. The source of drinking water is important because potentially fatal diseases such as diarrhoea and cholera are common in Ghana (GSS, 2009). From the 2008 Ghana Demographic and Health Survey (GSS, 2009) about 77.0 percent of households obtained their drinking water from an improved source while 13.8 percent of them used un-improved source and 9.0 percent used bottled or sachet water (GSS, 2009).

Water is the basic need of human life and in fact, an essential component of primary health care and poverty alleviation. A former United Nations Secretary General, Kofi Annan noted that “No single measure would do more to reduce diseases and save life, in the developing world than bringing safe water to all” (Nketia-Amponsah *et al.* 2009). This assertion is true considering that water is one of the essential natural resources for sustaining life on earth and without its availability, life on earth would cease to exist. This again confirms the views expressed by the United Nations Secretary General Ban Kimoon that safe drinking water and adequate sanitation are crucial for poverty reduction, crucial for achieving any and every one of the Millennium Development Goals (Nuhu *et. al.*

2014). Safe drinking water is a basic need for good health and it is also a basic right for human and economic development. Diarrhoea is the second leading cause of under-five morbidity and mortality after pneumonia and malaria (UNICEF 2006).

According to Miller (1997), about 97.0 percent of water exists in oceans that are not suitable for drinking and only 3.0 percent is fresh water. He further observed that 2.97 percent of the 3.0 percent of the fresh water is comprised of glaciers and ice caps and the remaining little portion of 0.3 percent is available as surface and ground water which is suitable for human use. This means that safe water is already a scarce resource in many parts of the world.

According to Jackson *et al.* (2001), the quantity of available water in developing regions of South Asia, Middle East and Africa is decreasing sharply while quality of water is deteriorating rapidly due to fast urbanization, deforestation and land degradation. According to them,(Jackson *et al.*, 2001), worldwide, more people are dying from poor quality of water every year than from all forms of violence including war and it is estimated that about 26.0 percent of all deaths are the outcome of contagious diseases particularly among children in sub-Saharan Africa.

The United Nations Millennium Development Goal Seven (MDG7) aimed at reducing by half the proportion of people without sustainable access to safe drinking water by 2015 based on 1990 levels. The source of water supply, particularly for drinking has a tremendous effect on the burden of diseases. One of the main benefits of clean drinking water supply is a reduction in diarrhoea cases (GSS, 2009).

## 1.2 Statement of the Problem

Diarrhoea is a major health problem. It is believed to spread through contaminated food or drinking water, or from person to person as a result of poor hygiene. There are three clinical types of diarrhoea: acute watery diarrhoea which lasts several hours or days and includes cholera; acute bloody diarrhoea also called dysentery; and persistent diarrhoea. The last two which are dysentery and persistent diarrhoea last at least fourteen days (Godana & Mengiste, 2013).

Globally, there are 1.7 billion cases of diarrhoeal diseases every year out of which 760,000 children under five die, and are the second leading causes of death in children under five years old (WHO, 2013). It is estimated that 900 million people lack access to improved drinking water worldwide. This is because about 70.0 percent of household drinking water is found to contain fecal matter (Rachel *et al.*, 2011)

In sub-Saharan Africa (SSA), diarrhoea and water-borne diseases are leading causes of mortality and morbidity among children under five (UNICEF, 2013). According to the 2011 Ethiopian Demographic and Health Survey, 13.0 percent of children had diarrhoea in the two weeks preceding the survey at the national level. Deaths attributed to diarrhoea were 23 per 1000 live births (Mihrete *et al.*, 2014). Infant and Child mortality is a basic indicator of a country's socio-economic development and quality of life as well as a specific measure of the health status of a people. Although under-five mortality has declined from 105 deaths per 1000 live births in 1985 to 80 per 1000 in 2008, one child in every 13 Ghanaian children dies before the fifth birthday (GSS, 2009).

The occurrence of diarrhoea, according to Godana and Mengiste (2013), is significantly associated with the lack of latrine ownership, lack of improved water source, person to person transmission as a result of poor hygiene, contaminated food or drinking water, level of education, and place of residence. Most of the pathogenic agents causing diarrhoea in infants and children are transmitted via the fecal-oral route (Esrey, & Habicht, 1985). Improved sources of water according to WHO and UNICEF (2005) are piped water into homes, public standpipe, borehole, protected spring and rainwater collection; the unimproved sources are unprotected wells and springs, vendors and tanker-services, surface water (river, dam, lake, pond, stream, canal or irrigational channels).

It is widely recognized that exposure to diarrhoea pathogens in developing countries is conditioned by factors as age of children, quality and quantity of water and availability of toilet facilities (Woldemicael, 2001). The most efficient and hygienic method of human waste disposal is when the population has access to improved type of toilet facility (GSS, 2009).

According to Godana and Mengiste (2013), diarrhoea kills more than HIV and AIDS, and malaria combined. Diarrhoea kills about two million people especially children under five each year. They also found that in Ethiopia, a child dies every 15 seconds from diarrhoea caused largely by poor sanitation and contaminated water.

The success of any health policy or health care intervention depends on a correct understanding of the socio-economic, environmental and cultural factors that determine the occurrence of diseases and deaths. Safe drinking water is an

essential component of primary health care and has vital roles in poverty alleviation (Haq *et al.*, 2008).

Although many African countries along the equator receive a great amount of rainfall, access to drinking water remains a challenge to them (Yongsi, 2010). Inadequate drinking water not only results in more morbidity and mortality cases, it also increases health cost, lowers worker productivity and also lowers school enrolment (World Bank, 1994). Water availability has been a major concern for most civil society organizations and successive governments in Ghana. A number of children still die every year from preventable diseases related to poor provision of water and sanitation.

Poor sanitation has been identified as a key cause of diseases such as cholera (diarrhoea) amongst children. In view of this, a lot of policies and programmes have been implemented by the Government of Ghana to ensure that households keep to good hygienic practices. Typical amongst these policies is the declaration of the first Saturday of every month as national sanitation day since the last quarter of 2014 by the government. However, despite the education given to the Ghanaian population on keeping good hygiene by washing of hands with soap and water and the provision of sanitary facilities in the form of dustbin in various homes and at vantage points, Ghana still experiences relatively high levels of diarrhoea and under-five morbidity.

Diarrhoea predisposes children to malnutrition which makes them highly susceptible to other infections. This has been found to be a major contributor to illness and death particularly among children under five. According to the Ghana Statistical Service (2009) there were 80 deaths per every 1000 children in Ghana.

Since contaminated water has been found as the main transmitter of diarrhoea incidence among children, it is important to investigate whether or not in Ghana, the source of drinking water contributes to the incidence of diarrhoea among children and mothers should be educated or informed on how to keep to good hygiene at homes in order to reduce the incidence of diarrhoea in Ghana.

### **1.3 Research Questions**

- i. What is the relationship between household source of drinking water and the incidence of diarrhoea among children under-fives in Ghana?
- ii. What is the variation in diarrhoea incidence among children less than five years in Ghana?
- iii. What is the effect of socio-demographic characteristics of mothers on diarrhoea incidence among children less than five years in Ghana?

### **1.4 Rationale of the Study**

The survival of infants and children is of great importance to families, communities and the nation as a whole. One important indicator of developmental growth is to eliminate child mortality in a country. The report of the Ghana Demographic and Health Survey (conducted in 2008) indicates that child mortality rate of 80 per 1000 live births can be reduced if preventable diseases like diarrhoea are reduced through the use of protected source of drinking water by households.

The source of drinking water has also led to the recent outbreak of cholera in the country. According to the WHO (2012), there were about 9548 cholera cases out of which 77 percent of these cases were in the Greater Accra region. The cause

of cholera outbreak is mainly related to contaminated drinking water and poor sanitary conditions in the region. This has the tendency of increasing the incidence of diarrhoea among children under five years.

Even though quite a number of research works have been done in this area across the World, studies in Ghana have been based on communities and localities. Typical among them are Household, environmental and behavioural determinants of childhood diarrhoea morbidity in the Tamale Metropolitan Area (TMA) by Osumanu (2007), and Boadi and Kuitunen (2005) on Environment, wealth, inequality and the burden of disease in the Accra Metropolitan Area, Ghana. Studies by Issaka Konton Osumanu (2007), Sarfo *et al.* (2013) and Nuhu *et al.* (2014) have examined either the relationship between water and sanitation and diarrhoea or water infrastructure and diarrhoea among children under five years. The current study focused on source of household drinking water and diarrhoea among children under five years in the whole country Ghana. It is envisaged that the study will make empirical contribution to the body of knowledge relating to diarrhoea amongst children under five.

The study will also contribute to literature by examining the source of household drinking water and diarrhoea among children less than five years in Ghana. Children (under 15 years) in Ghana constitute a considerably high proportion of the population (38.3%) according to the 2010 Population and Housing Census of Ghana (GSS 2012), however, attention of stakeholders on the health of these children has mostly been turned to exclusive breast feeding and early childhood immunization not paying much attention to the kind of water that

is being used in preparing complementary food for these children. This study will therefore bring to the fore the relationship between the household source of drinking water and child morbidity.

### **1.5 Objectives of the Study**

The general objective of this study was to examine the relationship between source of household drinking water and diarrhoea incidence among children less than five years in Ghana.

The specific objectives that the study seeks to achieve are:

- i. To describe the socio-demographic and background characteristics of mothers and the children.
- ii. To examine the incidence of diarrhoea among children under five years in Ghana.
- iii. To make policy recommendations based on the findings of the study.

### **1.6 Definition of concepts**

The World Health Organization (WHO, 2013) defined diarrhoea as the passage of three or more loose liquid stools per day or more frequent passage than is normal for the individual.

Water source has also been categorized by the Ghana Statistical Service (GSS 2009) as improved and unimproved source of water. The improved source of drinking water consists of piped water into dwelling or homes, public tap/standpipe, borehole, protected dug well, protected spring and rainwater collection. The unimproved sources are unprotected dug well, unprotected spring, tankers and surface water (river, dam pond) sachet and bottled water.

Type of toilet facility has been categorized by the GSS (2009) as improved and unimproved toilet facility. The improved toilet facility consists of flush toilet or pour flush to pipe sewer system, ventilated improved pit latrine, pit latrine with slab and composting toilet. Unimproved toilet facilities are flush or pour flush to elsewhere, pit latrine without slab or open pit, bucket, hanging toilet or hanging latrine, and no facilities.

### **1.7 Organization of the Study**

The study comprised seven chapters. Chapter One consists of the background to the study, statement of the problem, research questions, rationale of the study, the research objectives, definition of concepts and organization of the study. Chapter Two covers related literature review on diarrhoea amongst children under five years of age, conceptual framework and hypotheses. Chapter Three discusses the methodology, sources of data, sample design, categorization of variables, methods of data analysis and data limitations. Chapter Four looks at the demographic characteristics of children under five years and incidence of diarrhoea in Ghana. Chapter Five is the socio-demographic profile of mothers and diarrhoea incidence among children. Chapter Six looks at the relationship between mothers' socio-demographic characteristics and diarrhoea incidence among children under five years in Ghana to specifically measure the relationship between source of drinking water and incidence of diarrhoea among children in Ghana. Chapter Seven, which is the final chapter summarizes the key findings of the study based on which conclusions and recommendations are made on incidence of diarrhoea among children less than five years in Ghana.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Introduction

The broad aim of this chapter is to review the relevant literature to provide a clearer understanding of the factors that cause diarrhoea amongst children less than five years in Ghana. The increasing trend towards the elimination of childhood morbidity and mortality has drawn both social and academic interests resulting in many insightful studies on the causes of morbidity among children. The increasing attention given to child health in the country stems from the interest in assessing the consequences of a wide array of public policies.

The review of the literature is structured to look at the theoretical underpinning of childhood mortality relative to diarrhoea before examining the relevant literature at the global level. It then looks at what has been done within the context of developing countries including Ghana, the study area.

Diarrhoea is said to be caused by pathogens through fecal-oral route transmission. Infant and child mortality, to a very large extent, signals the health of a nation and its potential for economic growth and development. Not surprisingly, a huge amount of scholarly effort has been invested in understanding the subject. Many research works have tried to explain the factors that cause diarrhoea amongst children less than five years. Although the literature covers a wide variety of such studies, this review will focus on individual and household characteristics that cause diarrhoea amongst children under five years in the country.

Diarrhoeal disease is one of the major causes of disease burden and mortality in children under five years old. A greater proportion of this disease burden is among children growing up in the world's poorest countries and is largely associated with poor drinking water and sanitation (Hunter *et al.*, 2013). In recognition of this, improved access to safe drinking water and sanitation has been one of the key aspects of the Millennium Development Goals (MDGs). Although recent statements from the United Nations and World Health Organization have claimed that the MDG on water access has been met ahead of target, there have been cogent arguments that these claims are exaggerated (Hunter *et al.*, 2013). In any event, even if the MDG targets have been met in full, Hunter *et al.* (2013) observe that there still remains many hundreds of millions of people without access to sustainable safe water supplies.

