

**THE EFFECT OF IMPROVED SANITATION ON CHILD
HEALTH IN GHANA.**

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DECLARATION

This is to certify that this thesis is the result of research undertaken by Fatima Nkansah towards the award of the Master of Philosophy (MPhil) degree in Economics at the Department of Economics, University of Ghana. I hereby declare that with the exclusion of references made to other people's works, which have been appropriately acknowledged, this thesis is entirely my own work under the guidance of my supervisors and neither part nor whole of it has been presented for another degree elsewhere.

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ABSTRACT

Adequate sanitation is an important component for the development of any country. It is a basic necessity required by every human being the world over to live a decent and dignified life. But almost a third of all people worldwide do not have access to this basic amenity the majority of whom can be found in Sub-Saharan Africa. This has contributed immensely to diarrhoeal morbidity and consequent mortality among people especially children under-5.

Though there are studies on the effect of sanitation on under-5 morbidity due to diarrhoea in Ghana, most of these are case-control studies. Few studies have made use of population based data such as the Ghana Demographic and Health Survey for this purpose. The current study fills this gap by investigating whether there is a relationship between improved sanitation and under-5 morbidity due to diarrhoea using data from the 5th round of the Ghana Demographic and Health Survey. A logit model is employed. The result showed a negative relationship between access to improved sanitation and under-5 morbidity due to diarrhoea. A strong and significant association was also found between under-5 morbidity due to diarrhoea and improved drinking water source, maternal education, household wealth, child's birth-weight, and age and breastfeeding status of the child. The study therefore recommends that policy makers should endeavour to enforce laws on the provision and use of safe sanitation by households. Furthermore, policy on girl-child education should be enforced to the letter and better still ensure that girls are well enrolled at the tertiary level. In addition, measures should be implemented to ensure the provision of safe drinking water to the entire population.

DEDICATION

I dedicate this thesis to my son, Taha Asamoah Muhammad Adam.

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TABLE OF CONTENTS

CONTENT	PAGE
DECLARATION	ii
ABSTRACT.....	iii
DEDICATION	iv
ACKNOWLEDGEMENTS	v
LIST OF FIGURES	xii
LIST OF TABLES	xiii
CHAPTER ONE	1
INTRODUCTION	1
1.1 Background	1
1.2 Problem Statement	6
1.3 Objectives of the study	7
1.4 Hypothesis of the study	8
1.5 Significance of the study	8
1.6 Organisation of the study	8
CHAPTER TWO	10
LITERATURE REVIEW	10
2.1 Introduction	10
2.2 Theoretical Literature	10
2.3 Empirical Literature	18
2.3.1 Environmental determinants.....	19
2.3.2 Household and Maternal Characteristics	25

2.3.3 Child Characteristics.....	29
2.4 Conclusion.....	31
CHAPTER THREE	33
OVERVIEW OF SANITATION IN GHANA	33
3.1 Introduction	33
3.2 Sanitation Facility Coverage in Ghana - Statistical Overview.....	33
3.3 Policy structures	37
3.3.1 Public Sector.....	38
3.3.2 Sector Agencies and Departments	39
3.3.3 Policies and Programmes.....	41
3.4 Challenges with Water Supply, Sanitation and Hygiene Education	42
3.5 Conclusion.....	44
CHAPTER FOUR.....	45
METHODOLOGY	45
4.1 Introduction	45
4.2 Model Specification and Empirical Framework	45
4.4 Definition of Variables and Expected Signs	49
4.4.1 Dependent variable	49
4.4.2 Explanatory variables	49
4.5 Method of analysis	55
4.5.1 Justification for the application of the logistic regression in the study	55
4.6 Data source	57
4.7 Conclusion.....	58
CHAPTER FIVE	59
DISCUSSION OF RESULTS	59

5.1 Introduction	59
5.3 Descriptive Statistics of the Explanatory variables.....	59
5.3.1 Sanitation and Water supply.....	59
5.4 Results from the Logit Estimation	63
5.5 Conclusion.....	69
SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS	71
6.1 Introduction	71
6.2 Summary of the study	71
6.3 Policy Recommendations.....	73
6.4 Limitations of the study.....	75
REFERENCES	77

LIST OF ABBREVIATIONS

ADRA	Adventist Development and Relief Organisation
AfDB	African Development Bank
AFD	Agence Francaise de Developpement
AMA	Accra Metropolitan Area/Assembly
CDD	Centre Democratic Development
CIDA	Canadian International Development Agency
CONIWAS	Coalition of NGOs in Water and Sanitation
CWSA	Community Water and Sanitation Agency
DAs	District Assemblies
DANIDA	Danish International Development Agency
DfID	(UK) Department of International Development
ESP	Environmental Sanitation Policy
ETCs	Entity Tender Committees
FBO	Faith-Based Organisation
GDHS	Ghana Demographic and Health Survey
GDP	Gross Domestic Product
GTZ	German Technical Cooperation

GPRS	Ghana Poverty Reduction Strategy
GSS	Ghana Statistical Service
HIV/AIDS	Human Immune Virus/ Acquired Immune Deficiency Syndrome
JICA	Japan International Cooperation Agency
KVIP	Kumasi Ventilated Improved Pit (latrines)
MDGs	Millennium Development Goals
MICS	Multi Indicator Cluster Survey
MLGRDE	Ministry of Local Government, Rural Development and Environment
MMDAs	Metropolitan, Municipal and District Assemblies
MWRWH	Ministry of Water Resources, Works and Housing
NCWSP	National Community Water and Sanitation Programme
NGOs	Non-Governmental Organisations
NWP	National Water Policy
OLS	Ordinary Least Squares
ORS	Oral Rehydration Solution
SHEP	School Health Education Programme
TMA	Tamale Metropolitan Area

UNICEF	United Nations Children's Emergency Fund
UNFPA	United Nations Population Fund
UN-WDPAC	United Nations Water Decade Programme on Advocacy and Communication
USAID	United States Agency for International Development
VIP	Ventilated Improved Pit (latrines)
WASH	Water, Sanitation and Hygiene
WC	Water Closet
WDs	Works Departments
WHO	World Health Organisation
WRC	Water Resource Commission
WSDBs	Water and Sanitation Development Boards
WSP	Water and Sanitation Programme
WSS	Water Supply and Sanitation
WSSCC	Water Supply and Sanitation Collaborative Council
WVI	World Vision International

LIST OF FIGURES

Figure		Page
3.1	Sanitation coverage in Ghana.....	36

LIST OF TABLES

Table		Page
5.1	Distribution of sample by type of sanitation and sources of drinking water used by household.....	60
5.2	Sample distribution of selected covariates.....	62
5.3	Descriptive statistics of the explanatory continuous variables.....	63
5.4a	A simple logistic model on the probability of childhood diarrhoea in Ghana.....	64
5.4b	A multivariate logistic model on the probability of childhood diarrhoea in Ghana.....	64

CHAPTER ONE

INTRODUCTION

1.1 Background

Health is only possible where a household or a neighbourhood community has access to adequate resources to meet their needs and ensure the protection of both the household and the work environment from life-threatening pollutants, pathogens, physical hazards and environmental and social stress. Some of these defence mechanisms according to Songsore and McGranahan (1993) include, among other things, access to improved sanitation. But this continues to be one of the world's major challenges and particularly in the rapidly growing cities of developing countries (Foo, 1997 cited in Jin *et al.*, 2006).

Improved sanitation has been defined diversely in the literature. The UN-Millennium Project (2005) has defined safe sanitation as access to excreta and waste water facilities and services that provide privacy and dignity while at the same time ensuring a clean and healthy living environment both at home and in the immediate neighbourhood of users. Accordingly, WHO/UNICEF (2012) also defines it as one that hygienically separates human excreta from human contacts.

It is however important to note that only users of improved sanitation facilities are considered as having access to sanitation on condition that the facility is neither shared by multiple households nor public (WHO/UNICEF, 2012). Facilities in the improved

category can be said to include flush or pour flush to piped sewer systems, septic tank and pit latrines; ventilated improved pit latrines (VIP) and composting toilets. This indicates that any sanitation facility that does not fall within this category is not safe and users are considered as having no access to sanitation. Hence, unsafe facilities may include flush or pour flush to elsewhere, pit latrine without slab or open pit, bucket or hanging latrine, and open defecation.

The UN-Millennium Development Goal target 7c seeks to halve by the year 2015, the number of people who have no access to sustainable drinking water and basic sanitation (United Nations, 2002). As of 2010, an estimated 2.5 billion people worldwide were still without access to improved sanitation suggesting that many countries were off track in meeting the MDG sanitation target, including much of sub-Saharan Africa and several of the most populous countries in Asia (WHO/UNICEF, 2012). It can be argued that about a third of the world's inhabitants are at serious risk of exposure to sanitation related diseases and the most affected sections of the city are slum dwellers (WSP, 2012). Conditions are most severe in sub-Saharan Africa, where 64% of the population is without access to safe sanitation, and deaths due to diarrheal diseases are greater than in any other region (WHO/UNICEF, 2012).

Burden of disease analysis suggests that lack of access to adequate sanitation, safe water supply, and hygiene is the third most significant risk factor for poor health in developing countries with high morbidity and mortality rates (WHO, 2002). High diarrhoeal

morbidity and mortality in infancy and childhood in developing countries have been proven to be largely due to lack of access to safe sanitation given that exposure to diarrhoea-causing agents is frequently related to the use of contaminated water and to unhygienic practices in food preparation and disposal of excreta (WHO/UNICEF, 2004). An estimated 1 billion episodes of diarrhoeal disease occur worldwide with consequent mortality of about 2.2 million people per year (Montgomery and Elimelech, 2007). This figure excludes disease burden associated with other sanitation related diseases such as intestinal helminthes, schistosomiasis, and trachoma.

Of the many sanitation related diseases, diarrhoea has been recognised as the leading cause of morbidity and mortality among children under-5 years of age the world over (Black et al, 2010). In addition, the long-term consequences of diarrheal diseases have been linked to secondary health impacts, such as malnutrition and reduced cognitive function in children (Montgomery and Elimelech, 2007). The burden of diarrhoeal disease disproportionately affects young children in low- and middle-income countries who have higher incidence rates due to inadequate water and sanitation and nutritional risk factors, such as suboptimal breastfeeding and zinc and vitamin A deficiency (Lamberti et al, 2011; Brown et al, 2009). Children living in impoverished areas also have higher case-fatality rates compared to children living in high-income countries due to lack of access to quality health care and timely and effective treatment with Oral Rehydration Solution (ORS) and zinc (Santosham et al, 2010).

Ghana, like any other developing country, faces the challenge of managing effectively basic sanitation issues. Urban growth in the country, as in many other countries, is characterized by unplanned settlements where municipal authorities have been unable to enforce laws on the provision and use of adequate sanitation alongside this development (Crook and Ayee, 2006). Moreover, governments over the years have not released the budgeted funds allocated to the sub-sector thereby depriving millions of Ghanaians access to safe sanitation (Republic of Ghana, 2009). According to statistics, the population of Ghana grew by 9.4 million from 1990 to 2000, but only 2.3 million citizens secured access to safe sanitation over the same period.

Overall, nearly 21 million equivalent to 87% of the 25 million people in Ghana are without access to safe improved toilet, while about 54% use shared latrines and 20% practice open defecation (WSP, 2012). Open defecation not only has higher costs than any other sanitation practice, it has considerable adverse social impacts as people are affected by their neighbours' and community's sanitation status as well as their own (WSP, 2012). Inadequate sanitation, for instance, is the major cause of the outbreak and spread of communicable diseases such as diarrhoea (Adubofour et al., 2013).

The health status, especially child health in Ghana is relatively far from ideal compared to other countries in Sub-Saharan Africa. Demographic and health indicators in Ghana have been poor and have shown only slow improvement over the years, while the demand for health care is on the rise. Diarrhoea morbidity levels in general and

particularly among children under-5 are quite high and especially in slum areas of the country (Adubofour, et al, 2013). Diarrhoea happens to be the second most treated disease in most health facilities in the country (Boadi, 2004). Moreover, infant and child mortality rates are high, but within the range expected, given the country's income level, and consistent with those in the Sub-Saharan African region. Infant mortality rates (per 1000 live births) recorded in 2008 and 2013 were 50 and 39 respectively whilst the under-five mortality rate (per 1000 live births) for the same years were 80 and 72 respectively (UNICEF, 2013). Nevertheless, improvement in the above health outcomes has been slow compared with Gross Domestic Product (GDP) growth since 2002.

This study seeks to empirically examine the association between sanitation and under-5 morbidity in Ghana for which more comprehensive data is available. As in other research works (Clasen, et al. 2012; Deribew, 2007; Osumanu, 2007; Boadi and Kuitunen 2005), this study relies on under-5 morbidity as a measure of health outcome because studies have revealed that sanitation related diseases such as diarrhoea mostly affect children. Hence, under-5 morbidity may give a better measure of health though this measure may be imperfect. Besides, it is relatively easy to obtain data on this indicator of health outcome in Ghana. Data on children under-5 across households in Ghana contained in the 2008 Ghana Demographic and Health Survey (GDHS) is used for this analysis.

1.2 Problem Statement

Improved sanitation has significant impacts not only on health but on social and economic development, particularly in developing countries, as it leads to the disruption of the transmission paths for many gastro-intestinal and other infectious diseases (Montgomery and Elimelech, 2007). It is estimated that about 10% of the global burden of disease is associated with lack of access to adequate sanitation with diarrhoea killing approximately 2.5 million children under-5 annually (WHO/UNICEF, 2012). In Ghana, almost 19,000 people including 5,100 children die annually from diarrhoea of which nearly 90% is directly attributed to poor sanitation, water and hygiene (WSP, 2012). This largely preventable disease burden affects not only individuals and families but puts pressure on health care systems and jeopardises economic productivity (WSP, 2012).

Though there is a lot more to be done to improve sanitation to impact positively on child health, there is usually less interest in sanitation hence till date sanitation initiatives have attracted little support. According to WaterAid (2013) between 2008 and 2011, the Government of Ghana spent an average of 0.3% of the country's GDP on sanitation and water combined. This amount was far short of the 0.5% of GDP that the Government of Ghana committed to spending on sanitation alone. Whilst, US\$ 290 million (about GH¢580 million) is lost due to poor sanitation, open defecation costs the country GH¢79 million every year. According to the 2011 Multi Indicator Cluster Survey (MICS), 23 out of every 100 Ghanaians practice open defecation on a daily basis, which represents over 5.7 million people (Health Statistics, 2013).

Indicators of health, particularly under-5 mortality due to diarrhoea have not shown much signs of improvement. Approximately 13,900 adults and 5,100 children below the age of 5 years die through diarrhoea every year-nearly 90% of which is directly attributed to poor water, sanitation and hygiene (WSP, 2012). Based on the information provided above, the following research questions arise;

- What is the association between sanitation and under-5 morbidity due to diarrhoea in Ghana?
- What are the other significant correlates of under-5 morbidity due to diarrhoea in Ghana?

1.3 Objectives of the study

The main objective of the research is to empirically assess the association between improved sanitation and under-5 morbidity due to diarrhoea.

Specifically, the study seeks to;

- Investigate the relationship between improved sanitation and under-5 morbidity due to diarrhoea in Ghana.
- Examine other significant correlates of under-5 morbidity due to diarrhea in Ghana.

1.4 Hypothesis of the study

Ho: There is no significant association between sanitation and under-5 morbidity due to diarrhoea in Ghana

H1: There is no significant correlation between sanitation and under-5 morbidity due to diarrhoea in Ghana

1.5 Significance of the study

This work is significant because most of the studies that have been conducted on sanitation in Ghana have been on the sanitation situation of the country from household demand for improved sanitation to willingness to pay for improved sanitation services (Awunyo-Vitor, et al. 2013; Amfo-Otu, et al 2012; Spencer, 2012; Atuahene, 2010; Whittington et al, 2010). However, few studies have been conducted on the effect of sanitation on under-5 morbidity due to diarrhoea in the country employing the case control design. Due to this gap in the literature, the study proposes to help fill the gap by providing empirical evidence on the association between improved sanitation and under-5 morbidity due to diarrhoea in Ghana.

1.6 Organisation of the study

The study is organised in six chapters. Chapter one consists of the background to the study, the statement of the problem as well as the research questions, objectives, the significance, and the organisation of the study. The next chapter, chapter two, constitutes a review of relevant literature. The overview of sanitation in Ghana is contained in

chapter three and chapter four describes the research methodology and the source of data to be used in the study. The data analysis, interpretation, and discussions are presented in chapter five. Chapter six provides the summary, conclusion, policy recommendations and limitations of the study

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The aim of this chapter is to review relevant literature on the effect of improved sanitation facilities within the household on the health of the child. Literature on the determinants of under-5 morbidity and consequent mortality shall also be reviewed following the objectives of the study. A child's demand for health is a derived demand and it is dependent on the demand for health of the adult caregiver be it the mother or the guardian hence the theoretical literature will focus on the demand for health as propounded by Grossman (1972). The route of the diarrhoea pathogen is through ingestion of contaminated water or food hence the empirical review will offer insights into literature on the preferred topic in addition to water supply. Though empirical studies on the topic in Ghana are scanty, studies in other developing and developed countries will be reviewed for policy purposes. The ultimate goal of this chapter is to bring to fore the theoretical and empirical underpinning of the study.

2.2 Theoretical Literature

The study utilises the demand for health theory, propounded by Grossman (1972). The model treats social, economic, and environmental factors as inputs of the production of health of the individual. In his theory, Grossman (1972) posited that an individual is born with a certain level of health stock that diminishes overtime but can be augmented through acts of investment, ie, the individual is a producer of health. This assumption therefore means that the individual combines several variables to produce good health.

According to Grossman (1972), the available health stock produces a stream of “healthy time” payoffs that determine market participation (investment aspect) and non-market participation (consumptive aspect). Because no one wants to be sick, health becomes a consumption good when a reduction in sickness time increases utility. On the other hand, health becomes an investment good when health is seen as an asset because a reduction in sickness time increases labour income. Accordingly, a stream of “healthy time” enjoyed by the child indirectly increases the utility of the mother since a reduction in sickness time for the child will allow for increased payoff in health as an investment good and health as consumption good for the mother. This theory has further been expanded and simplified by several authors making it a widely used concept in health studies.

Preceding Grossman (1972) is the work of Gary Becker in 1965. In the Gary Becker model, the health production function specifies how the human capital model is explained in the demand for health. The household production function model of consumer behavior explains the process through which improved sanitation as one of the many inputs into the production function is transformed to produce an output of health. This model by Becker has also been used extensively to examine the factors which affect under-5 morbidity. However, Becker’s model examines only wage effect on the health of the individual

Contributing to the discussion on health as consumption good and health as investment good, Muurinen (1982) concluded that health stock depreciates with age. The health stock of older people depreciates faster than younger ones. As age continues to increase,

health stock depreciates and this increases demand for medical care. Age therefore has a negative effect on health as an investment good but positive effect on health as consumption good.