Khan *et al.*, (2013) observed that diarrhoea is one of the important public health issues worldwide. The World Health Organization (WHO/UNICEF, 2009) noted that disease burden due to diarrhoea can be attributed to the environmental risk factors (for example, poor water quality and poor hygiene). Sarfo *et al.*, (2013) posited that diarrhoea disease and its complications remain a major cause of morbidity and mortality in children, especially in developing countries. It is widely recognized that exposure to diarrhoeal pathogens in developing countries is as a result of factors such as quality and quantity of water, availability of toilet facilities, level of education, economic status of households, type of place of residence and general sanitary conditions (personal or domestic hygiene) of surrounding homes (Diame *et al.*, 1990; Tamaeus &Lush, 1995). In Ghana, diarrhoea has been identified as the second most common health problem treated

in outpatient clinics (Osumanu, 2007). According to Osumanu (2007 pp.59), statistics from the Ministry of Health indicate that diarrhoea accounts for 84,000 deaths annually in Ghana with 25.0 percent of the cases reported among children under five years.

## **2.2 Developing Countries and the incidence of diarrhoea**

In developing countries, about 2 million people, the vast majority being children under five, die from diarrhoea each year. Nearly 90 percent of diarrhoea is attributed to unsafe drinking water, inadequate sanitation and poor hygiene (Godana and Mengiste, 2013).

In sub-Saharan Africa, mortality caused by acute diarrhoea varies from 1.9 percent of all deaths in the Gambia to 37.0 percent in Nigeria, with most of the deaths occurring during the first year of life (WHO/UNICEF, 2004). Child mortality in urban settings in general and in urban slums of megacities in particular seems to be higher than in other urban areas, but lower in rural areas (Balk *et al.*, 2004). According to Balk *et al.* (2004), 2.5 million children die from diarrhoea annually in the world. More than 95 percent of these deaths are concentrated in developing countries particularly in the African and South East Asian regions. The WHO and UNICEF recently reported the continuing vulnerability of the population of developing countries to diarrhoea and other environmental related diseases, not only because of lack of safe drinking water, hygiene, and sanitation facilities, but also of poor general health and nutritional status. An estimated 2.5 billion people lack access to modern sanitation facilities, and almost one billion people do not have access to safe drinking water (WHO and UNICEF, 2009). The

lack of sanitation may increase the risk of diarrhoea diseases, as infected fecal matters can be transported to the digestive tract of other uninfected persons through hands, water and foods. Folarin *et al.* (2013) observed that in many parts of the developing countries including Nigeria, drinking water is collected from unsafe surface sources outside the home. Again, a study of risk factors in rural Africa on diarrhoea in children under five years showed that an improvement in water supply and sanitation has a potential of reducing the incidence of diarrhoea within household, (Diame *et al.* 1990; and Lush, 1995).

A situational analysis by Kumar and Subita (2012) observed that minimum progress had been made in achieving MDG 4 in developing countries. The study found that there are multiple reasons for poor declining trends of diarrhoeal diseases especially in the developing countries. They emphasized the need for the strengthening of comprehensive diarrhoeal disease prevention strategy at the primary level including improvement of water, sanitation and hygiene.

### **2.3 Diarrhoea Transmission**

Feachem (1984) observed that the transmission of diarrhoea pathogens may be water-borne, food-borne, or direct. According to him, water-borne transmission occurs when human beings drink water contaminated by faecal material. Food-borne transmission may occur when food contaminated by human excreta is eaten, while direct transmission may occur when young children put their fingers in the mouth or the mothers contaminate food during its preparation. In the light of this, Carlos *et al.*, (2013) noted how bacteria and other diarrhoea-causing micro-organisms may enter a child's body through the water she drinks,

the food she eats, and putting 'dirty' fingers, toys, and other foreign objects in their mouths. They also found that unsanitary disposal of stool may contaminate unprotected water supply or food. Failure to wash hands adequately especially before eating or cooking may also lead to unhealthy ingestion.

Arif and Ibrahim (1998) observed that many water supply schemes may be ineffective in reducing diarrhoeal morbidity because it may be the quality and usage pattern of water in the home, not the purity of water at its source that largely determines the impact of diarrhoeal morbidity on the individual members of the community, particularly children. This perspective is held by many scholars such as Esrey *et.al.* (1985) who also observed that it is likely that water storage in home containers may result in increased contamination depending on storage conditions. To this end, they concluded that uncontaminated source of water may become polluted by the time it is ingested.

Again, the presence of latrine in the household, according to Arif and Ibrahim (1998), does not necessarily mean that a child uses it. They indicated that children are often permitted to defecate indiscriminately in many African communities, even where basic sanitation facilities exist and adults use them. Their conclusion is that it is not easy to hypothesize that availability of sanitation facilities or the usage pattern of latrines in the home transmits pathogens causing diarrhoea. They made similar conclusion for supply of water, but stated that increased water supply is likely to lead to improved personal hygiene, household hygiene, and safe disposal of human faeces; and all these may lead to a major reduction in the transmission of diarrhoeal disease.

#### **2.4 Demographic characteristics of mothers of under-five children**

Some attempts have been made over the years to find out the relationship between literacy and hygiene. The results, even though not conclusive, have been that hygiene and education may be related. However, Feachem (1984) argued that such observations in themselves are not useful. His reason is that families with the lowest educational attainment may be those with the lowest income, poorest housing, most crowding, and worst sanitary facilities. These conditions which he described as confounding variables could promote the transmission of enteric pathogens. He, however, admits that after controlling for these confounding variables, educational attainment shows a significant impact on the incidence of diarrhoea, and the reason he gives is that educational differences cause behavioural differences that affect the transmission of the enteric pathogens.

According to Masangwi *et al.* (2009) in a study on behavioral and environmental determinants of childhood diarrhoea in Chikwawa, Malawi; unsafe water, sanitation and hygiene remain the major causes of mortality and morbidity. Using Bayesian logistic regression, they found that children belonging to households with mothers above 40 years were less likely to report sick children with diarrhoea than children from households with mothers of ages 15 years or less. It is assumed that older women have experience on how to take proper care of children because they have given birth to more children than young women. Again, they observed that households with secondary school educated women were less likely to report diarrhoea sickness than others with women that had no formal education. There was, however, no significant difference in childhood diarrhoea between households with primary school educated women and those that

had not attended any school. Arif and Ibrahim (1998) in a study on “diarrhoea morbidity differentials among children in Pakistan” found that the age of the child’s mother did not turn out to be statistically significant.

Mihrete *et al.* (2014) observed that maternal education does have a strong association with childhood diarrhoea. Children with non-educated mothers were about two times more likely to have diarrhoea when compared to children of mothers who had primary education and above.

Hoek *et al.* (2002) observed that the high prevalence of diarrhoea among children whose mothers were literate was unexpected because female literacy is generally considered one of the strongest determinants of child health. To them, education of mothers had a strong positive effect on health. They explained that this could be due to the fact that well-educated women reported episodes of diarrhoea more accurately. They further observed that the higher prevalence of diarrhoea among children of educated mothers could also have been due to the shorter duration of breast-feeding and earlier introduction of potentially contaminated weaning food. In the words of Lechtenfeld (2012), children with diarrhoea incidence tend to have mothers who are younger. This implies that the older the mother, the less the incidence of diarrhoea among children in the household.

## **2.5 Source of Drinking water and diarrhoea incidence**

Masangwi *et al.* (2009) observed that children from households that use private tap are less likely to have suffered diarrhoea than those using public or compound piped water. There was, however, no statistically significant difference

between those using boreholes or wells and those using public or compound piped water.

According to Carlos *et al.* (2013), pipe water and own flush toilets helped to prevent diarrhoea in under-five children in rural Philippines. They found that many households in rural areas do not have access to piped water and they rely mostly on dug-well and spring which are normally contaminated during typhoons and floods.

Hunter *et al.* (2013) raised serious concerns about the validity of assuming that protected groundwater is safe. In the view of Hunter *et al.* (2013), there is sufficient evidence to support the conclusion that both water quality and quantity are important. Although, not the primary focus of their study, they found that the use of own latrines compared to shared ones was associated with about 22.0 percent reduction in diarrhoea. Folarin *et al.* (2013) found that in many parts of the developing world, drinking water is collected from unsafe surface sources outside the home and is held in household storage vessels. Mihrete *et al.* (2014) observed that children in households where their main drinking water source was not improved were two times more likely to have diarrhoea than children from households that had improved source of drinking water. However, Arif and Ibrahim (1998) observed that a relatively safe source of drinking water (piped/motor-pump inside the house) did not show statistically significant association with diarrhoeal morbidity.

In another study by Hunter *et al.* (2010) on water source and diarrhoeal disease risk in children under five years old in Cambodia, the role of improved drinking water regarding diarrhoea disease burden was identified to be important

in the world's poorest countries. They re-emphasized this point by stating that household water treatment is being heavily promoted in many parts of the world despite the generally poor evidence that these technologies are effective in reducing self-reported diarrhoea. In their view, a number of authors have expressed concerns about the safety of rainwater harvesting as a drinking water source. However, they observed that rain water was associated with a reduced risk, while; protected groundwater sources were associated with the highest risk of the illness.

According to Fewtrell and Colford (2004), water supply interventions reduced diarrhoeal illness levels even though the effects are mainly seen with the provision of household pipe connection into their various homes. They further remarked that water source improvements also decrease the level of diarrhoeal illness, even though the result was not statistically significant. However, Arif and Ibrahim (1998) have observed that among children, sanitation facilities seemed to be more important than the supply of drinking water.

Jalan and Ravallion (2003) found that any reduction of diarrhoea incidence among children less than five years crucially depends on hygienic water handling at the household level which is enhanced by education. However, the authors did not find any health benefits among children from poor families with less educated mothers.

Kakakhel *et al.* (2010) reported that behind pneumonia, diarrhoea is responsible for morbidity and mortality in Pakistan. According to them, the risk factors for diarrhoea include unavailability of safe drinking water, improper disposal and poor sanitation practices. Their study which was conducted in a rural

community near Islamabad, Pakistan, concluded that unsafe drinking water is a risk factor for diarrhoea and that rural communities have a higher percentage of unsafe water supply and unimproved sanitation facilities compared to urban communities.

Hoek *et al.* (2002) in a study on the availability of irrigation in Pakistan found that there are a high rate prevalence of stunting and diarrhoea among children under five years in an area where people used irrigation water for domestic needs. According to them, poor availability of water for domestic use was the most important risk factor for diarrhoea and stunted growth in their study area. They, therefore, concluded that improving the availability of water for domestic use could have an important impact on the health of children in the study area. However, their sample was not large enough to allow for an independent test on the effect of sanitation on the health of under-five children. Furthermore, Sarfo *et al.* (2013) in a study in Donkorkrom in Ghana observed that drinking contaminated water is one of the associated causes of diarrhoea in children under five years in most developing countries.

## **2.6 Type of toilet facility and diarrhoea incidence**

Godana and Mengiste (2013) found that diarrhoea is higher among children of families who had no latrine as compared to children of families who had latrine. This means that children whose families improperly dispose infant faeces were more likely to have diarrhoea when compared to those children whose families properly dispose infant faeces. Using both descriptive analysis and binary logistic regression in identifying factors associated with acute diarrhoea among

under-five children in Derashe District of Southern Ethiopia, they identified latrine availability, home-based water treatment, and source of water and disposal of infant faeces as factors associated with childhood diarrhoea. The study further found that a high proportion of the adult population used to defecate in an open space, a situation that could increase the risk of diarrhoea disease incidence. The strength of their study was that, it was community-based and that it particularly addressed acute childhood diarrhoeal morbidity in rural communities. However, the study adopted the retrospective design, and since it is a case-control study, it had the potential for recall bias.

Masangwi *et al.* (2009) also observed that households with no toilet facility were more likely to have reported diarrhoeal sickness amongst their children than those that have toilet facilities. However, there was no statistical difference between those using public toilet facilities and those who share toilet facilities with other households. Children from households which had no toilet facility were about six times more likely to have diarrhoea than others whose households had toilet facility.

Mihrete *et al.* (2014) showed that there is about 60 percent reduction of childhood diarrhoea in households that disposed the stool of children properly (those who disposed of the stool of children in a toilet) than households that leave stool of their children unattended to or from households where children defecate in the open space.

Brown *et al.* (2013) observed that 95 percent of diarrhoea deaths in children under five years of age could be prevented by 2025 through targeted scale-up of proven interventions such as safe and accessible excreta disposal,

support for basic hygiene practices (like hand-washing with soap and water), and provision of a safe and reliable water supply. They observed that sanitation aims at preventing contamination of the environment by excreta and hence prevent the transmission of pathogens that originate in faeces of an infected person.

On the other hand, Oyemade *et al.* (1998) could not establish any association between the disposal of human excreta and the incidence of diarrhoea. However, an association was established between where a child defecates (on the ground or in the open space) and the incidence of diarrhoea. According to them, defecating in the open is partly culture-related, and most women, particularly the uneducated ones, have poor perception of the risk associated with it and also indiscriminate waste disposal has a high rate of incidence of diarrhoea especially when this is done near the vicinity where the child plays or is fed.