Using the general production function for child quality, Becker and Tomes in 1976 indicated that it is not enough for parents to be endowed with income. Parents' income must be spent on the quality of children for their health to improve. They concluded that there is a positive relationship between parent's expenditure on child quality and child health.

In their demand function for health, Zweifel and Breyer (1997) discussed the effect of wages on a person's health status. They followed Grossman in their categorisation of health as consumption good and health as investment good. Zweifel and Breyer (1997) showed that the higher the lifetime wage, the lower the incentive to hold health as a consumptive good and the higher will be the marginal incentive to hold health as an investment good. Therefore, the lifetime wage effect on health as a pure consumptive good is negative but positive on health as a pure investment good. Since wages affect the health of a mother and the health of the mother affects the health of the child, wages affect child health.

Furthermore, Zweifel and Breyer (1997) arrived at the same conclusion as that of wage in their discussion of schooling effect on health. Thus, education has a negative effect on health as consumption good. This is because educated people do not like to be sick

considering the amount of labour income they stand a chance to lose. Therefore, an educated person lives cautiously when it comes to health matters with the effect of lowering the rate of depreciation. An individual will invest more in his or her health just to keep healthy at all times. Hence education is positively related to health as an investment good.

However, in 2000, Grossman made a modification to the demand for health theory with its model built on the inter-temporal utility function represented by:

$$U_t = U(\phi_t H_t, Z_t), t = 0, 1, \dots, n \dots \dots \dots (1)$$

Where;

H_t = Health stock at time t ;

ϕ_t = Service flow per unit stock at time t ;

$\phi_t H_t$ = Total consumption of health services at time t ; and

Z_t = Consumption of other commodities at time t

According to Grossman (2000), the individual's health status is determined by the consumption of health care and a vector of environmental, socioeconomic and demographic factors. Hence death occurs when an individual's health stock at a particular time is less than or equal to some minimum amount of health stock required to survive ($H_t \leq H_{min}$).

This assumption demands that an individual must aim at investing in his or her health in order to live. Therefore, an individual's life span is determined by the quantities of health capital that is maximised subject to a production function and resource constraints. Given this assumption, the net investment in the stock of health is defined as the gross investment minus the rate of depreciation of the health stock. That is;

$$NetI = I_t - \delta_t H_t \dots \dots \dots (2)$$

Where;

δ_t = Depreciation rate in the t^{th} period and

I_t = Gross investment at the t^{th} period

H_{t+1} = The amount of health investment of the individual at time $t+1$

H_t = the amount of health investment the individual makes at time t

To Grossman, the depreciation rate is exogenous but depends on age and lies between zero and one, that is,

$$0 < \delta < 1$$

Consumers are assumed in the model to produce gross investment (I) in health (H) and other composite goods (Z) in the utility function according to the set of household production functions given by:

$$I_t = I_t(M_t, TH_t; E) \dots\dots\dots (3)$$

$$Z_t = Z_t(X_t, T_t; E) \dots\dots\dots (4)$$

Where;

M_t = Vector of inputs, like medical care purchased to contribute to the gross investment in health at time t ;

TH_t = Time input for health at time t ;

E = Stock of knowledge of the consumer and it is exogenous;

X_t = Vector of inputs for the production of the composite goods (Z) at time t ;

T_t = Time input for Z at time t

Equations (3) and (4) assume that, E does not vary over an individual's life time.

Again, M_t , X_t , TH_t and T_t are assumed to be scarce resources, therefore, the goods budget constraint equates the present value of expenditures on goods to the present value of income over the life cycle plus the initial asset of the consumer (discounted property income). This is presented by:

$$\sum_{t=0}^n \frac{P_t M_t + Q_t X_t}{(1+r)^t} = \sum_{t=0}^n \frac{W_t T W_t}{(1+r)^t} + A_0 \dots\dots\dots (5)$$

Where;

P_t = Price of M_t ;

Q_t = Price of X_t ;

W_t = Hourly wage rate at time t ;

TW_t = Total hours of work;

A_0 = Initial assets;

r = Market interest rate.

The time constraint is also given as:

$$\Omega = TW_t + TH_t + TZ_t + TL_t = 365 \dots\dots\dots (6)$$

Where;

Ω = The total amount of time available in any given period and it is fixed.

TW_t = Time allocated for work at time t ;

TH_t = Time input for health at time t ;

TZ_t = Time input for other commodities (Z_t);

TL_t = Time lost due to illness at time t .

Given the above information, we maximize the utility function in equation (1) subject to equations (3) to (6) and the resulting equation becomes the optimal health capital to be

attained from the investment in health. With further manipulations, Grossman (2000) finally arrived at the reduced form equation for health as:

$$\ln H = \alpha \ln M_t + \rho_H E - \delta_t - \ln \partial_0 \dots \dots \dots (7)$$

Where ρ_H measures the percentage increase in the health production due to a unit increase in stock of knowledge (E) and ∂_0 is the disturbance term.

From equation (7), the health production function is a function of health inputs (medical care) represented by M_t , human capital (stock of knowledge/education) given by E and the depreciation rate of health (δ_t) which is associated with age. Again, Grossman posited that wealth, wage rates, the price of medical care and age can influence the demand for health. According to him, wealth and wage rate influence the demand for health positively whereby an increase in an individual's wealth or wage will lead to an increase in the demand for health. Conversely, the price of medical care and age has a negative relationship with the demand for health.

It is important to note that the health of the mother affects the health of the child. However, the major limitation still remains that the health of the mother is not known to the researcher. The health of the child can either improve or deteriorate even in the presence of adequate sanitation. This suggests that there may be child morbidity depending on household and maternal characteristics. Also, Grossman assumes that the total time available to the individual apportioned to be spent on work, consumption of

other composite goods including leisure, sickness and investing in health all add up to 365 days.

2.3 Empirical Literature

The effect of improved sanitation on child health can be depicted using a conceptual framework developed by Wibowo and Tisdell (1992). Their framework consists of non-medical determinants of health in which sanitation and water supply are the main treatment variables incorporated into the health production function. This model has been adopted by quite a number of authors in their study of the relationship between sanitation and child health. Several of these literature examined socioeconomic, maternal and child characteristics as control variables in addition to safe sanitation (Fening and Edoh, 2009; Osumanu, 2007; Boadi and Kuitunen, 2005; Bour, 2003; Gyimah, 2003, 2002; Ahiadeke, 2000). Thus, this study also looks at the relationship between maternal, socioeconomic and child factors and under-5 morbidity due to diarrhoea in addition to the main treatment variable – improved sanitation. Logistic regressions have been widely used in most of the influential studies undertaken in different countries. This is because in studying health outcomes, the interest is in relative effects of the independent variables and the logistic regression gives us this outcome.

2.3.1 Environmental determinants

2.3.3.1 Improved Sanitation and safe drinking water

Several studies have examined the relative importance of adequate sanitation and safe drinking water in the reduction of child morbidity. However, some of these studies found no relevant relationship between adequate sanitation and safe drinking water and child health. One of such studies is that of Rahman and colleagues in 1985. They analysed cross-sectional data from two villages in Bangladesh to assess the impact of environmental sanitation and crowding on infant mortality. To investigate this impact, 2471 infants born in 1976 and 1977 were followed up for a year. The indicators used for the environmental variables were sanitation, water supply and household size and the health indicators were neonatal and post neonatal mortality among these children. Using a multiple logistic regression analysis and controlling for some socioeconomic, demographic and biological factors, they found out that the presence of a sanitation facility in the home as well as small household size reduces the incidence of post neonatal mortality whilst a standard water supply had a negative but statistically insignificant effect. For neonatal mortality, there was no significant relationship with the environmental variables investigated.

Similarly, a study by Lee et al (1997) set out a framework for estimating the effects of health interventions that takes into account the three principal mechanisms by which improvements in the health infrastructure augment children's health: by affecting the magnitude of parental resources allocated to the health of children, by influencing who among children born survive, and by directly affecting the health of survivors given

parental resource allocations. They devoted particular attention to the nonrandom allocation of household resources to children and to the selectivity effects of alterations in health interventions through their effect on child survival. Estimates were obtained from data sets describing child health and survival, sanitation facilities, drinking water sources, and child-specific nutritional intake from Bangladesh and the Philippines. Semi-parametric estimators were used in the context of a structural equations system to estimate the effects of the health infrastructural variables on child survival and the effect of increased calorie consumption and of improvements in the water and sanitation on measures of children's nutritional status net and gross of these interventions on child survival. They concluded however that, neither variations in water sources nor improvements in sanitation facilities appeared to significantly affect child survival.

Likewise, the cross-sectional epidemiological study on water and sanitation practices in the Northern Region of Ghana undertaken by Peletz in 2005 could not establish a relationship between sanitation and diarrhoeal illnesses. The analysis compares diarrhoeal illness with different exposure factors including sanitation access, filtration of drinking water and community type (traditional and modern). However, the presence of sanitation facility at home reduces the risk of diarrhoeal morbidity among household members. The only statistically significant relationship was found between filtration of drinking water and diarrhoeal morbidity among household members.

Such results may be expected due to some methodological issues encountered by these researchers such as the health outcomes as well as the method of analysis employed. The results obtained by Rahman et al (1985) may be attributed to the fact that neonatal mortality has been found to be influenced chiefly by maternal environment during pregnancy and delivery as well as the traditional unhygienic birth care practices in the study area. This goes to say that the health measures used were inappropriate for such a study as well as that of Lee and colleagues (1997). The measurement of child survival used in their study (anthropometric indicators) have been proven in the literature to understate the effectiveness of improvement in sanitation and water supply in augmenting health using reduced form estimates in evaluating health interventions (Lee et al, 1997). Furthermore, the exposure factors examined by Peletz (2005) were not all found to be statistically significant as their association with diarrhoeal illness may be difficult to detect because of the many exposure factors for diarrhoeal diseases and also because of the small sample size used in the study.

These notwithstanding, there are studies in both advanced and developing countries that confirms improvements in health as a result of access to improved sanitation facilities and safe drinking water though they may not be void of methodological problems.

Employing simple ordinary least squares and logit models to analyse demographic and health survey data from 70 countries, Gunther and Fink (2010) conclude that there are considerable health benefits generated by improvement in sanitation and water infrastructure. They also found that access to advanced water and sanitation technologies

reduces the odds of suffering from diarrhoea among children under-5 by 7.3% and 12.3% respectively and substantial and similar reductions in under-5 mortality risk. There was also a strong evidence of positive health spillovers of access to improved sanitation at all levels. Child diarrhoea and mortality were the dependent variables whilst the uses of sanitation and water infrastructures were the main explanatory variables.

Cronin et al (2008) have also found similar results. In their survey of two refugee camps in Africa they reviewed sanitation and water provision in association with selected health and nutrition indicators. Their study revealed that, at the household level, the household reporting a case of diarrhoea within the previous 24 hours had less water per person per day and poor sanitary conditions than those not reporting any case. Also the poor sanitation conditions, lower access to water supply, malnutrition as well as lack of hygiene education in these camps creates a high burden of morbidity among citizens. They are not only likely to contract many communicable diseases but also suffer from more frequent, severe and prolonged episodes of these diseases of which watery diarrhoea and malaria are highest among the range of diseases.

In his study of household environmental and behavioural determinants of childhood diarrhoea morbidity in the Tamale Metropolitan Area (TMA) Ghana, Osumanu (2007) examined the relative roles of environmental and behavioural risk factors in transmitting diarrhoea in children under-5. A statistical sample of residential areas of the TMA was employed in order to investigate disparities in the prevalence of childhood diarrhoea among households with differing socioeconomic and environmental conditions. Using the

logistic regression analysis, Osumanu (2007) found that there is a significant association between childhood diarrhoea morbidity and toilet sharing. Other significant determinants were source of drinking water either from vendors or drinking water stored in pots and frequent consumption of prepared foods from street vendors. He therefore concludes that the observed differences in incidence of diarrhoea among children under-5 in the TMA show the importance of wealth and affordability of environmental services and incorrect sociocultural practices in the spread of the disease.

The results of Boadi and Kuitunen (2005) also confirm these findings. In their study on childhood diarrhoeal morbidity in the Accra Metropolitan Area (AMA), Ghana, they specifically looked at environmental, socio-economic and behavioural risk determinants of diarrhoeal morbidity among children under-6 years. The results of a survey of two weeks incidence of diarrhoea among children under six years in the metropolis indicated that there is a significant association between diarrhea morbidity and access to sanitation facilities and water. Other variables included in their study were hygiene practices, flies infestation and the regular consumption of street food. The household economic status and education of the mother were also significant determinants of diarrhoea.

Similarly, Meddings and others (2004) researched on the cost effectiveness of a latrine revision programme in Kanbul, Afghanistan by employing a case control design involving 1238 cases and 625 controls of children under-5 and children under-11. Using a logistic regression model, their study revealed that a latrine intervention in Kabul was cost effective in reducing the risk of childhood diarrhoea morbidity and mortality.

Between the two age groups (under-5 and under-11 years), the intervention effectiveness was slightly greater for children under-5 than among children under-11 years indicating that children under-5 are more vulnerable to diarrhoea morbidity than slightly older ones.

In a study by Root (2001), he examined the effect of partial latrine coverage on diarrhoeal morbidity at the household and community levels. Weekly morbidity data on 272 children aged less than 5 were collected for 45 weeks from October 1996 to August 1997 in two neighbouring semi-arid communities in rural Zimbabwe. The communities were similar except for access to safe sanitation, ie, 62% of the children in community A lived in households with latrine and in community B there was no sanitation in any of the households. The study revealed that diarrhoeal morbidity was 68% lower in community A than in community B. this was possibly due to the reduced fecal contamination of the community environment in the presence of latrines. Among the number of variables that were controlled for includes household wealth, maternal education, breastfeeding, sex and age of child.

Using Demographic and Health Survey datasets from Ghana and Nigeria, Ahiadeke (2000) examined whether the protective effects of breast-feeding are greatest where the poorest sanitation conditions prevail. It was found that mixed-fed infants aged between 0 and 11 months tend to have a higher risk of diarrhoea than fully breast-fed children, while the risk of diarrhoea among weaned infants is twice that of mixed-fed infants. The probit regression models employed in the analysis were used to predict the probability of diarrhoea associated with each breast-feeding pattern for both 'poor' and 'good'

sanitation areas. Therefore sanitation and water supply quality have significant health effects on children in particular and that the pattern of breast-feeding either shields the child or increases the risk of diarrhoea among these children.

Furthermore, Huttly et al (1997) in their systematic review of literature on the prevention of diarrhoea in young children in developing countries confirmed the importance of some key preventive interventions such as sanitation and water supply. Other interventions reviewed in the study were breastfeeding, weaning practices and personal and domestic hygiene.

A clinic-based case-control study was conducted in Lesotho by Daniels and colleagues in 1990 to assess the impact of sanitation on diarrhoeal morbidity among children under-5 by performing a logistic regression analysis to model this association while controlling simultaneously for several confounding variables. The results indicate that under-5-year-olds from households with a latrine may experience 24% fewer episodes of diarrhoea than such children from households without a latrine. Parental occupation, maternal education, socioeconomic status and availability of water were among the number of explanatory variables controlled for.

2.3.2 Household and Maternal Characteristics

2.3.2.1 Maternal Education, Mother's Age at Birth, Household Wealth and Place of residence

The role of maternal education in child survivorship has been made evident by several studies on health in developing countries though the effect at the country level is higher

than that at the individual level (Gyimah, 2003). Educated women tend to be more independent than uneducated ones. This gives them empowerment to organise and affect society positively hence maternal education somewhat influences most of the other socioeconomic and demographic determinants of child health. With regard to childcare, which is a significant factor in child survival, the educated woman is keener (Bour, 2003). In Ghana, whereas 73% of mothers without formal education immunised their children against BCG, DPT, polio, and measles between 2004 and 2008, 83.5% of mothers with middle/JSS education did (GSS and MI, 2009). The educated and those of high socioeconomic status utilise health services more than the uneducated and those of low social class.

The survey by Bour (2003) has clearly identified that mothers' education has a significant impact on childhood morbidity and mortality. It could emphatically be hypothesised, going by the survey, that mothers' education exhibits an inverse relationship with childhood mortality. The model that emerges is that mothers who have an appreciable level of education are able to cater better for the health needs of their children. They have access to higher incomes through employment with good pay. With relatively better access to financial resources, they have better access to antenatal and postnatal services, and are in a better health condition to ensure better health of their children.

In two separate papers, Gyimah (2002; 2003) looked at socioeconomic as well as bio-demographic factors that affect child mortality. The first looked at ethnicity and infant mortality in Sub-Saharan Africa using Ghana as a case study and controlled for some

socioeconomic and bio-demographic factors. The socio-economic and locational factors include maternal education, rural-urban place of residence and north-south region of residence and the bio-demographic factors were maternal age at birth, birth order of child, birth spacing and the duration of breastfeeding. He found that in the presence of the socioeconomic and the bio-demographic factors, intrinsic cultural norms were not significant determinants of infant mortality.

The second study accessed the interaction effects of maternal education and household facilities on childhood diarrhoea in Sub-Saharan Africa using Ghana as a case study. He asserts that a good living environment, that is, toilet facilities and safe water, is essential in reducing risk of child morbidity and mortality. Employing a binary logistic regression method, he found that children of mothers who are less educated were the most vulnerable to diarrhoea in the absence of toilet and water facilities. The population based data from the 1998 Ghana Health and Demographic Survey (GDHS) was used for both studies.

In their case-control study on the impact of socioeconomic status and sanitation levels on the prevalence of diarrhoea in the Akim Oda area in Ghana, Fening and Edoh (2009) conducted a survey between August and October, 1998 in the study area to relate socioeconomic differences, as measured by income, education, occupation and housing, among residents in three communities to diarrhoea prevalence. There was clinical and laboratory diagnosis of diarrhoea and administration of structured interview-administered questionnaires to find from residents their demographic, socio-economic, health practices

and status, and to seek their opinions on diarrhoea transmission, control and prevention. The survey revealed that residents from Old-town and Aduasa belong to low social class and was reflected in their high illiteracy, unemployment rates and associated poor sanitation. As such, they had the highest prevalence of diarrhoeal diseases. Contrarily, residents from Quarters residential area were found to belong to high social class, which was reflected in their high literacy, employment rates and good sanitation. As such, they had no case of diarrhoea.

Findings from the World Fertility Survey and DHS surveys indicate that births to young mothers (under age 20 years) and older mothers (35 years and over) are at an elevated risk of dying. Results from the 2008 Ghana Demographic and Health Survey (GDHS) confirm the expected curvilinear relationship between mother's age at birth and childhood mortality. Accordingly, a study by Deribew et al (2007) also indicates that children whose mothers' age were below 20 years were more likely to die before age five than those whose mothers' aged 20 and above.