## **2.7 Characteristics of under-five children and diarrhoea incidence**

Mihrete *et al.* (2014) found the age of the child and birth order to be significantly associated with childhood diarrhoeal morbidity. The risk of diarrhoeal morbidity was higher at age 6-11 months and 12-23 months and lower at the age of 24 months and above compared to 0-5 months. Again, Kumar and Subita (2012) observed that in Iraq, diarrhoea was associated with age of the child, area of residence, maternal education, source of water, toilet facility, and disposal of children's stool and dirty water. Again, in India, they found that young age, lower educational level of the mother, non-potable water at storage points were associated with water-borne diseases. Bartlett (2005) observed that children's vulnerability to pathogens is related both to their exposure and to their level of

immunity. Small children have a drive to play and explore and are therefore in close contact with the ground with little appreciation of hygiene. This implies that children are more likely to come into contact with excreta. Bartlett (2005) further observed that bottle-fed infants are at high risk. He explained that without clean water and hygienic conditions, bottles cannot be sterilized and formula cannot be safely mixed.

Boys and girls are said to be equally affected by diarrhoea (Lechtenfeld, 2012). Findings of the effect of sex on diarrhoea have been misleading. This study therefore, seeks to establish the effect of the sex of the child on the likelihood of contracting diarrhoea as they drink water from both improved and unimproved sources.

## **2.8 Type of place of residence and diarrhoea incidence**

Water and sanitation access interact strongly with the place of residence of households in explaining the patterns of infant and child mortality. Van de Poel *et al.* (2009) observed that the differences in water and sanitation access (among other factors) substantially explain the variability in infant mortality between urban and rural settings. Rapid urbanization has resulted in poor access to safe water and as a result progress has been slow towards reducing urban child mortality. Carlos *et al.* (2013) observed that most rural areas have sub-standard toilet facilities and more vulnerable are households with shared toilet facilities.

The effect of drinking water source on diarrhoea morbidity from the literature is inconclusive. While some researchers found a strong impact of improved water source on diarrhoeal morbidity, others did not find any significant

association between the two. Even where improved water source had been found to have a strong impact on diarrhoeal morbidity, the conclusions have not been made clear. Any generalization about the effect of improved water on diarrhoeal morbidity could be misleading since level, patterns and trends vary widely between and within countries.

This study will therefore, contribute to advance current understanding of the effect of improved drinking water source on diarrhoeal morbidity in children under five years in Ghana. Specifically, this study seeks to establish the effect of household source of drinking water and its impact on diarrhoea among children under five in Ghana. Studies done in the country have tended to highlight the role of toilet facilities in the reduction of diarrhoea among children under five years.

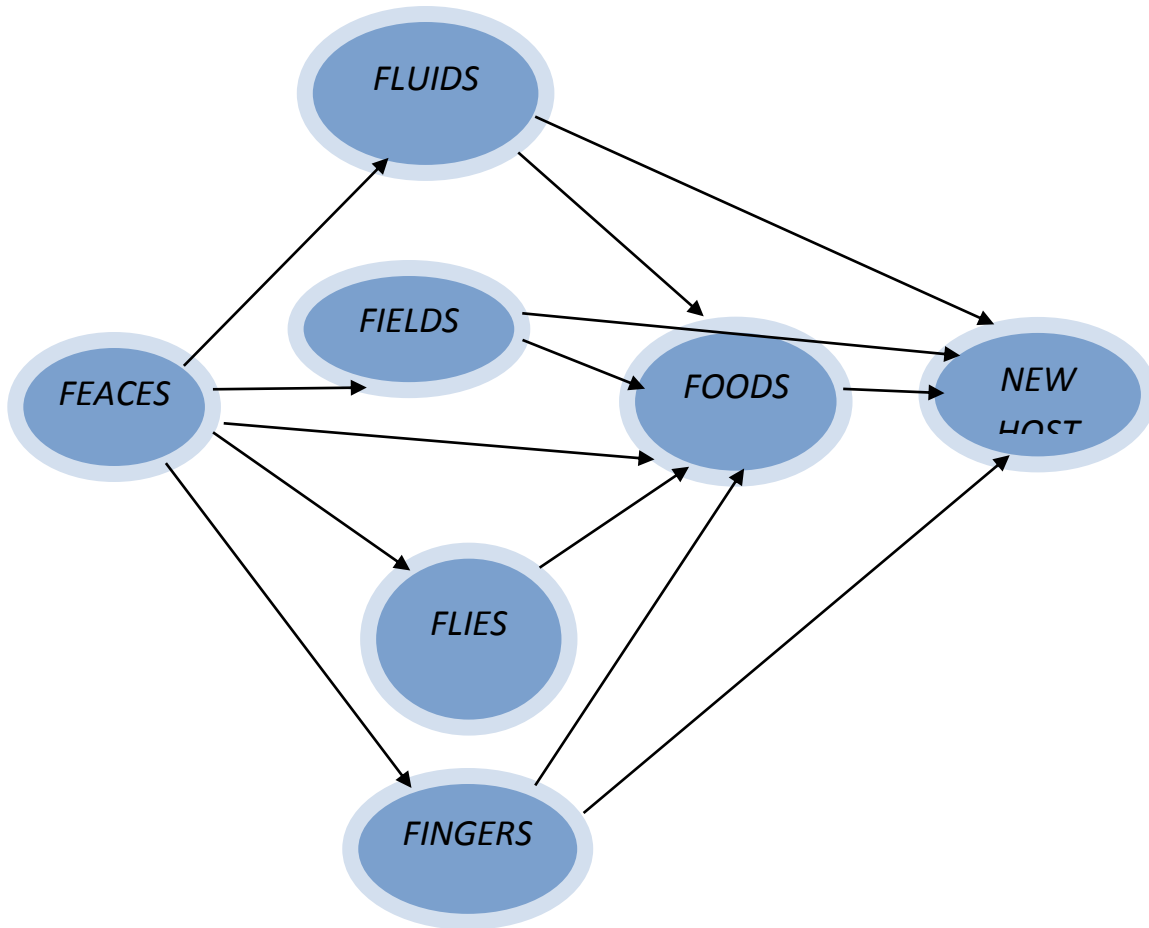
## **2.9 Conceptual Framework**

Human excreta are believed to contain over 50 known bacterial, viral, protozoan and helminthic pathogens (Brown *et. al.*, 2013). According to Brown *et al.* (2013), the majority of excreta-related infections are obtained through ingestion, less often through inhalation. Excreta-related infections are said to travel through a variety of routes from one host to the next. This happens either as a result of direct transmission through contamination of drinking water, soil, utensils, food, and flies as indicated in Figure 2.1. Theoretically, fluid (water) is considered as the major route of transmission of diarrhoea, especially, in children under five years.

The F-diagram (Figure 2.1) which was developed by Mara *et.al.* (2010) illustrates the major transmission pathways for excreta-related pathogens. The model depicts

the five intermediary transmission environments from which an individual may become infected with a faeco-oral pathogen (fluids, field (ground), flies, finger and foods).

**Figure 2.1: The F - Diagram (showing the routes of diarrhoea transmission)**



*Source: Mara et al, 2010*

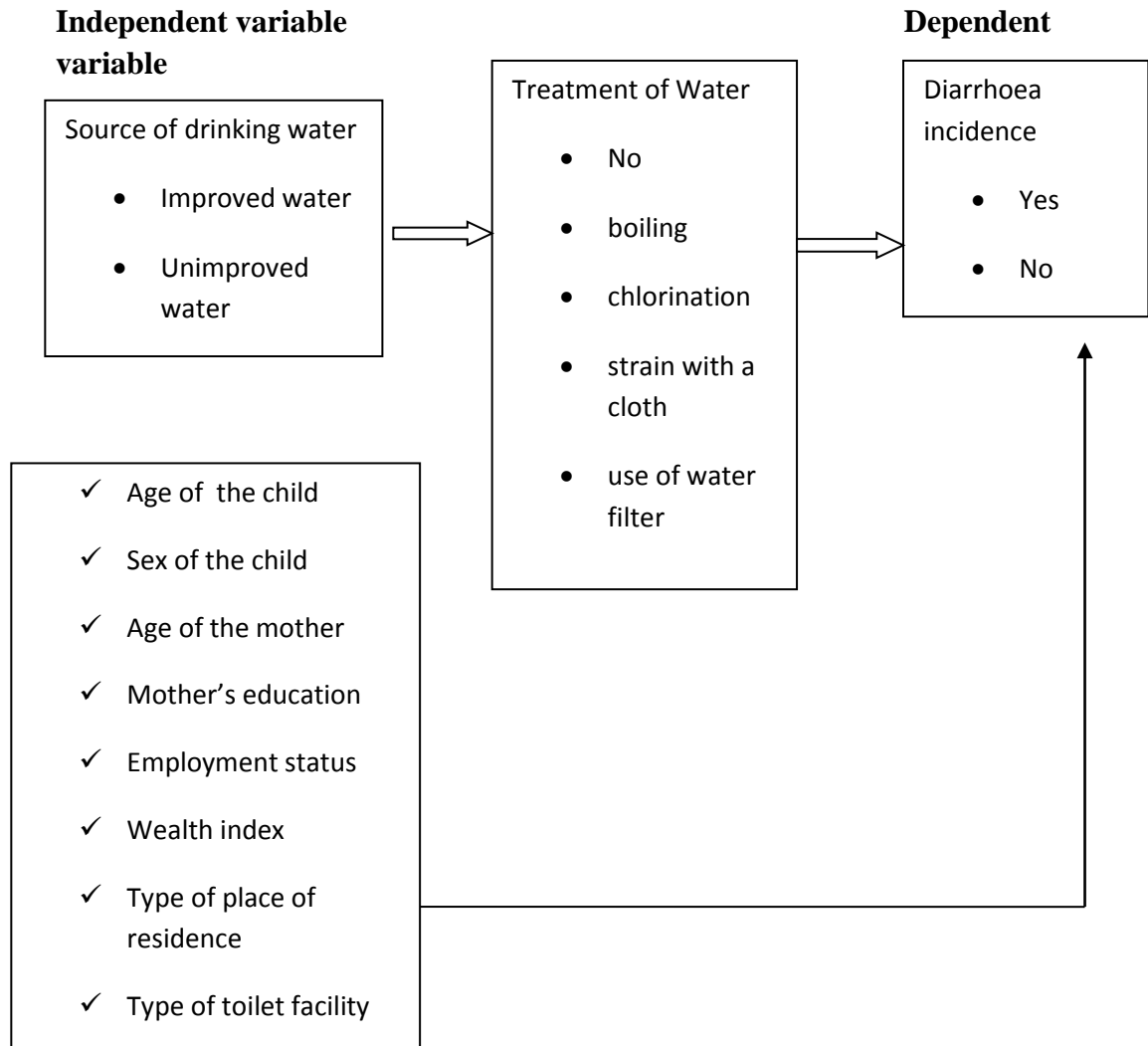
As shown in the theoretical F-Diagram above, there are about four vehicles of diarrhoeal transmission. The first is through fluids (independent variable), that is, when contaminated water is drunk or is used to prepare food, the under-five child is likely to be infected with diarrhoea incidence which is denoted as the New Host (dependent variable) in the F-diagram. Again, when children play on the ground

and put contaminated objects into their mouths or flies come into contact with food and finally when mothers do not wash their hands with soap and water, under-five children are likely to be infected with the New Host which is the incidence of diarrhoea (Figure 2.1).

However, this study examines the impact of water (fluids) as a vehicle for diarrhoea transmission and a modified version of the F-Diagram (Figure 2.1) is developed for the purposes of this study. Fluid is represented by as the source of drinking water - improved and unimproved source. Faeces is the type of toilet facility, foods is when contaminated water is used to prepared formulae for children and the new host is the incidence of diarrhoea which is the dependent variable (Figure 2.2). The variables in Figure 2.1 were modified into Figure 2.2 for the purpose of this study. The emphasis in this adapted framework is to explain the effect of water source (as a host of diarrhoeal pathogens) in diarrhoea morbidity.

Water source in this study is an independent variable (as shown in Figure 2.2) and the main variable of interest. According to Brown et al (2013) Schistosomiasis is caused by open defecation or anal cleansing close to or in water bodies where the miracidia can hatch and find a snail host to complete their lifecycle. They observed further that the use of surface water sources like lakes, rivers and irrigation canals for domestic water needs, for washing and bathing have been associated with an increased risk of diarrhoeal infection. This makes it imperative for this study to find out the various types of water sources used and their relative risk levels in causing diarrhoea.

**Figure 2.2: Operational Framework: a modified version of the F - Diagram on source of drinking water and incidence of diarrhoea**



Source: Adapted and modified from Mara *et al.* (2010)

The source of household drinking water can either be improved or unimproved. The improved source of drinking water includes piped water into dwelling or homes, plot or yard, public tap, tube well, borehole, protected dug well, protected spring and rain water collection whereas the unimproved source includes unprotected spring, tanker water, surface water (river, lake, pond, stream, canal or

irrigations channels) sachet and bottled water. The expectation is that unimproved water source is more likely to cause diarrhoeal morbidity because it is assumed to be contaminated by faeces. Once a household consumes water from unimproved sources, it is expected that the risk level will be high since that water may contain lot of diarrhoeal causing pathogens. On the other, if the household drinks from an improved source, then the probability of children in that household contracting diarrhoea is less.

However, there are some confounding variables in the process that must be controlled for. For instance, the age of the child has been observed to have significant impact on diarrhoea.

Sanitation (type of toilet facilities) helps in preventing contamination of the environment by excreta, and therefore, helps in the prevention of pathogens that originate in faeces of an infected person. Problems posed by inadequate water supplies are further complicated by poor sanitation, which can cause water to become contaminated, and which greatly heightens the need for hygiene. Curtis *et al.* (2000) observed that where infants and small children are concerned, the only safe sanitation methods are those that eliminate all possibility for contact with excreta. The purpose here is to identify the effect of these confounding variables on diarrhoeal morbidity.

## 2.10 Hypotheses

Based on the literature review and the conceptual framework, the following hypotheses will guide the study.

- i. Under-five children in households with access to improved source of drinking water are less likely to have diarrhoea incidence compared with their counterparts without access to improved water in Ghana.
- ii. Under-five children who are below the age of one year are less likely to have diarrhoea incidence compared to their counterparts who are one year and above in Ghana.
- iii. Under-five children in households with the richest wealth quintile are less likely to have diarrhoea incidence compared to their counterparts in households with the poorest wealth quintile in Ghana.

## CHAPTER THREE

### METHODOLOGY

#### 3.1 Source of Data

The demographic and health survey (DHS) which was conducted in 2008 is the main source of data for this study. It is the fifth of the DHS series in Ghana following those conducted in 1988, 1993, 1998 and 2003. The sixth edition was conducted in 2014. The 2008 DHS is a nation-wide survey implemented in a representative probability sample of 12,810 households in 427 clusters. The sample used for the survey was carefully selected in such a way as to allow for separate estimates of key indicators for each of the ten administrative regions of Ghana, and also for rural areas separately.

The main objectives of the survey were to provide up-to-date information on fertility and childhood mortality levels; fertility preferences; awareness, approval and use of family planning methods; maternal and child health; knowledge and attitudes towards HIV and AIDS and other sexually transmitted infections (STIs); and prevalence of HIV among the adult population.

All women of age 15-49 years who were usual members of the selected households or who slept in the selected households the night before the interview were eligible for the survey. The data set has information on all living children under the age of five years at the time of the interview, as well as deceased children who would have been less than five years old if still alive at the time of interview. Questions were asked of participating households whether a child under

the age of five has been ill with fever, cough, or diarrhoea in the two weeks preceding the interview. Detailed information was also collected on individual basic demographic characteristics and social status (age, sex, religion, marital status, and ethnicity), their knowledge and use of family planning methods, and on their knowledge and attitudes towards HIV and AIDS and other sexually transmitted infections. Information from these data will help to assess the impact of household source of drinking water and diarrhoea among children under five years old.

### **3.2 Sample design**

A two-stage stratified random sampling design was adopted. The stratification was achieved by dividing each region into urban and rural areas. At the first stage, a total sample of 427 clusters was selected with probability proportional to size. The distribution of the selected clusters across the ten administrative regions or strata was based on proportionate allocation, using the size of the population in each region. In the second stage of selection, a fixed number of 30 households were selected in every urban and rural cluster by an equal probability systematic sampling.

All the sampling units involved in the survey had a known, non-zero probability of selection. The sampling frame of the primary units used in the survey was based on the 2000 Population and Housing Census. The survey is not a self-weighting sample design because disproportionately larger samples from regions with smaller populations were drawn. Therefore, each sampled household did not have the same chance of selection into the sample. In view of this, weights

were computed to reflect the different probabilities of selection in order to obtain the true contribution of each selected cluster in the sample based on the first and second stage probabilities of selection. The number of occupied households successfully interviewed was 11,778 with a household response rate of 99 percent.

### **3.3 Categorization of variables**

#### **3.3.1 Dependent variable: Incidence of Diarrhoea**

The dependent variable for the study is diarrhoea among children under five years. This question sought information from mothers on whether their children under five years had diarrhoea two weeks preceding the survey. Mothers whose children had diarrhoea answered “Yes” and those who did not have diarrhoea answered “No.” The responses were coded as 1 for “Yes”, 2 for “No” and 3 for don’t know.

For this study, incidence of diarrhoea was treated as a dichotomous variable and was recoded as 1 = Yes and 2 = No. The code 3 which was don’t know in the GDHS was recoded into code 2 as No. the respond don’t know was not significant that whichever way it was treated, its impact on the result was not realized or was not significant.

#### **3.3.2 Independent Variable: Source of household drinking water**

The main independent variable for this study is source of household drinking water. In the 2008 GDHS, households were asked their source of drinking water and the following responses were provided: piped into dwelling, piped into yard/plot, public tap/standpipe, borehole, protected well, unprotected well,

protected spring, river, rainwater, tanker truck, cart with small tank, bottled water, sachet water and other. For the purpose of this study, the various categories of drinking water were regrouped as 1 and 2, one (1) representing improved source of drinking water and two (2) coded as unimproved source of drinking water.

Under the improved sources are piped into dwelling/homes, piped to yard or plot, public tap, borehole, protected well, protected spring and rainwater. Rainwater is classified as an improved source of drinking water by the WHO/UNICEF Joint Monitoring Programme in 2013. Their main argument is not how the water is being stored, but its source or where it is coming from.

The unimproved source includes unprotected well, unprotected spring, river, tanker truck, and cart with small tank, bottled water and sachet water. Both bottled and sachet water were also classified as unimproved by WHO/UNICEF (2005) because they argue that the source of the water is not known and again the treatment cannot be guaranteed. “Other” source is recoded into unimproved source because it is assumed that respondents or mothers were not able to identify the source of their drinking water.

### **3.3.3 Control Variables**

These are variables which have direct influence on the dependent variable but are not the main variable(s) of interest so they are controlled for. These control variables include mother’s and child’s characteristics:

- i. Age of the child: This study is interested in children under five years and only age in completed years were considered as 0, 1, 2, 3 and 4.
- ii. The sex of the child was also coded as either male or female.
- iii. Age of the mother: The age of the mother was categorized into five age groups as 15-19, 20-24, 25-29, 30-34, 35-39, 40-44 and 45-49.
- iv. Mother's educational level: This refers to the highest level of education mothers have attained or completed at the time of the survey. The responses from the survey were categorized as No education, Primary education, Secondary education and tertiary education.
- v. Type of place of residence: The responses were grouped into urban and rural with the urban representing all localities with 5,000 or more population while others with less than 5,000 were considered as rural areas.
- vi. Sanitation: Sanitation here is looked at in terms of type of toilet facility used by households. The question on toilet facility wanted to find out the type of toilet facility used by mothers as to whether it was improved or unimproved. The responses that were provided for mothers to choose from ranged from flush to piped sewer system, flush to septic tank, flush to pit latrine, flush somewhere else, flush don't know where, ventilated improved pit latrine, pit latrine with slab, pit latrine without slab, no

facility/bush, composting toilet, bucket/pan and other. This was recoded into two as Improved and Unimproved toilet facility. The improved toilet facility is made up of flush to piped sewer system, flush to septic tank, flush to pit latrine, ventilated improved pit, pit latrine with slab and composting toilet. Unimproved toilet facility is made up of flush somewhere else, open pit, no facility or bush and bucket. "Other" was recoded as an unimproved toilet facility. Not a de jure residence was not considered in the analysis because it is not a usual member or a permanent household.

vii. Wealth Quintile Index: This index provides consistent measure of combined indicators of household income and expenditure. It also provides information on the wealth status of Ghanaian households. The question usually asked during the DHS is whether the household has a number of suggested items ranging from television set to bicycle or car as well as household characteristics.

These responses were grouped into five categories poorest, poorer, middle, richer and richest.

viii. Respondent's Employment status: This question wanted to find out whether mothers are employed or unemployed and the responses were categorized into two as unemployed or seeking employment and the rest made up of physical scientists,

architects, engineers, accountants, farmers, jurists, teachers, maids, book keepers, stenographers, sale girls and a whole lot of categories. For the purpose of this study, however, these responses were reclassified as Employed and Unemployed because from the survey it was assumed that unemployed or seeking employment were mothers looking for jobs while the rest of the responses may mean mothers are engaged in one way or other all other things being equal so this categorization was done to find out the status of children whose mothers are employed and those whose mothers are not in relation to the incidence of diarrhoea among children less than five years.

- ix. Treatment of household water: This question wanted to find out the various ways through which mothers make their water safe for drinking. The responses were categorized into boiling, bleach or chlorination, strain through cloth and water filtration. For the purpose of this study, all the above categorization of water treatment was used.

### **3.4 Method of Analysis:**

The analysis was done using SPSS version 20 to determine the prevalence of diarrhoea. In this study, three levels of analysis were conducted at the univariate, bivariate and multivariate levels. Descriptive statistics was applied to the demographic characteristics, sanitation coverage and water source. A frequency distribution of individual cases is presented using graphs and tables.

The bivariate analysis was conducted for the purpose of determining the relationship between variables. Cross tabulation and chi - square were used to test the association between the dependent variable and independent variables while controlling for other variables.

Finally, in the multivariate analysis, relationships between the dependent variable, the independent and control variables were examined simultaneously. A binary logistic regression was used as the method of analysis to estimate the significant relationship between the dependent variable and the independent variables due to the dichotomous nature of the dependent variable: whether a child had diarrhoea in the past two weeks preceding the survey or not. Statistical significance of the results obtained is set at  $\alpha \leq 0.05$ .

### **3.5 Limitations**

During surveys such as DHS, there are technical problems associated with the information on the prevalence or incidence of mortality and morbidity of diarrhoea obtained from cross-sectional studies. Data that were collected cross-sectionally in such studies are difficult to take into account all seasonal differences of the occurrences of diarrhoea.

During the GDHS, neither the children were examined nor were the mothers given a precise definition of what constitute an episode of diarrhoea. The question about diarrhoea measures the mother's perception of her child's health rather than morbidity according to clinical examination since perception of illness is not similar among different social groups. This may create variations and in extreme cases distortions across different socio-economic groups.

Again, memory lapse can also become a setback. Under-five children who had diarrhoea incidence one month or beyond before the survey was conducted may all be excluded from estimation and this can lead to underestimation of diarrhoea incidence in the sampled households.

## **CHAPTER FOUR**

### **BACKGROUND CHARACTERISTICS OF RESPONDENTS**

#### **4.1 Introduction**

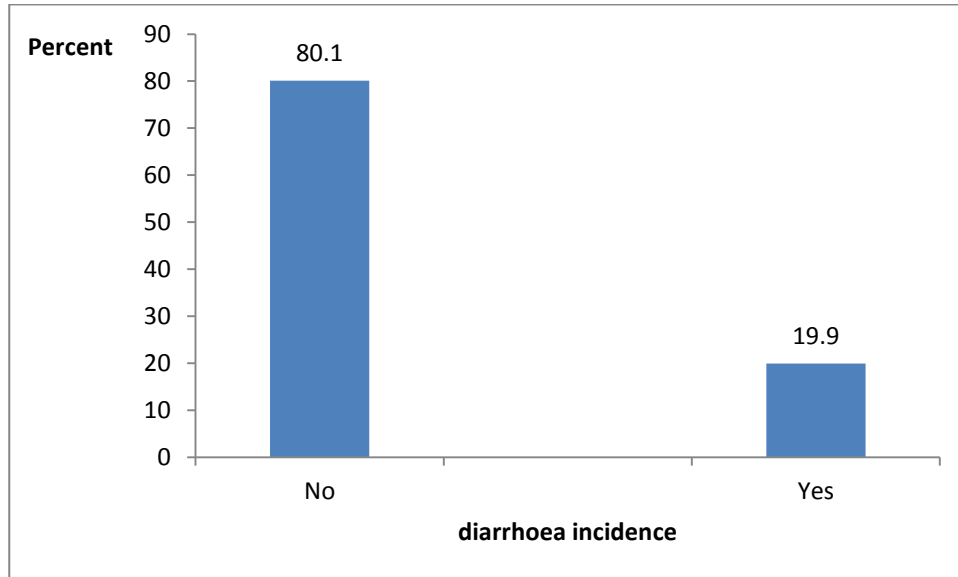
The twin goals of this chapter are to present and discuss the influence of household source of drinking water, that is improved and unimproved source of water on diarrhoea among children under five years old and also discuss the influenced of other important determinants of diarrhoea among children under five years in Ghana.

#### **4.2 Socio-Demographic Characteristics of children under five**

##### **4.2.1 Diarrhoea incidence**

Figure 4.1 shows the percentage distribution of diarrhoea incidence among children less than five years in Ghana as at the 2008 GDHS. The majority of children under five years of age (80.1%) did not have diarrhoea while 19.9 percent of them had diarrhoea two weeks preceding the survey in Ghana.