Household location or area of residence plays a key role in determining under-5 morbidity and consequent mortality in any country. There are tremendous rural-urban differences in terms of provision and availability of economic and social amenities. As a result, mothers and children living in urban areas are more likely to have access to life improving amenities than their rural counterparts. Using the 1987 Saudi National Child Health Survey data in Saudi Arabia, Al-Mazrou et al (1997) conducted a study to find out factors associated with infant and child mortality in Saudi Arabia. The survey was

conducted taking a stratified sample of over 8,400 ever married/divorced/widowed women having at least one child under-5 from over 9,000 households. Since health care facilities are more accessible in urban areas than rural areas, under-5 mortality rates were found to be higher for rural and southern regions and lower for urban and eastern regions. Residential factors are among the most important differentials affecting under-5 mortality.

2.3.3 Child Characteristics

2.3.3.1 Child's Breastfeeding status, Birth-Weight, Age and Sex

UNICEF and WHO recommend that children be exclusively breastfed during the first 6 months of life and that children be given solid or semi-solid complementary foods in addition to continued breastfeeding from 6 months until age 24 months or more when the child is fully weaned. The WHO recommends exclusive breastfeeding of babies for the first 6 months due to its nutritional and protective significance which have been widely proven in the literature. Exclusive breastfeeding is recommended because breast milk is uncontaminated and contains all the nutrients necessary for children in the first few months of life. In addition, the mother's antibodies in breast milk provide immunity to disease. Breast milk has been scientifically proven to safeguard the child against infections and consequent death up to 5 years of age (Deribew et al, 2007; Huttly, 1997; Briend et al 1988).

In his research to estimate a health demand and a health production function for children in Brazil, Kassouf (1993) used the Gary Becker production function model to determine

those household behaviours which affect child health. The inputs of this kind of health production function can either have negative or positive impacts on a child's health. Examples of such inputs which have positive effect are the number of times a child is breastfed per day, the child's consumption of milk, and the presence of a toilet, refrigerator, and water filter. The other inputs which have negative influence are number of sticks of cigarette smoked per day, alcohol consumption and reduced time for breastfeeding. Race, age, gender, parent's age, education and household characteristics are treated as exogenous variables. In Bangladesh, Briend et al (1988) also found that among malnourished children, breastfeeding protected against death from all causes up to 5 years of age.

A child's birth weight or size at birth is an important indicator of the child's vulnerability to the risk of childhood illnesses and the chances of survival. Low birth-weight, defined by the World Health Organisation (WHO) as any baby born with weight of less than 2.5kg, has serious short and long term effects on a person. People born with low birth-weights are more likely to fall ill during childhood, be physically stunted and lag behind their peers in school (Gissler et al, 1999). Accordingly, Ashworth (1998) found that low birth-weight babies 0-59 months old had 60% more days with diarrhoea in Papua New Guinea and 33% more days in Brazil. Similar results have been found in other countries with regards to pneumonia and acute respiratory infections.

Root (2001) in a research on sanitation, community environment and childhood diarrhoea conducted a survey on 272 children under-5 to examine the impact whilst controlling for

some socioeconomic, bio-demographic and child factors. He found out that the age of the child was significantly associated with diarrhoeal morbidity but found no relationship between the child's sex and the risk of diarrhoea. In Lesotho, Daniels et al., (1990) found that diarrhoea episodes among children under-5 were highest in 6-11 month olds. However, there was no statistical significance between age and sex of a child and diarrhoeal morbidity.

2.4 Conclusion

The demand for health theory by Grossman (1972) has been widely used as the conceptual framework on which the association between improved sanitation and health is built. The chapter gave the clarity of problems which have been investigated in the literature. Following Grossman, many authors have categorised health as consumption good and health as an investment good. The discussion went further to examine how various factors such as wage, education, wealth and age affect health both on the consumption and investment components as well as their impact on child survival. The framework set out by Grossman in the demand for health theory has also been developed in this section.

The second part looked at the empirical works that have been undertaken in the area of sanitation in different countries. The review found out that the most commonly used method for such investigations is the logistic regression which examines the relative effect of sanitation as an explanatory variable on the health of children under-5. The section also looked at some household, maternal and child characteristics as determinants

of under-5 morbidity. Some of the commonly found determinants were access to safe sanitation, improved sources of drinking water, mother's age at birth of child, educational level of mother, household wealth, rural urban place of residence, as well as child factors such as birth-weight, breastfeeding status, age and sex. However, the major determinants of under-5 morbidity varied across section.

CHAPTER THREE

OVERVIEW OF SANITATION IN GHANA

3.1 Introduction

The sanitation coverage in Ghana is discussed in this chapter. The chapter also discusses the policy structure of the sanitation sub-sector including the challenges faced by the sub-sector. This study is interested in toilet facilities, hence discussions on sanitation will be limited to toilet facilities.

3.2 Sanitation Facility Coverage in Ghana - Statistical Overview

The sanitation sub-sector in Ghana is combined with that of water, thus, the water and sanitation sector. This is based on the fact that these two are inter-connected in relation to the health of the people (Entsua-Mensah et al, 2007). Despite this, issues on water supply receive greater attention than sanitation and so sanitation lags far behind water supply (Republic of Ghana, 2009; Magala and Roberts 2009). As a result, most of the activities of the institutions involved in the sub-sector borders more on water supply and little is said about sanitation, especially urban sanitation. This is simply due to the high population density in urban areas and individual households cannot be provided with sanitation facilities due to lack of space (Awuah et al, 2009). With the current situation, the MDG sanitation target will be missed by 2015 even if the country doubles its steps towards its achievement but on the aggregate, the water supply target has been met ahead the target year (WSP, 2012; JMP, 2012; Awuah et al, 2009).

At the national level, only a small fraction (13%) of households has access to improved sanitation facilities though there are regional differences. Of the total population without access, 54% use shared facilities, 13% use other unimproved facilities whilst 20% defecate in the open (WSP, 2012). However, the overall sanitation coverage in Ghana is higher than what is estimated with the inclusion of other sanitation facilities in its current definition by the World Health Organisation (WHO) since shared facilities – improved or unimproved - are not included in this category (Awuah et al, 2009).

There are disparities among the various regions in terms of access. Statistics indicate that the urban population has increased tremendously but these are largely concentrated in few regional capitals such as Sekondi-Takoradi in the Western region, Kumasi in the Ashanti region and Accra in the Greater Accra region. However, only Greater Accra and Ashanti regions account for a large urban residence, 90.5% and 60.5% respectively (GSS, 2012). Improved facilities are therefore used by most households in the Greater Accra region (23%) compared to the three northern regions (4%). Ashanti region, which is the most populous region, happens to rank fourth (18.5%) after Eastern (20%) and Western regions (19%) respectively. Central, Volta and the Brong Ahafo regions account for the least of households in terms of access with 13.5%, 13% and 12.7% respectively (GSS, 2012).

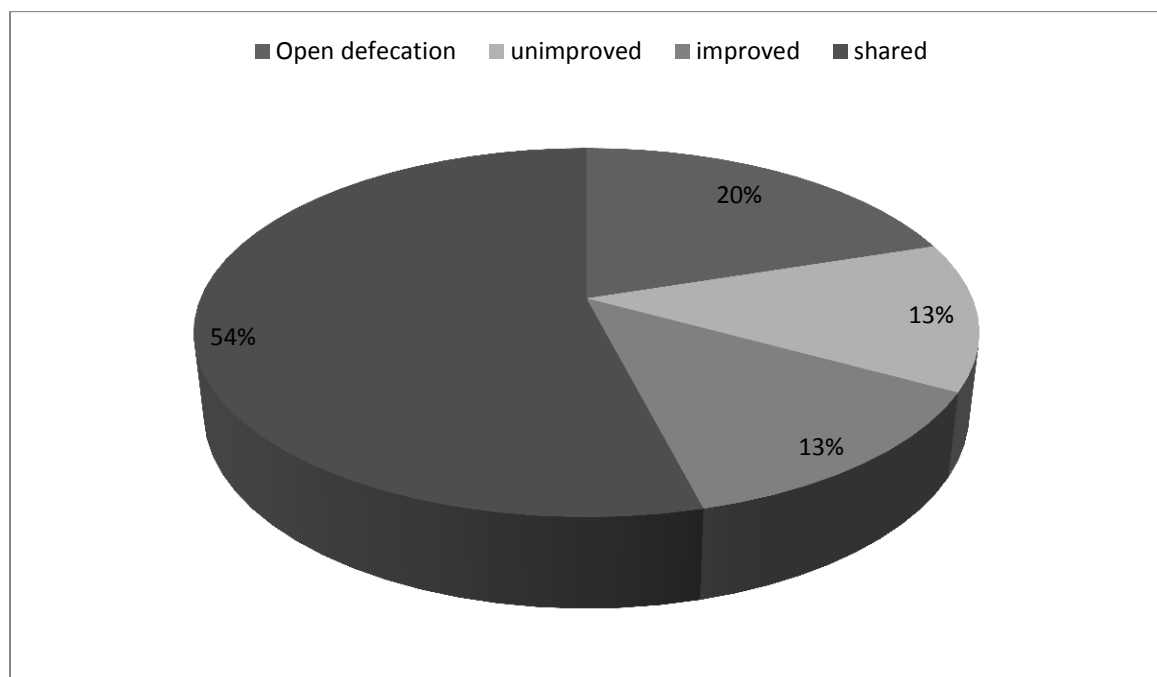
Countrywide, about 16.9% of households have toilet facilities that are exclusively used by their members (this figure, however, include unsafe facilities). Another 26% of households use facilities that are shared with other households in the same house or

households from another house. A small proportion of households (2.8%) use toilet facilities located in another house and shared with other households. Besides, access to improved sanitation is more of urban than rural phenomenon as the rural-urban disparity is very wide. Whilst about 15% of urban households have access to adequate sanitation, only 7% of their counterparts in the rural areas do (GSS and MI, 2009). Such facilities are even scarcer among the rural poor. Moreover, with the exception of the three northern regions, public toilet is the main toilet facility used by large proportions of households in all regions, ranging from 30% in Volta to 44% in Brong Ahafo (GSS, 2012; Boadi, 2004). About 72% of households in the three northern regions have no access to a toilet facility.

Moreover, the well-known sanitation technologies available and used by households in Ghana include: water closets (WC) (15.4%); Kumasi Ventilated Improved Pit latrines (KVIP) (10.5%); Simple Pit latrines (19.0%); Composting toilet, mostly found in rural areas and it is used by 0.1% of the population; and Bucket/Pan latrines mostly used by low-income households and are unhygienic because they have to be emptied by laborers who collect the buckets several times per week (GSS, 2012). They were therefore to be phased out of the country completely. Nevertheless, bucket/pan latrines are still used by about 0.7 % of Ghanaians as at 2010 from 4.0% in 2000 (GSS, 2012). This is due to the slow pace of law enforcement in the sub-sector (Atuahene, 2010). Other technologies include Enviro-Loo; Aqua Privy among others used by about 0.3% of the population. Besides, a large number of the residents in both urban and rural Ghana practice open defecation or defecate in some materials like waste paper or plastic bag. This practice has

been given different terminologies in different cities like ‘wrap and throw’ in Cebu (Philippines) or ‘flying toilets’ in Accra (Ghana) (Atuahene, 2010). Studies have found open defecation to be a serious problem especially in large informal settlements in urban areas of the country (WSP, 2012; Abaitey (2011); Maoulidi, (2010)). Figure 3.1 shows the sanitation coverage in Ghana.

Fig 3.1 Sanitation Coverage in Ghana



Source; (WSP, 2012)

Ghana is a country with a significant number of largely decentralised wastewater and fecal sludge treatment facilities but only a few are in good shape and functioning (Murray and Drechsel, 2011). However, as in many other parts of the developing world, human population growth and waste generation far outstrips their overall capacity. Waterborne sewerage covers only about 5% of households in Ghana, and hence, the majority of

excreta are collected in septic tanks and dry latrines (MLGRDE, 2008). Households, communities and institutions are therefore responsible for hiring companies to collect fecal sludge from septic tanks and public toilets.

Unfortunately, emptying is often deferred due to the cost involved and many of these septic tanks lack properly functioning drain fields and tend to overflow, causing a risk of ground and surface water pollution (MLGRDE, 2008). According to municipal records, the three fecal sludge treatment plants operational in Accra in 2000 received about 90,000 m³ of sludge, while an additional 70,000 m³ could not be absorbed. The excreta from household bucket latrines, normal pit latrines and other improved pit latrines is usually manually collected and discharged untreated into open drains, in the bush or in nearby water bodies (Murray and Drechsel, 2011).

3.3 Policy structures¹

Ensuring good sanitation is the collective responsibility of all citizens, communities, private sector enterprises, Non-Governmental Organisations (NGOs), and institutions of governments. Currently, a number of institutions exist to supervise and regulate water supply and sanitation in Ghana. The policy framework is based on the Ghana Poverty Reduction Strategy (GPRS). At the national level, there are four ministries involved in sanitation. There are also a number of Agencies and Departments involved in the sub-sector as well as Policies and Programmes to serve as guidelines.

¹ Adapted from Water and Sanitation Sector Performance Report| 2009

3.3.1 Public Sector

The Ministry of Local Government, Rural Development and Environment (MLGRDE) is the lead agency in the sanitation sector. It is responsible for creating and coordinating sanitation policy, issuing guidelines on sanitation services and their management, and for supervising the National Environmental Sanitation Policy Coordinating Council. The MLGRDE shares responsibility for setting sanitation policies and coordinating funding for the subsector in association with the Ministry of Water Resources, Works and Housing (MWRWH).

The Ministry of Water Resources, Works and Housing (MWRWH) is responsible for water provision, and oversees the Community Water and Sanitation Agency (CWSA). Furthermore, the ministry solicits funding from external support agencies, monitors the sector, and advises the Cabinet. The Water Sector Restructuring Secretariat, created in 1997 in the Ministry of Water Resources, Works and Housing, oversees the process of private sector participation in the sector.

Through the School Health Education Programme (SHEP), the Ministry of Education is tasked to implement the hygiene promotion and the school health programme in water and sanitation in all educational institutions particularly at the basic level.

The Ministry of Health and the Ghana Health Service are responsible for the management of health services in the country and providing health data, supporting health education activities, and contributing to regulation and standard-setting for health services. The

health sector relies on environmental sanitation data and information to contribute to disease prevention and control.

3.3.2 Sector Agencies and Departments

Established by Act 564 of 1998, the Community Water and Sanitation Agency (CWSA) is a facilitating agency under the Ministry of Water Resources, Works and Housing. It is the main institution in charge of water supply and sanitation in rural and small towns. Its mandate is to facilitate the provision of safe drinking water and related sanitation and hygiene services to rural communities and small towns in Ghana. The Community Water and Sanitation Agency (CWSA) is in charge of coordinating and facilitating the implementation of the National Community Water and Sanitation Programme (NCWSP) in rural areas, which is carried out directly by the communities and their District Assemblies. The institution does not directly construct, operate, and maintain facilities for water supply and sanitation. Instead, its role is to coordinate the work of a number of actors which carry out the services in rural areas, including public sector organisations, local beneficiary communities, private sector organisations, and NGOs. The CWSA is also expected to ensure that financial support from development partners is effectively used. The agency operates in ten regional offices besides its head office in Accra. The CWSA has become a preferred body through which foreign donors work to implement projects related to water and sanitation. Most of the actual sanitation work in Ghana is done at the metropolitan, municipal and district assembly (MMDA) level. At the district level, the CWSA works through Water and Sanitation Development Boards (WSDBs).

Established under the Local Government Act, 462, Metropolitan, Municipal and District Assemblies (MMDAs) are responsible for the preparation of the District Water and Sanitation Plans. This responsibility, however, does not include urban water supply. MMDAs play a crucial role of ensuring that facilities provided to rural and small towns are adequately managed and maintained. They are required to ensure that Water and Sanitation Committees and Water and Sanitation Development Boards are formed and given recognition to manage rural and small town water facilities provided. MMDAs are also expected to establish a budget line for water and sanitation either through central government allocations or through internally generated funds.

Development partners play a very important and indispensable role in Ghana's water and sanitation sector. These roles extend from financial assistance to technical assistance and, through participation in (and sometimes championing) sector dialogues, contribute to development of sector policies and strategies. There are many external development assistance partners working in the sector. Development partners currently contribute about 80% of total WASH sector funding. The partners include: African Development Bank (AfDB), Agence Française de Développement (AFD), CIDA, DANIDA, GTZ, DfiD, European Union, Japan International Co-operation Agency (JICA), Netherlands, UNICEF, International Water and Sanitation Centre, and the World Bank.

Though currently difficult to estimate the exact contribution of Non-Governmental Organisations (NGOs) in Ghana's Water and Sanitation sector in terms of financing, there is a lot of field evidence to suggest that the significant presence of both

international and local NGOs and Faith-Based Organizations (FBO) in the WASH Sector in Ghana is indeed helping to accelerate sector growth.

WaterAid, World Vision International (WVI), Church of Christ, the Catholic Church, Plan International and Adventist Development and Relief Organization (ADRA), are among international NGOs sometimes playing roles of donors and implementers. The formation of the Coalition of NGOs in Water and Sanitation (CONIWAS) in 2003 has also contributed to a better sector coordination, having been collaborating with the MWRWH and its agencies, particularly CWSA. In effect this has enabled CONIWAS to bring its members to conform to sector's procedures and guidelines, a situation which was previously missing.

3.3.3 Policies and Programmes

Ghana's national Environmental Sanitation Policy (ESP) was developed in 1999 in consultation with a variety of stakeholders and covers the broad spectrum of environmental sanitation including solid and liquid waste, industrial and hazardous waste, storm water drainage, environmental and hygiene education, vectors of disease, and disposal of the dead (Republic of Ghana 1999). The policy identifies many of the major problems and constraints in environmental sanitation, including the lack of assigned roles for governmental bodies, the lack of capacity and skilled professionals at all levels, and the problems associated with the transfer of responsibilities for environmental sanitation without the corresponding budget, personnel, and equipment transfers. The policy then lays out its strategy to deal with these problems. It was however revised in 2007.

To overcome the lack of coordination between the numerous sector institutions, the National Water Policy (NWP) was launched in February 2008, which covers water resources management, water supply and sanitation. Although the sector has made progress, a lack of coherence in policy formulation resulted in a multitude of implementation strategies. The NWP aimed to formulate a comprehensive sector policy and to make it easier for development partners to provide the necessary support to the sector. The NWP had been prepared by the Water Resources Commission (WRC) since 2002.