**Figure 4.1: Percent distribution of diarrhoea Incidence among under-five children**

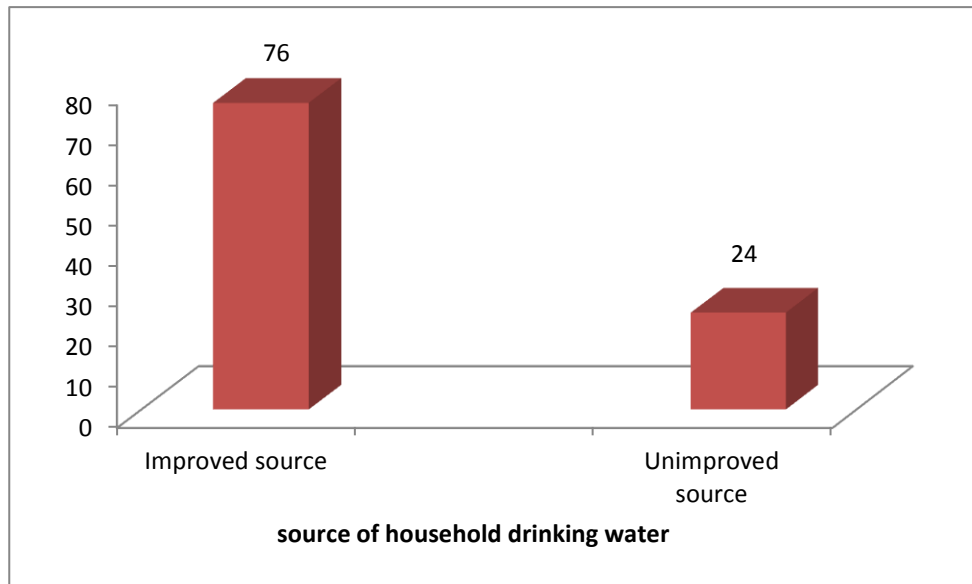


**Source: Computed from 2008 GDHS**

#### **4.2.2 Source of Household Drinking Water**

Figure 4.2 shows the distribution of households by source of drinking water. Mothers of children less than five years who used improved source of drinking water constitute 76 percent compared to 24 percent of mothers who used unimproved source of drinking water two weeks preceding the survey in Ghana. This shows that majority of mothers of under five children have access to improved source of drinking water in Ghana.

**Figure 4.2: Percentage Distribution of household source of drinking water**

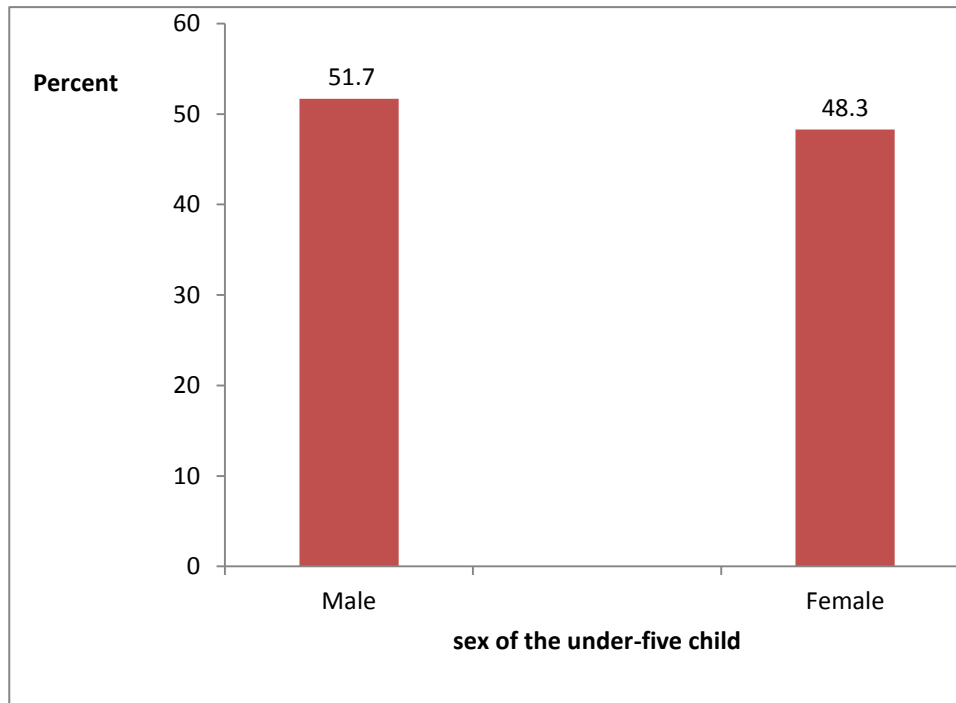


Source: Computed from 2008 GDHS

#### **4.2.3 Sex of the Child**

Figure 4.3 shows the percentage distribution of children under five years by sex. More than half of the children less than five years are males 51.7 percent. The females constitute 48.3 percent. This may be as a result of the usual higher sex ratio at birth that is recorded in almost all populations.

**Figure 4.3: Percentage distribution of under-five children by sex**



Source: Computed from 2008 GDHS

#### **4.2.4 Age of the child**

Table 4.1 indicates that 22.7 percent of the children under five are less than one year old. There are not much variation between under-five children who were 2 and 3 years respectively (18.2% and 18.5%) and again those at age 1 and 4 years can also be said to be of the same proportions 20.2 percent and 20.4 percent respectively. These variations may be due to differences in births rate at the various ages.

**Table 4.1 Percentage distribution of children under five years by single age**

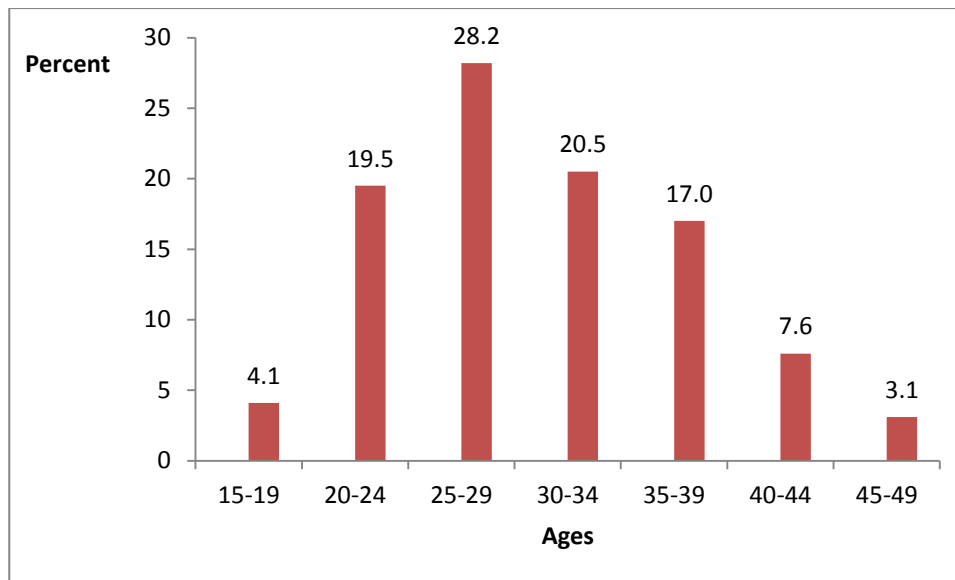
Age	Frequency	Percent
0	619	22.7
1	551	20.2
2	496	18.2
3	506	18.5
4	557	20.4
Total	2728	100

Source: Computed from 2008 GDHS

#### 4.2.5 Mothers' Age

The Ghana Demographic and Health Survey (GDHS) collected information on the age of mothers from 15 to 49 years. The frequency distribution of the age of mothers shows that the highest proportion of mothers of children less than five years fall within the age group 25-29 years (28.2%). As the age increases the proportion of mothers with under-five children also reduces. This is reflecting the fertility pattern by age with a peak at age 25-29 years and it can be seen from Figure 4.4 that as mothers grow, then fertility starts to decline steadily.

**Figure 4.4: Percentage Distribution of Mothers' Age**



Source: Computed from 2008 GDHS

#### **4.2.6 Mothers' Level of Education**

Table 4.2 shows the percentage distribution of mothers' level of educational attainment. The table shows that the highest proportion of mothers with children under five was 40.4 percent attaining secondary educational level. Mothers who have no education representing 32.5 percent and only 2.6 percent of them have attained tertiary level education. This low rate of tertiary education has always been the case with reducing numbers as the educational ladder increases. This may be as a result of so many combinations of factors.

**Table 4.2: Percentage distribution of mothers of children under five by level of education**

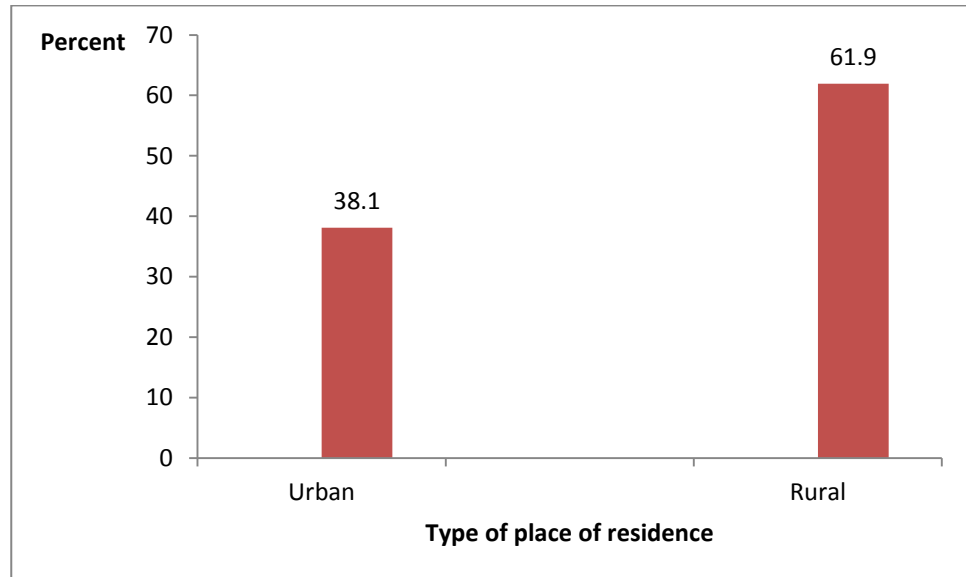
Variable	Frequency	Percent
No education	886	32.5
Primary	668	24.5
Secondary	1102	40.4
Tertiary	72	2.6
Total	2728	100

Source: Computed from 2008 GDHS

#### 4.2.7 Type of Place of residence

The 2008 GDHS collected information on the type of place of residence of households. From Figure 4.5, about 62 percent of children less than five years live in the rural areas compared to 38.1 percent of them living in the urban areas. This shows that majority of under-five children in Ghana are living in the rural areas. This may be as a result of a higher fertility in the rural area compared to the urban localities in Ghana.

**Figure 4.5: Percentage distribution of mothers with children under-five years by type of place of residence**

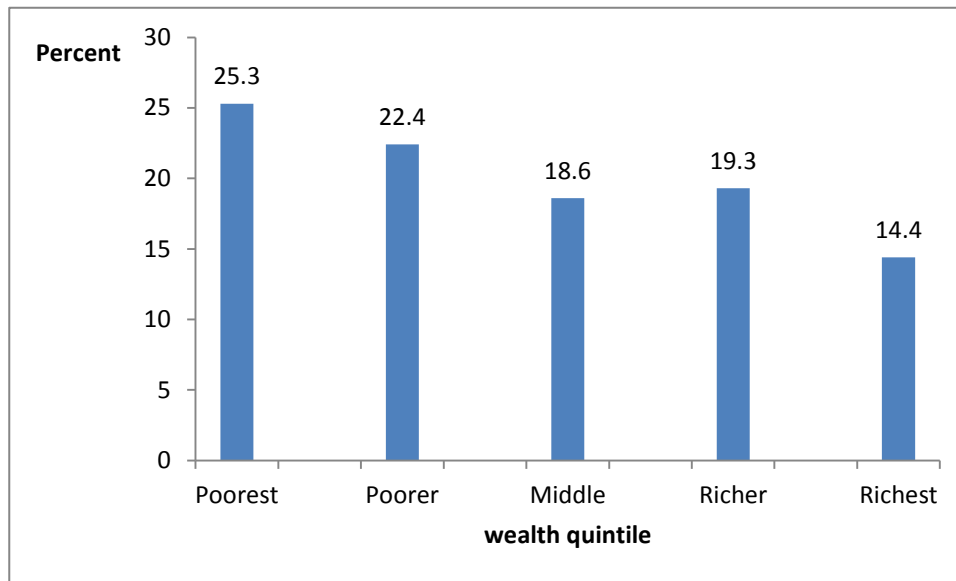


Source: computed from 2008 GDHS

#### **4.2.8 Wealth Quintile Index**

The distribution of households' wealth quintile falls within five categories. Figure 4.6 indicates that the highest proportions of household wealth quintile fall within the poorest and poorer categories: 25.3 percent and 22.4 percent respectively. There is a small variation between the middle and the richer. The richest quintile represents the smallest proportion of 14.4 percent. This shows that a chunk of households in the survey falls within the first two categories in Ghana.

**Figure 4.6: Percentage distribution of mothers with children under-five years by wealth quintile**

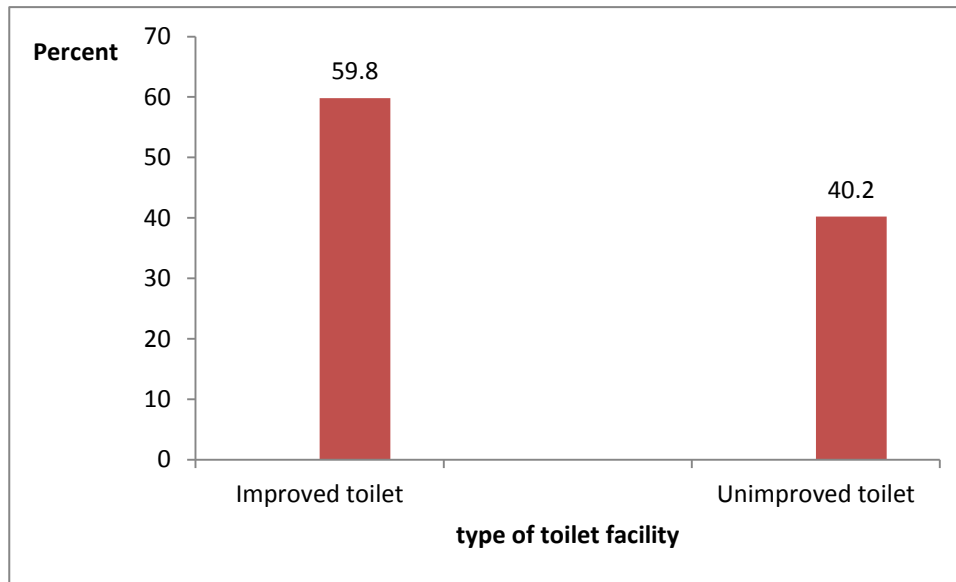


Source: Computed from 2008 GDHS

#### 4.2.9 Type of toilet facility

Figure 4.7 shows the frequency distribution of mothers with children under five years by type of toilet facility used in Ghana two weeks preceding the DHS. Majority of mothers constituting 59.8 percent used an improved type of toilet facility compared to 40.2 percent using unimproved type of toilet facility.

**Figure 4.7: Percentage distribution of type of toilet facility**

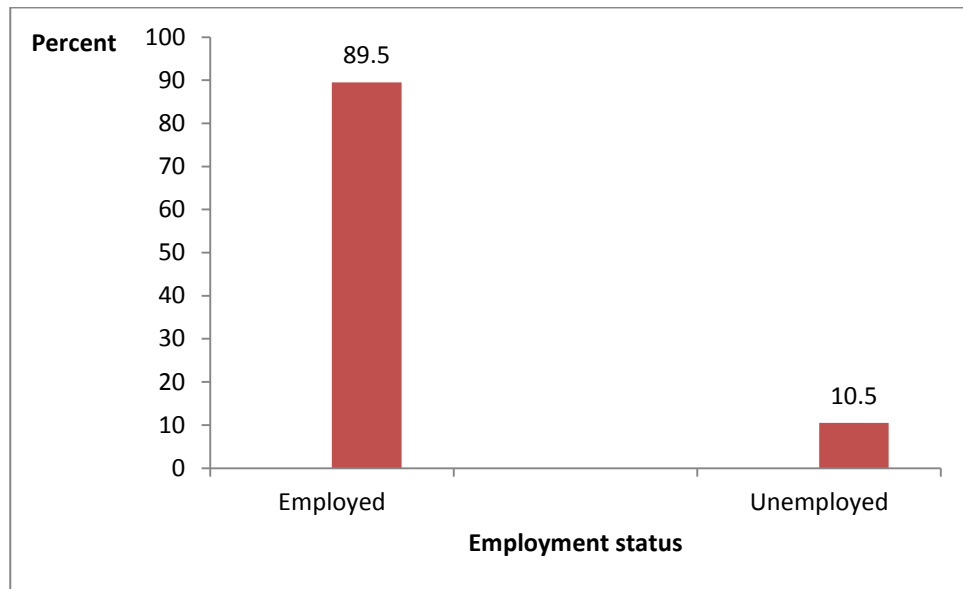


Source: Computed from 2008 GDHS

#### **4.2.10 Employment status of mothers**

There is a majority of mothers with children less than five years who were employed (89.5%) compared to those who were unemployed (10.5%) as shown in Figure 4.8. This shows that more females are engaged in one way or the other in an economic activity which can lead to an improvement in their standard of living and that of their under-five children.

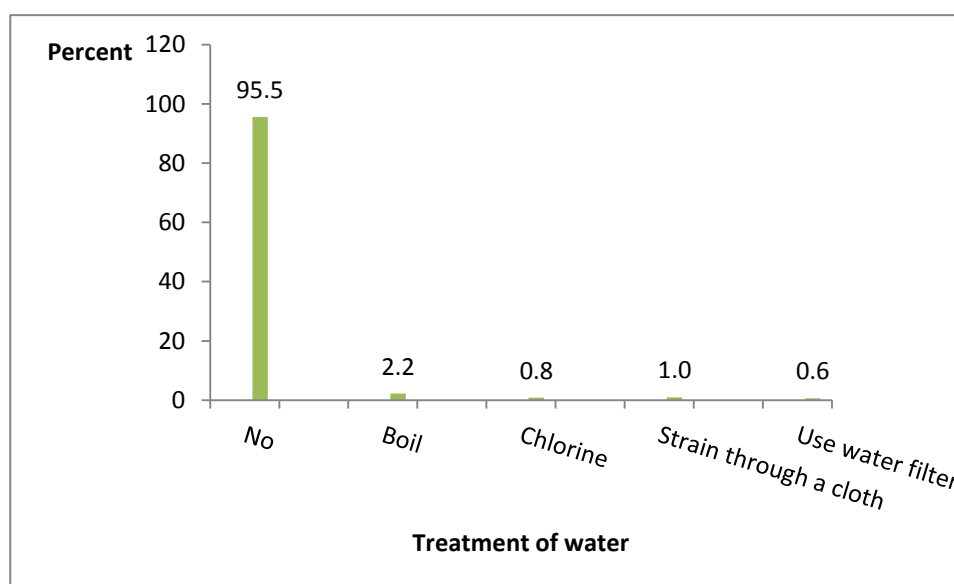
**Figure 4.8: Percentage distribution of mothers with children under five years by employment status**



Source: Computed from 2008 GDHS

#### **4.2.11 Treatment of households' drinking water**

Figure 4.9 shows the percentage of mothers of children less than five years in Ghana by type of treatment of drinking water. Majority of mothers (95.5%) do not treat their drinking water. There was only a small variation among mothers who treat their drinking water by type of treatment used. Less than five percent of mothers of children less than five years old treat their drinking water. It is assumed that most mothers of children less than five years do not treat their drinking water because they may assumed that so far as the water is from an improved source, there is no need for treatment before children drink it.

**Figure 4.9: Percentage distribution of treatment of source of drinking water**

Source: Computed from 2008 GDHS

### 4.3 Conclusion

From the forgoing analysis, 19.8 percent of children less than five years had diarrhoea and 76 percent of mothers with children under five years used improved source of drinking water in Ghana. A high proportion of 28.2 percent of mothers with children less than five years fall within the age group 25-29 years because this reflect fertility pattern by age with a peak at this age. There were also a high proportion of 40.4 percent of mothers with children less than five years who had attained secondary education, about 62 percent of children less than five years lived in the rural areas compared to 38.1 percent of them in the urban areas and about 60 percent of mothers with under five years children used an improved type of toilet facility in Ghana two weeks preceding the survey.

## CHAPTER FIVE

### SOCIO-DEMOGRAPHIC PROFILE OF MOTHERS AND DIARRHOEA INCIDENCE AMONG CHILDREN

#### 5.1 Introduction

Household source of drinking water and the socio-economic characteristics of the mother and that of the child may affect the incidence of diarrhoea among children under five. The bivariate analysis was intended to gain insights into the association between household source of drinking water and the incidence of diarrhoea morbidity among children under five years old in Ghana. Cross tabulation is used to find the association between the variables.

#### 5.2 Source of household drinking water and incidence of diarrhoea

According to Hunter et al, (2013) a higher proportion of the diarrhoea disease is among children growing up in the world's poorest countries and is largely associated with inadequate drinking water and sanitation. This means that the availability of drinking water is very important in reducing the disease burden among under-five children. From Table 5.1, there is no statistically significant variation in diarrhoea incidence between mothers who used improved water and those who used unimproved source of drinking water. Under-five children whose mothers used improved source of drinking water had 20 percent diarrhoea incidence rate compared to 19.5 percent among their counterparts in households using unimproved source of drinking water. There is, however, no statistically significant association between source of household drinking water and the

incidence of diarrhoea among under-five children. This may be attributed to a number of factors like the unhygienic handling of water from the source and even at the household level where anybody can just put any cup into the water and fetch or children can even dip their dirty hands into the water especially where the storage container is not having a cover or lid. Again this can be attributed to the mode of storage. That is, do the storage containers have covers or not? Do mothers of under-five children normally wash the containers before refilling them or they only top up the water when it is half-way full? All these need to be taken into consideration before a concise conclusion can be established between household drinking water and diarrhoea incidence but not the source of the water alone that has to be looked at as has been observed by Arif and Ibrahim (1998) that many water supply schemes, for example, extension of water supply to households for instance may be ineffective in reducing diarrhoea morbidity because it may be quality and usage pattern of water in the home, not the purity of water at its source that largely determine the impact of diarrhoeal morbidity particularly on children.

**Table 5.1: Percentage distribution of diarrhoea incidence and household source of drinking water**

Source of drinking water	Diarrhoea incidence		Total (%)	Frequency
	No	Yes		
Improved	80.0	20.0	100	2414
Unimproved	80.5	19.5	100	314
Total	80.1	19.9	100	2728
$\chi^2 = 0.58$		Degree of freedom = 1		p-value = 0.810

Source: Computed from 2008 GDHS

### 5.3 Type of place of residence and diarrhoea incidence

Table 5.2 shows that out of a total population of 2,728 children less than five years almost 20 percent had diarrhoea two weeks preceding the survey in Ghana. The proportion of children under five years in the rural areas who had diarrhoea was higher (21.4%) compared to that in the urban areas (17.4%). This shows that more children in rural areas had diarrhoea. This may be as a result of rural areas not having sufficient potable water supply because of the problem of extension of the main water supply connection to these areas.

Again urban areas also have better living areas compared to rural areas when children are exposed to dirty floor or bare ground consequently, diarrhoeal risk is higher among rural children. This is consistent with the findings of Woldemicael (2001) which indicates that in relation to type of place of residence, children living in the urban areas were 46 percent less likely to have diarrhoea compared to children living in the rural areas. The results of the analysis about the type of place of residence and diarrhoea incidence shows that there is a statistically significant association between the type of place of residence and the incidence of diarrhoea among children less than five years with a p-value of 0.012.

**Table 5.2: Percent of diarrhoea incidence by type of place of residence of child**

Type of residence	Diarrhoea incidence			Frequency
	No	Yes	Total (%)	
Urban	82.6	17.4	100	1039
Rural	78.6	21.4	100	1689
Total	80.1	19.9	100	2728
$\chi^2 = 6.277$		Degree of freedom = 1		p-value = 0.012

Source: Computed from 2008 GDHS

#### **5.4 Households type of Toilet facility and incidence of diarrhoea**

The most efficient and hygienic method of human waste disposal is when the population has access to improved toilet facilities (GSS, 2009). Table 5.3 shows that households who used unimproved toilet facility had 22.8 percent of children less than five years who had diarrhoea compared to their counterparts who used improved toilet facility (17.9%). This shows that there is a high risk of getting diarrhoea by using an unimproved toilet facility. Godana and Mengiste (2013) observed that the occurrence of diarrhoea is significantly associated with the lack of latrine ownership. Again, Carlos et al (2013) found that pipe water and own flush toilets helped to prevent diarrhoea in under-five children in rural Philippines'. Furthermore, Mihrete *et al*, (2014) found that children from households that had no toilet facility were six times higher risk of having diarrhoea than children from families who had toilet facility. Again, households with lack of improved sanitation (toilet facility) have a high risk of contaminating with human excreta. Also, it has been found that children in households with improved sanitation have more than 50 percent probability of escaping diarrhoea (Kumi-Kyereme and Amo-Adjei 2015). From Table 5.3, there is a statistically significant variation in diarrhoea incidence by type of toilet facility used among children under five years old.

**Table 5.3: Percent of diarrhoea incidence among under-five children by type of toilet facility**

Toilet facility	Diarrhoea incidence			Frequency
	No	Yes	Total (%)	
Improved	82.1	19.7	100	1631
Unimproved	77.2	22.8	100	1097
Total	80.1	19.9	100	2728

$$\chi^2 = 9.836$$

Degree of freedom = 1

p-value = 0.002

Source: Computed from 2008 GDHS

**5.5 Water Treatment and incidence of diarrhoea**

From Table 5.4, children of mothers who treat their water by boiling reported the highest proportion of 29.3 percent with diarrhoea. From the table, there is some small variation in the incidence of diarrhoea among those who do not treat their drinking water and households who used other methods of water treatment.