In 1992 Ghana initiated the National Community Water and Sanitation Programme (NCWSP) to provide solutions to the problems of water and sanitation in rural communities and small towns. The NCWSP was launched in 1992 to address the challenge of providing water to rural communities and small towns in Ghana. To ensure the implementation of the programme, the Community Water and Sanitation Agency (CWSA) was established.

3.4 Challenges with Water Supply, Sanitation and Hygiene Education

The water and sanitation sector is confronted with some challenges since its inception. These challenges include: budget constraints, limited capacity at district assembly level for water and sanitation service delivery, lack of legal power to enforce guidelines and standards, long processes involved in the use of the procurement law, among others.

To begin with, the sector has not received the full complement of its annual budget either from government or its development partners over the years. In the case of government

there has been little or no contribution to the investment budget, and funds for administrative expenses have always been cut back by more than half. The exceptional case was in 2009 when the agency was given GH¢30 million for investments but was not allowed to roll it over into the following year. Consequently, only about 10% was released.

The capacity of the districts to effectively manage water and sanitation projects under their jurisdiction is still a challenge. Apart from the fact that the proposed Works Departments (WDs) are not established in many District Assemblies (DAs), the rampant transfer of trained staff on specific water and sanitation projects also immensely undermines the capacity of the DAs.

By its Establishment Act, CWSA should serve as the focal point of the community water and sanitation sub-sector. The Agency's role as the Government Agency facilitating service delivery and regulating the sector further makes this inevitable. In recent past, however, some operators, particularly NGOs, have been operating without any reference to CWSA or the NCWSP guidelines. As the Agency makes the effort to take command of the sub sector, weaknesses still remain in terms of effective coordination of sector practitioners. On the field, this has made efforts at a fair distribution of resources difficult. Compilation of statistical data on provision of facilities has also suffered as some NGOs still fail to report on their operations.

The requirements of the Procurement Act are quite cumbersome, time consuming and laborious to deal with. This situation thus leads to delays in the execution of some projects. In the past there have been instances where it has been difficult to get heads of Entity Tender Committees (ETCs) to convene and chair meetings. The evaluation process is burdensome especially at the DAs where the expertise is limited when it comes to water and sanitation projects. On the other hand some donor agencies insist on following their own procurement processes which is allowed by the Procurement Act. The granting of what is known as “No Objection” in donor parlance has been done by the home countries of the donor agencies. In the case where a donor procurement process is being utilised, it does not preclude the application of the national procurement process. In effect the agency manages a dual procurement system on some of its projects. This contributes to some of the delays in procurement.

3.5 Conclusion

From the discussions in this chapter, sanitation broadly covers human, solid and liquid waste disposal. However, human excreta disposal and management is of significance in this study. The definitions and description of sanitation technologies available and used in Ghana indicates progress in the subsector but the overall coverage nationwide says otherwise. This is because coverage is below what is expected with the achievement of the MDG on sanitation in mind. The various institutions, policies and programmes involved in the water and sanitation sub-sector should speed up progress and achievements within the subsector. Nevertheless, the constraints outlined here mitigate the sector's progress.

CHAPTER FOUR

METHODOLOGY

4.1 Introduction

Different methods have been employed in the literature to investigate the effect of improved sanitation on child health in different countries. The aim of this chapter is to present a discussion of the methodology and the data that will be used in this study. The chapter initially highlights the empirical framework from which the estimated model in this study is derived and then it also focuses on the estimation technique. This chapter further discusses the reasons underlining the choice of the variables that are used in the study and the sources of data.

4.2 Model Specification and Empirical Framework

To study the effect of improved sanitation on child health, this study will utilise the demand for health theory propounded by Grossman in 1972 which he later modified in 2000. The theory postulates that individuals produce health by making use of socioeconomic as well as environmental variables. Thus economic agents produce health using the health production function as given by Grossman (2000).

A health production function describes the relationship between combination of health inputs, both medical and non-medical, and resulting health output. It shows how health inputs are combined to produce a particular level of health, and how health status changes

if health inputs used and their combinations change. Thus, Grossman (2000) developed a theoretical health production function, which is specified as:

$$H=F(X)..... (1)$$

Where

H= measure of individual health output

X = vector of individual inputs to the health production function **F** and it includes, among other things, medical care, socioeconomic status, consumption of public goods, time devoted to health related procedures, initial individual endowments like genetic makeup, and community endowments such as the environment.

Following Grossman (2000), the demand for health is modeled as an investment framework, where health is the outcome of a productive process and choices are made to maximize utility. The model used in this study is based on the same premise where economic agents/countries produce health by utilizing socioeconomic as well as environmental variables such as access to improved sanitation. Hence health is a function of socioeconomic and environmental variables.

In addition to improved sanitation and safe water supply variables, a number of other factors have been demonstrated in the literature to have significant effect on child health. These variables include breast feeding behaviour, maternal education and age at birth, household economic status, and place of residence, food hygiene, personal hygiene and diarrhoea education. Unfortunately data inadequacy, both in quality and availability, preclude the inclusion of some of these variables. This study, therefore, focuses on

sanitation complemented by water supply as the main independent variables in the first model whilst I control for maternal age at birth, maternal education, and child's weight at birth, economic status of household, rural urban place of residence, breastfeeding status of child as well as the child's age and sex in a second model. The dependent variable to be used as a measure of child health is under-5 morbidity due to diarrhoea.

In order to establish a relationship between improved sanitation, in addition to some socioeconomic and demographic factors and child health, the study estimates a health status model specified in a form as follows;

$$Y_i = \alpha + \beta X_i + \varepsilon_i \dots \dots \dots (2)$$

Where

$Y_i = 1$ If there is morbidity of a child between birth and exactly five years due to diarrhoea

$Y_i = 0$ If otherwise

$X_i =$ variables that explain Y

$\alpha =$ constant and

$\beta =$ regression coefficients that ultimately describe the marginal effects of changes in the X 's on Y .

Following the logit model, two empirical models are specified as follows:

$$U5M_i = \beta_0 + \beta_1 AIS_i + \beta_2 ASD_i + \varepsilon_i \dots \dots \dots (3)$$

$$U5M_i = \beta_0 + \beta_1 AIS_i + \beta_2 ASD_i + \beta_3 MA_i + \beta_4 HHW_i + \beta_5 ME_i + \beta_6 PR_i + \beta_7 CBW_i + \beta_8 BFS_i + \beta_9 CAGE_i + \beta_{10} GEN_i + \varepsilon_i \dots \dots \dots (4)$$

Where:

$U5M_i$ = under-5 morbidity due to diarrhoea

AIS_i = access to improved sanitation within the household

ASD_i = access to safe drinking water

MA_i = mother's age

HHW_i = household economic status

ME_i = mother's education level

PR_i = place of residence

CBW_i = child's weight at birth

BFS_i = child's breastfeeding status

$CAGE_i$ = child's age

GEN_i = sex of child

ε_i = error term

4.4 Definition of Variables and Expected Signs

The variables to be employed in this study are defined in addition to their expected a priori.

4.4.1 Dependent variable

UNDER-5 MORBIDITY DUE TO DIARRHOEA (U5M)

Diarrhoea morbidity is defined in the literature as passing of 3 or more watery stools within 24 hours and lasting for at least 14 days. In the 2008 GDHS, mothers were asked whether any of their children under five years of age had diarrhoea during the two weeks preceding the survey. It takes a value of one (1) if a child under-5 suffered some bouts of diarrhoea within the specified time period and zero (0) if otherwise.

4.4.2 Explanatory variables

ACCESS TO IMPROVED SANITATION (AIS)

The WHO/UNICEF Joint Monitoring Programme categorises improved sanitation into six types namely flush/pour flush to septic tank, flush/pour flush to a piped sewer system, flush/pour flush to a pit latrine, ventilated improved pit latrine, pit latrine with slab and composting toilets which are not shared. Any other type of toilet facility that does not fall within this category is considered unimproved and thus inadequate. The GDHS also adopts this by categorising the sanitation variable into improved and unimproved. Following the GDHS, the sanitation variable is categorised into improved and unimproved facilities.

It is expected that households with an improved sanitation facility will be least likely to report cases of diarrhoeal morbidity among children under-5 compared to those without.

Therefore, access to improved sanitation is expected to relate negatively to under-5 morbidity due to diarrhoea.

ACCESS TO SAFE DRINKING WATER (ASD)

The availability and accessibility to a safe drinking water source may, to a large extent, minimize the prevalence of water-borne diseases among household members, especially children under-5. The source of drinking water is most important because potentially fatal diseases such as diarrhoeal diseases, guinea worm and bilharzia, among others are very common in Ghana. The GDHS classifies this variable into 6, i.e, piped water into dwelling/yard/plot, public tap/standpipe, tube well/borehole, protected dug well, protected spring and rain water harvest. As a result, all other sources of drinking water are unsafe and as such users are regarded as not having access to safe drinking water. This is also a dummy variable that takes on the value of one (1) if the child in the household has access to safe drinking water and zero (0) if otherwise.

All things being equal, it is expected that children with access to improved drinking water source will report few cases of diarrhoeal morbidity as against those without access. Therefore, access to improved source of drinking water is expected to be inversely related to under-5 morbidity due to diarrhoea.

MATERNAL AGE AT BIRTH (MA)

The health of a child essentially depends on the health of the mother. The age of the mother, in any case, suggests how best she can be of help to the vulnerable child. This is a continuous variable. Young mothers are assumed to be more vulnerable to some sort of stress that comes with pregnancy and child birth and are least likely to be able to properly take care of themselves and protect their children from some preventable diseases such as diarrhoea. Hence, it is expected that as mothers age increases there will be a decreasing probability of morbidity due to diarrhoea among children under-5.