**Table 5.4: Percentage distribution of diarrhoea incidence and household water treatment**

Water treatment	Diarrhoea incidence		Total (%)	Frequency
	No	Yes		
No	80.2	19.8	100	2604
Boil	70.7	29.3	100	59
chlorine	81.0	19.0	100	21
Strain through a cloth	85.7	14.4	100	28
Use of water filter	87.5	12.5	100	16
Total	80.1	19.9	100	2728

$$\chi^2 = 4.363$$

Degree of freedom = 4

p-value = 0.359

Source: Computed from 2008 GDHS

### 5.6 Mother's age and the incidence of diarrhoea

From Table 5.5, there is not much variation in the incidence of diarrhoea among children less than five years by mothers' age except for children belonging to mothers in age group 15-19, 35-39 and 45-49 which have a little higher than 20 percent of children less than five years with diarrhoea incidence two weeks preceding the survey. It is assumed that mothers at ages 15-19 years do not have the requisite skills and knowledge to care for children and also because they are young the rate of diarrhoea incidence could be high. Again from Table 5.5, these mothers might be living in the rural areas where children are exposed to dirty floor or bare ground, consequently, diarrhoeal is higher among these children.

**Table 5.5: Percent of diarrhoea incidence by age of mother of under-five children**

Mothers' age	Diarrhoea incidence		Total (%)	Frequency
	No	Yes		
15 - 19	77.7	22.3	100	112
20 - 24	81.0	19.0	100	532
25 - 29	80.1	19.9	100	770
30 - 34	81.9	18.1	100	558
35 - 39	77.6	22.4	100	464
40 - 44	80.6	19.4	100	207
45 - 49	78.8	21.2	100	86
Total	80.1	19.9	100	2728

$$\chi^2 = 3.828$$

Degree of freedom = 6

p-value = 0.700

Source: Computed from 2008 GDHS

This contradicts what Mesangwi *et al*, (2009) found that children belonging to households with mothers above 40 years were less likely to report diarrhoea incidence among their children than children of mothers of age 15 years or less. The result, however, shows that there is no statistically significant variation in diarrhoea incidence among children by age of mother (Table 5.5).

### 5.7 Mothers' Education and the incidence of diarrhoea

Mothers' education is an important determinant of child survival. Education also translates to better skills and knowledge that are essential in understanding and using existing healthcare resources. As the educational level of mothers increases, there is the likelihood of diarrhoea incidence reducing among children

less than five (Table 5.6). It is assumed that mothers with higher educational attainment know how to take care of their under-five children and also to report child illness faster to the health center than mothers with primary or no education. This can even be confirmed in Table 5.6 when comparing mothers who have attained primary and secondary school. The incidence of diarrhoea among children less than five years whose mothers had primary education is higher 19.8 percent than under-five children whose mother had secondary education 17.6 percent. This reiterates the findings of Woldemicael (2001) which indicate that the prevalence of diarrhoea varies indirectly with education of mothers.

The result from Table 5.6 shows that there is statistically significant association between educational attainment of mothers and the incidence of diarrhoea among children less than five years. The findings in Table 5.6 agree with Mihrete *et al*,(2014) that maternal education has a strong association with childhood diarrhoea. Children of non-educated mothers were two times more likely to have diarrhoea when compared to children of mothers who had primary education and above.

**Table 5.6: Percent of diarrhoea incidence among under-five children by mothers' education**

	Diarrhoea incidence			Frequency
	No	Yes	Total (%)	
No education	76.1	23.9	100	886
Primary	80.2	19.8	100	668
Secondary	82.4	17.6	100	1102
Tertiary	94.1	5.6	100	72
Total	80.1	19.9	100	2728
$\chi^2 = 21.988$		Degree of freedom = 3		p-value = 0.000

### 5.8 Wealth index and the incidence of diarrhoea

The distribution of children by household wealth index in Table 5.7 shows that as the household economic status improved diarrhoea morbidity also reduced. A high proportion of 25.5 percent of children less than five years in the poorest wealth quintile had diarrhoea two weeks preceding the survey, followed by children in households in the poorer wealth quintile (21.5%). The results indicates that the higher the wealth quintile of households, the lower the incidence of diarrhoea disease among children under five years. This conforms to the study carried out by Boadi and Kuitunem (2005) that children from poor homes have higher incidence of diarrhoea than their counterparts in the medium and high wealth quintiles. Again, according to Woldemicael (2001), children's health is affected by the environmental conditions and economic status of households. Children from better-off households have lower diarrhoeal morbidity and mortality. The results in Table 5.7 show a statistically significant variation in diarrhoea incidence by mothers' wealth quintile at a p-value of 0.000.

**Table 5.7: Percent of diarrhoea incidence among children under-five by wealth quintile of mothers**

	Diarrhoea incidence			Frequency
	No	Yes	Total (%)	
Poorest	74.5	25.5	100	691
Poorer	78.5	21.5	100	610
Middle	78.5	16.3	100	507
Richer	83.7	16.3	100	528
Richest	89.8	10.2	100	393
Total	80.1	19.9	100	2728
$\chi^2 = 42.900$ Degree of freedom = 4      p-value = 0.000				

### 5.9 Mothers' employment status and diarrhoea incidence among children

The analysis sought to find out whether there is a relationship between the employment status of mothers and the incidence of diarrhoea among children less than five years in Ghana. Table 5.8 shows that 21 percent of children less than five years whose mothers were unemployed had diarrhoea two weeks preceding the survey. This is similar to the finding from Alaa *et al.*, (2013) that the risk of diarrhoea is five times higher with children with unemployed mothers compared to others whose mothers are employed. From Table 5.8, the chi-square test shows that there is no statistically significant variation in diarrhoea incidence by mothers' employment status.

**Table 5.8: Percent of diarrhoea incidence among under-five children by mothers' employment status.**

Employment status	Diarrhoea incidence		Total (%)	Frequency
	No	Yes		
Employed	80.3	19.7	100	2442
Unemployed	79.0	21.0	100	287
Total	80.1	19.9	100	2728

$$\chi^2 = 0.248$$

Degree of freedom = 1

p-value = 0.619

Source: Computed from 2008 GDHS

### 5.10 Sex of the child and the incidence of diarrhoea

Table 5.9 which depicts incidence of diarrhoea by sex of the child shows that a relatively higher proportion of 20.3 percent females compared to 19.4 percent of males had diarrhoea two weeks preceding the GDHS. This is consistent with a study by El Samani *et al.* (1989) which shows that the risk of diarrhoea was higher

for females than in males in a rural Sudanese community but the Chi-Square Test however shows no statistically significant relationship between the sex of the child and the incidence of diarrhoea. This however shows that the sex of the child does not necessarily determine whether a child will be having diarrhoea incidence or not, other factors like for example mother's education, type of place of residence have to be considered.

**Table 5.9: Percent of diarrhoea incidence by sex of child**

Sex of the child	Diarrhoea incidence		Total (%)	Frequency
	No	Yes		
Male	80.6	19.4	100	1409
Female	79.7	20.3	100	1319
Total	80.1	19.9	100	2728

$$\chi^2 = 0.325$$

Degree of freedom = 1

p-value = 0.568

Source: computed from 2008 GDHS

### 5.11 Age of the Child and the incidence of diarrhoea

Table 5.10 indicates that diarrhoea incidence is highest (32.7%) at age one and lowest at age four (11.7%). Again, diarrhoea incidence is quite high at age two (22.2%). These show that at this age, that is age one and two, children start crawling and some even start walking and so are exposed to dirty ground, they can even put any dirty object they found on the ground into their mouths hence higher morbidity and mortality. Children are also susceptible to many health problems such as pneumonia and diarrhoea, and these contribute to high morbidity in

children under five. The analysis also shows that there is a statistically significant association between age of the child and incidence of diarrhoea among children under five in Ghana. This supports studies done by Mihrete *et al.* (2014) and Woldemicael (2001) which indicate that the incidence of diarrhoea is higher in the second half of an infant's life when immunity is weaker and exposure to contaminated weaning food is increased.

**Table 5.10: Percent of diarrhoea incidence by age of child**

Age of the child	Diarrhoea incidence		Total (%)	Frequency
	No	Yes		
0	81.1	18.4	100	619
1	67.3	32.7	100	551
2	77.8	22.2	100	496
3	85.4	14.6	100	506
4	88.3	11.7	100	557
<b>Total</b>	<b>80.1</b>	<b>19.9</b>	<b>100</b>	<b>2728</b>

$$\chi^2 = 91.333$$

Degree of freedom = 4

p-value = 0.000

Source: Computed from 2008 GDHS

### 5.12 Conclusion

At the bivariate analysis level, source of drinking water which is the main variable of interest was not statistically significant. This may be as a result of other factors such as the unhygienic handling of water from the source to the household point of use and mode of storage which were not included in the data set to be able

to find out the actual impact of drinking water and diarrhoea incidence among under-five children in Ghana. It will be my wish that further GDHS may include variables such as type of storage containers of household drinking water and how water is handled by households from the source to the final point of use to enable further studies to unravel the relationship between drinking water and diarrhoea incidence among under-five children.

Again, these variables, household's type of toilet facility, the age of the under-five child, mother's educational level, wealth quintile of the mother and type of place of residence of children under five were statistically significant predictors of diarrhoea incidence in Ghana.

## CHAPTER SIX

### RELATIONSHIP BETWEEN MOTHERS' SOCIO-DEMOGRAPHIC CHARACTERISTICS AND DIARRHOEA INCIDENCE AMONG CHILDREN

#### 6.1 Introduction

This chapter focuses on the analysis of the relationship between households' source of drinking water and diarrhoea incidence among children under five years. Binary logistic regression analysis was employed in this section to examine the effects of the independent variables and the intermediate variables on diarrhoea incidence among children under five years in Ghana two weeks preceding the survey. The use of the binary regression model is justified by the fact that the dependent variable which is measured by diarrhoea morbidity of the child is dichotomous (whether a child suffered diarrhoea or not two weeks preceding the survey). Reference categories were created for each of the variables for easy comparison using the odds ratio exponential  $\beta$ . Two different models were run to determine the possible effects of the variables on the incidence of diarrhoea.

The result of the binary model was interpreted in two different ways. The first looked at whether there is a statistically significant relationship between a particular independent variable and the dependent variable (at 95% confidence level). Variables with p-value of less than or equal to 0.05 were considered to be statistically significant in their explanation of the incidence of the under-five diarrhoeal disease.

The second approach looks at the probability of an event occurring when compared to a reference category by utilizing the odds ratio (exponential  $\beta$  calculated). Variables that were statistically significant at the bivariate level were type of place of residence, age of the under - five child, educational level of the mother, household's wealth quintile and type of toilet facility.

## **6.2 Interpretation of Binary Logistic results**

The first model was between the dependent variable and the independent variable which was source of household drinking water recorded an R square of 0.000. This suggests that the overall impact of the variable considered in the study did not explain or predict any variation in the dependent variable which was diarrhoea incidence. This means that other variables like the unhygienic handling of water from the source to the household point of use and the containers in which water is stored have to be taken into consideration and not only the impact of water at the source alone so that a concise relationship can be established between the source of drinking water and diarrhoea incidence among children under five years in Ghana. The second model was between the dependent variable, the independent variables and the intermediate variables and R square was 0.057 which suggests that the variables considered in the analysis predict or explain about 5.7 percent of the outcome variable which was diarrhoea incidence. Table 6.1 reveals that when the independent, control and intermediate variables were analyzed together, type of place of residence, wealth quintile of the mother and the age of the under-five child were statistically significant in explaining childhood diarrhoeal incidence.

The household source of drinking water which was the variable of interest was not a statistically significant predictor of under-five diarrhoea morbidity. From Table 6.1, mothers who used unimproved water source were 0.025 less likely to have diarrhoea incidence compared to their counterparts who used improved source of drinking water in the first model and 0.071 less likely to have diarrhoea incidence in the second model. This was contrary to expectation. This has been observed by Kakakhel *et al*, (2010), that the general perception that water supply is responsible for diarrhoea was found to be normally inaccurate. The statistical difference between diarrhoea incidence resulting from purified and non-purified water was very minimal or not significant. From the above findings the hypothesis is neither confirmed nor rejected because other variables like the unhygienic water handling and storage containers in which water is stored were not covered for in the data set that was used to establish the relationship. Further studies would be required to take into account the unhygienic handling of water and storage containers in which water are stored to investigate the relationship between source of drinking water and diarrhoea incidence among children under five years.

Table 6.1 indicates that type of place of residence was statistically significant and that children less than five years who live in the rural areas were 0.254 less likely to experience the incidence of diarrhoea compared to those living in the urban areas. This may be due to the effect of urban poverty and slum living conditions which may contribute to poor sanitation condition in urban households and associated higher diarrhoea risk. This confirmed the observation made by

**Table 6.1: Results of the multivariate analysis of diarrhoea incidence among children under-five**

`Model One					Model Two			
Variables	Sig.	Exp(B)	95% C.I.		Sig.	Exp(B)	95% C.I.	
			Lower	Upper			Lower	Upper
<b>Source of water</b>								
Improved RC		1				1		
Unimproved Source of	0.821	0.975	0.781	1.216	0.542	0.929	0.733	1.178
<b>Type of place of residence</b>								
Urban RC						1		
Rural					0.039	0.746	0.565	0.986
<b>Sex of the child</b>								
Male RC						1		
Female					0.781	1.028	0.846	1.25
<b>Wealth quintile of mother</b>								
Poorest RC					0			
Poorer					0.122	0.794	0.593	1.063
Middle					0.064	0.718	0.506	1.02
Richer					0	0.468	0.312	0.701
Richest					0	0.268	0.16	0.449
<b>Mothers age</b>								
15-19 RC						1		
20-24					0.683	0.899	0.538	1.5
25-29					0.704	1.102	0.667	1.823
30-34					0.839	1.056	0.626	1.779
35-39					0.248	1.364	0.806	2.309
40-44					0.881	1.047	0.577	1.901
45-49					0.575	1.23	0.597	2.534

**Table 6.1 continued**

Variables	`Model One				Model Two			
	Sig.	Exp(B)	95% C.I.		Sig.	Exp(B)	95% C.I.	
			Lower	Upper			Lower	Upper
<b>Mothers Educ.</b>								
No education RC						1		
Primary					0.406	0.892	0.681	1.168
Secondary					0.509	0.914	0.701	1.193
Tertiary					0.081	0.395	0.139	1.123
<b>Type of toilet facility</b>								
Improved RC						1		
Unimproved					0.902	1.015	0.803	1.282
Employment status								
Employed RC						1		
Unemployed					0.308	1.181	0.858	1.624
<b>Age of the child</b>								
Zero (0) RC					0			
1					0	2.193	1.664	2.889
2					0.186	1.224	0.907	1.652
3					0.05	0.721	0.519	1
4					0.001	0.556	0.397	0.78
<b>Treatment of water</b>								
No RC					0.316			
Boiling					0.137	1.568	0.866	2.837
Chlorination					0.719	0.807	0.252	2.59
Strain with a cloth					0.24	0.518	0.173	1.552
Use water filter					0.336	0.468	0.1	2.197
Constant					0.004	0.404		

*Model 1:  $R^2 = 0.000$*

*Model 2:  $R^2 = 0.057$*

*Source: Computed from 2008 GDHS*

Kumi-Kyereme and Amo-Adjei (2015) that “rural residents are less likely to report diarrhoea compared with those in urban areas. Moreover creation, of urban slums brings about the lack of or inadequate drainage and sewage networks, absence of sanitation and solid waste removal, all of which have combined to increase the risk of infectious diseases including diarrhoeal disease”.

Again, Table 6.1 indicates that there is a statistically significant relationship between the ages of children less than five years old and diarrhoea morbidity. Children who were one year are 2.193 times as likely to experience diarrhoea incidence compared to children less than one year. Children who were two years are 1.224 times as likely to experience diarrhoea compared to children less than one year. At these ages, that is at age one and two diarrhoea morbidity is high because weaning normally starts here and when contaminated water is used to prepare food for the under-five children or when mothers do not keep to good hygienic conditions in terms of not washing of hands before feeding children and not washing of hands after visiting the toilet, this could result in the outbreak of diseases which can result in under-five morbidity.

Furthermore, children of age three years and age four years were 0.721 and 0.556 respectively as likely to experience diarrhoea disease as children less than one year. At infancy or at the early months of the child, mothers tend to practice exclusive breast feeding which protects infants from infectious diseases like diarrhoea.

As the child grows to age three and four, the immune system becomes strong to fight against diseases, hence the less likelihood of diarrhoea incidence at infancy. This study is in agreement with a study conducted in Ethiopia which found out that diarrhoea incidence is higher in the second half of an infant's life when immunity is weaker and exposure to contaminated weaning food is increased (Woldemicael, 2001). On the basis of the finding, the second hypothesis which states that children less than one year are less likely to have diarrhoea incidence has been validated.

Again, there is statistically significant association between the wealth quintile of the mother of under-five children and the incidence of diarrhoea. Households of under-five children who are poor were 0.794 as likely to have diarrhoea as households of the poorest category. There is an inverse relationship between households' wealth quintile and diarrhoea incidence among children less than five years old, that is as the wealth quintile improves, diarrhoea incidence in children less than five reduces (Table 6.1). This study is in support of Godana and Mengiste (2013) who found that children who are poor and hungry are more likely to be visited by the forgotten killer disease of diarrhoea. Boadi and Kuitunen (2005) also reported that children from poor homes had higher diarrhoea incidence than their counterparts in the medium wealth quintile and higher wealth quintile. Households in the poorest categories find it very difficult to provide for their children and the tendency for them to use contaminated or unimproved source of drinking water is high due to the cost of water. This finding validates the hypothesis that under-five children from households in the poorest wealth quintile

are more likely to experience diarrhoeal disease compared to their counterparts from households in the richest wealth quintile.

The age of the mother of the under-five child was used to examine the incidence of diarrhoea among children under five years old. From Table 6.1, there was no statistical significant relationship between the age of the mother and the incidence of diarrhoea among children under five.

Table 6.1 again shows that there is no statistically significant relationship between mothers' educational level attained and incidence of diarrhoea among their children under five years. Table 6.1 indicates that under-five children whose mother had primary or higher educational attainment were less likely to experience diarrhoea incidence compared to children whose mothers had no education. Although statistically not significant, on the whole the finding appears to confirm a study by Timaeus and Lush (1995) who concluded that lower level of maternal education are associated with high incidence of diarrhoea morbidity among children under five years in Ghana.

Table 6.1 also takes into consideration the effect of mothers' employment status on the incidence of diarrhoea among children under five years. The result shows that there is no statistically significant association between mothers' employment status and diarrhoea morbidity among children less than five years. Table 6.1 however shows that mothers of under-five children who were unemployed have a higher probability to experience diarrhoea incidence compared to their counterparts who were employed.

Furthermore, there is no statistically significant relationship between type of toilet facility and the incidence of diarrhoea among children less than five years old in Ghana. However, it can be seen from Table 6.1 that households who use unimproved toilet facility were more likely to experience diarrhoea compared to their counterparts who use improved toilet facility. Households with lack of improved toilet facility have a higher risk of diarrhoea incidence and it was found by Kumi-Kyereme and Amo-Adjei (2015) that children in households with improved toilet facility have more than a 50 percent probability of escaping diarrhoea morbidity.

It can also be observed from Table 6.1 that the sex of children less than five years in the survey was not statistically significant in explaining diarrhoea incidence.

Finally, the relationship between the incidence of diarrhoea and household water treatment was not statistically significant.

### **6.3 Discussion**

From the results of the multivariate analysis of diarrhoea incidence among children under five years in Ghana, type of place of residence, age of the under-five child and the wealth quintile of mothers' of the households are statistically significant predictors of the incidence of diarrhoea among children under five years in Ghana. Source of household drinking water which was the main variable of interest was, however, not statistically significant in predicting diarrhoea incidence. This may be as a result of other factors like the unhygienic handling of

water from the source to the household point of use. The storage containers in which water is stored were also not considered in the data set. All of these have to be taken into consideration to enable us have an understanding of the effect of household drinking water on the incidence of diarrhoea and not to concentrate only on the source of the water.

## CHAPTER SEVEN

### SUMMARY, RECOMMENDATIONS AND CONCLUSION

#### 7.1 Summary

This chapter presents a summary of the main findings of the analysis of source of household drinking water and diarrhoea incidence among children less than five years in Ghana.

Adopting part of Mara *et al's* (2010) framework for the study on sanitation and health, an operational framework for this study was developed. This was based on the premises that, under-five diarrhoea works through proximate factors and distal factors. A distal factor such as household wealth quintile works through the proximate factors such as treatment of water to influence a child's exposure to the diarrhoea disease. The general objective of the study was to examine the relationship between households' source of drinking water and diarrhoea incidence among children under five years in Ghana to inform the public discourse towards addressing the increases in cholera outbreak in Ghana's cities and towns.

Three main hypotheses were tested in this study to investigate the relationship that exists between household's source of drinking water and diarrhoea incidence among children less than five years in Ghana. Under-five children in households with access to improved source of drinking water were conceived to be less likely to have diarrhoea compared with their counterparts without access to improved source of drinking water.

It was also hypothesized that children who were less than one year were less likely to have diarrhoea compared with others who were one year and above.

The third hypothesis was that under-five children in households in the richest wealth quintile category were less likely to have diarrhoea incidence compared with their counterparts in the poorest wealth quintile. Two of the hypotheses were accepted in the study which were children less than one year old being less likely to experience diarrhoea incidence compared to under-five children who were one year and above and the second hypothesis which states that under-five children from households in the poorest wealth quintile are more likely to experience diarrhoeal incidence compared to their counterparts from households in the richest wealth quintile. The results were consistent with several other research findings as described in Chapter Two of this study. For example, according to Woldemicael (2001), diarrhoea incidence is higher in the second half of an infant's life from age one and two years when immunity is weak and exposure to contaminated food is high. Godana and Mengiste (2013) also found that children who are poor and hungry are more likely to be visited by the forgotten killer disease of diarrhoea.

The 2008 GDHS was the main source of data used for the analysis in this study. At the multivariate level, two models of analysis were conducted, the first model considered the dependent and the independent variable which was source of drinking water while the second model considered all the variables. In the first model, source of drinking water which was the independent variable was not statistically significant, when all other variables were controlled for. However,

when all variables were included in the second model, i.e., age of the under-five child, sex of the under-five child, mothers educational level attained, type of place of residence, wealth quintile of mother, mothers employment status, type of toilet facility which were the control variables and treatment of water which was the intermediate variable, the age of the under child, type of place of residence and wealth quintile of mothers were statistically significant in predicting the incidence of diarrhoea. Other variables that were significant at the bivariate level but lost their significance at the multivariate level were the educational level of the mother and type of toilet facility due to their interactions with many other variables at this stage.

## **7.2 Conclusions**

From the analysis, 19.8 percent of children under five years had diarrhoea in Ghana two weeks preceding the survey. About 76 percent of mothers of children less than five years used improved source of drinking water compared to 24 percent who used unimproved source of drinking water. A high proportion of 28.2 percent of mothers with children less than five falls within the age group 25-29 years, 40.4 percent of mothers had attained secondary school level with 62 percent of under-five children living in the rural areas of Ghana. About 62 percent of children less than five live in the rural areas compared to 38.1 percent of them living in the urban centers.

Again, a high proportion of 32.7 percent of children at age one and 22.2 percent of children at age two respectively had diarrhoea incidence two preceding the survey and mothers with no education had 23.9 percent of children less than

five years who had diarrhoea compared to mothers who had tertiary education having 5.9 percent of under-five diarrhoea incidence.

Furthermore, households' type of toilet facility, age of the child, mothers' educational level, wealth quintile of the mother and the type of place of residence were statistically significant at the bivariate level of the analysis.

The study was able to achieve some of the objectives and has tested the stated hypotheses. The study revealed that type of place of residence, the age of the child and the wealth quintile of the mother were good predictors of diarrhoeal disease among children less than five years old in Ghana. The result of this study indicates that about 5.7 percent of the variation between the under-five diarrhoea disease and source of household drinking water is explained by the model. The rest of the percentage which were not covered may be due to the limitations of this study such as the sample size of the study which may be considered as small.

### **7.3 Recommendations**

Since type of place of residence has been found to be important in determining the incidence of diarrhoea among children less than five years, programmes such as Livelihood Empowerment Against Poverty (LEAP) which aim at reducing poverty should be enhanced to enable more households have the means to be able to take care of their infants. Infrastructure development such as construction of drainage and the provision of toilet facilities should be enhanced for the eradication of child morbidity and mortality. Mothers should be taught that

utensils used in weaning or introducing complementary feeds are as important as exclusive breast feeding.

Secondly, under-five children whose mothers were in the richer and richest wealth quintile are less likely to have under-five diarrhoea incidence compared to their counterparts whose mothers were poorest. This is because mothers in these categories are able to report diarrhoea incidence to the health centers quickly compared to those in the poorest wealth quintile. Although source of drinking water was not statistically significant in explaining diarrhoea incidence among children, future research including the DHS studies should incorporate variables including the process of handling of water from the source to the household level and how its storage in the various homes prior to use. This is, to be able to ascertain the effect of drinking water on diarrhoea and not to limit the analysis to the source of water to examine the incidence of diarrhoea which may have its limitations. This is because the source of water could be good but could be contaminated through handling between the source and the point of use.

Finally, since there is a relationship between a child's age and diarrhoea disease especially from age one and above, it is recommended that women should not only be educated on exclusive breastfeeding and immunization, but also on how to handle complimentary food practices of their children especially in the second half of the infant's life when immunity is weaker to avoid contamination and to prevent child morbidity and mortality. The focus should also be on personal and environmental hygiene practices among women both at the household and community levels. Public health authority must take up the challenge to intensify

the education for women on how best to take care of their under-five children and many other environmental practices like not allowing children to defecate indiscriminately on the ground and also exposing them to dirty ground or floor. Mothers should be encouraged to use improved type of toilet facility and adopt regular hand-washing with soap and water before feeding children to reduce the outbreak of infectious diseases like diarrhoea.

It is also recommended that the overall attitude of a mother to her child, relative to taking care of them in terms of promptly seeking assistance at health centers when they are not well, the importance which should be attached to childcare in terms of not feeding them with contaminated foods and water and the total wellbeing of the under-five child from birth to at least age five of the child life should be given much attention by the mothers. This must be deeply highlighted in the Ghanaian society to reduce or eliminate the incidence of diarrhoea among children less than five years in Ghana.

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