MOTHER'S EDUCATION (ME)

The impact of education on individuals is important in determining the knowledge and skills that can lead to the improvement in health of both the mother and the child. Educated mothers are better informed of the health hazards of most prevailing conditions such as unimproved sanitation facilities and thus in a better position to protect the child from diseases that may breakout from such conditions. The GDHS classifies this variable into “no education”, “primary education”, middle/JSS and “secondary or higher. Mothers with no education may not have the required knowledge of inherent diseases associated with inadequate sanitation facilities and therefore will be less capable of protecting their children from such diseases. Mothers with primary education may be privy to some behavioral practices required to protect their children from such preventable diseases. Mothers with middle/JSS and secondary or higher education are more likely to be

knowledgeable about such diseases and are expected to be able to protect their children from such diseases.

Following the classification employed by the GDHS, it is expected that the likelihood of under-5 morbidity due to diarrhoea will decline as maternal education rises.

HOUSEHOLD SOCIOECONOMIC STATUS (HHW)

This variable was constructed using information on household ownership of some consumer items including electricity, television, refrigerator, and bicycle, among others as well as dwelling characteristics such as main floor material, main roof material and main wall material provided by GDHS. Each asset was assigned a factor score generated through principal component analysis and the resulting scores were standardised. Each household was then assigned a score for each asset, and the scores were summed for each household. The sample was then divided into quintiles from one (lowest) to five (highest).

Wealthier households are more likely to have access to the appropriate health inputs to produce good health, particularly among children under-5. As a result, as we move up the wealth quintiles (that is, from one to five) there will be a decreasing probability of diarrhoeal morbidity among children under-5.

PLACE OF RESIDENCE (PR)

The distribution of social infrastructure in Ghana is such that rural communities are less developed in terms of infrastructure than what pertains in urban areas hence there are great disparities between rural and urban households. Moreover, the urban centre is viewed as a potential source of income and therefore has a lot of people migrating to such areas in search of non-existing jobs. The challenges that emerge from such situation mounts pressure on the limited amenities available and hence inequitable distribution of resources among the rich and the poor. In most cases, the urban poor forming a greater percentage of the population suffers most. Most of these people live in slums where there is overcrowding and the level of development is low. With limited access to social amenities, they live in insanitary environments which predispose them to various kinds of diseases (Adubofour et al, 2013; Crook and Ayee, 2006; Songsore, 1992). However, urban centres have more health facilities and access to more information that allows for the production of good health. On the other hand, rural communities may have lower population densities which may be more comfortable with less pressure and cleaner environment but few health facilities and other social infrastructure that will allow for the production of good health.

As a result, the a priori for this variable cannot be predicted.

CHILD'S BIRTH WEIGHT (CBW)

All things being equal, the condition of the child from birth in most cases determines its general well-being for most part of his or her life (GSS and MI, 2009; Gissler et al,

1999). A child who weighs below 2.5 kilogrammes at birth is feeble and is more likely to succumb easily to communicable diseases such as diarrhoea. On the contrary, children born with weights above 2.5 kilogrammes are considered healthy and therefore least likely to contract communicable diseases. This variable is treated as a continuous variable in the model. As a result, we expect a declining probability of under-5 diarrhoeal morbidity as child's birth-weight increases.

BREASTFEEDING STATUS OF CHILD (BFS)

Early supplementation is discouraged because it exposes infants to pathogens and increases their risk of infection, especially diarrhoeal diseases.

The GDHS obtained information on complementary feeding by asking mothers about the current breastfeeding status of all children under five years of age. For the purpose of the study, this variable has been categorised into “never breastfed”, “breastfed for the first 6 months only” and “breastfed for 6 months and above”. It is expected that children who were breastfed for the first 6 months and above 6 months will be at a lower risk of diarrhoeal morbidity as against children who were never breastfed.

AGE OF CHILD (CAGE)

The age of the child under-5 is reported to significantly affect morbidity. Older children are believed to be less susceptible to diseases compared to young ones. As a result, it is expected that the child's age will be inversely related to under-5 morbidity due to diarrhoea.

SEX OF CHILD (GEN)

This variable is included in the study to examine who are more hardy, male or female children. The a priori, therefore, cannot be predicted for this variable.

4.5 Method of analysis

Two logistic models are estimated: Model 1 examines the effects of improved sanitation complemented by safe drinking water source on the dependent variable without controlling for the other factors and Model 2 examines the interactive effect of the environmental variables, socio-economic demographic and child characteristics on the dependent variable. The p-values reported from using STATA 13 at 90%, 95% and 99% confidence levels are used to either reject or fail to reject the null hypothesis that the variable in question is statistically insignificant.

4.5.1 Justification for the application of the logistic regression in the study

In this study, the response for the dependent variable is binary which takes a value of one (if there is diarrhoea morbidity among children under-5 within the household) and zero (if otherwise). In such a situation, using the Ordinary Least Square (OLS) method to estimate a linear function that has a binary outcome may not be appropriate because the error term would not be normally distributed. A normal distribution requires that, the error term should take any value between positive and negative infinity ($\pm\infty$). However the error term in such a model can only take 0 or 1 for the dependent variables. This means that, the variance of the error term depends on the explanatory variables, hence bringing in the issue of heteroscedasticity (Jones 2005). This violates the assumption that

there should not be any correlation between the error term and any of the explanatory variables under the application of the OLS method. Given this limitation, the most appropriate options here is the logit and probit models.

The logit and the probit models assume that, there is a continuous latent variable y^* that determines a particular activity. Assuming y^* represents diarrhoea morbidity among children under-5, if y^* is positive, then there is death at birth and the observed binary outcome is one (1), otherwise, the outcome is equal to zero(0). Then the latent variable y^* is modeled by a linear regression function (Jones 2005). Since both the logit and probit models give similar conclusions, this study assumes that the error term is logistically distributed and therefore adopts the logistic model as specified by Gujarati (2004) for the estimation purpose. With the logistic model the coefficient of the independent variables only show whether the probability of an event occurring will increase or not when there is a change in the explanatory variables. A positive logit means that an increase in the value of the explanatory variable(s) will lead to an increase in the odds that the dependent variable equals one (1). On the other hand, a negative logit means the odds that the dependent variable equals one (1) decreases as the value of that explanatory variable increases (Gujarati, 2004). The odds ratio which is the ratio of the probability of the event occurring to the probability of not occurring and the marginal effect which measures the impact of a small change in the explanatory variable on the probability of under-5 morbidity due to diarrhoea are approaches used in interpreting a logistic model. This study uses the marginal effects approach for the interpretation of the logistic results.

4.6 Data source

The study will use secondary data from the 5th round of the Ghana Demographic and Health Survey (GDHS) conducted in 2008.

The Ghana Demographic and Health Survey (GDHS 2008) was planned and implemented by the Ghana Statistical Service (GSS) and the Ghana Health Service (GHS). It is the fifth of its kind conducted in the country since 1988. The survey was done as part of the global Demographic and Health Surveys (DHS) programme and was designed to monitor the population and health situation in Ghana as a follow-on to the 1988, 1993, 1998 and 2003 Ghana Demographic and Health Surveys (GDHS 2008).

The 2008 GDHS is a national survey that covers all the ten (10) regions of Ghana with a sample of 11,778 households. Eligible women aged 15-49 in half of the households were asked questions about themselves and their children born in the five (5) years since 2003 in the women's questionnaires. Some of the detailed information obtained by the survey are maternal and child health care, fertility, awareness and the use of family planning and childhood mortality.

The 2008 GDHS use the two-stage sample based on the 2000 Population and Housing Census to produce separate estimates for key indicators for each of the ten (10) regions in Ghana. All eligible men between the ages of 15 and 59 were interviewed using the Men's Questionnaires in half of the households chosen for the study. The content of the Men's Questionnaires were similar to those of the Women's Questionnaires, but was shorter

because it did not contain a reproductive history or questions on maternal and child health. In all, a total of 4,916 women in their reproductive age and 4,568 men between 15 and 59 years from 6,141 households were interviewed. The data collection took place over a three-month period from September to late November 2008 (GSS and MI, 2009).

This study is confined to children born to the sample of women in the five years preceding the survey, yielding a sample size of 2,992 children. The restriction of the study to recent births serves to ensure that the background maternal and household characteristics relate to current conditions. Since children of the same mother share similar characteristics and are therefore exposed to the same physical and social environments at the household level, the assumption of independence of observations inherent in conventional regression models is hard to justify. We therefore controlled for possible clustering of standard errors within the households to produce robust variance estimates (StataCorp, 2011).

4.7 Conclusion

This chapter developed the empirical model to be estimated in the study. It further defined the variables and justified their inclusion in the model. The chapter also justified the method of analysis as well as the source of data to be used.

CHAPTER FIVE

DISCUSSION OF RESULTS

5.1 Introduction

This chapter first presents the descriptive statistics of the variables used in the study. The chapter will discuss the results from the logit regression model and also throw more light on the various significant factors in order to contribute to the existing literature.

5.2 Descriptive Statistics of the dependent variable

5.2.1 Under-5 morbidity due to diarrhoea

About 21% of children under-5 living in 586 households had some bouts of diarrhoea within the two weeks preceding the survey.

5.3 Descriptive Statistics of the Explanatory variables

5.3.1 Sanitation and Water supply

Of the total sample, as many as 1,089 children representing 36.4% live in households that do not have access to a toilet facility. This goes to confirm the low sanitation coverage in the country and the increasing rate of diarrhoeal morbidity among children. Also, about 9.6% and 0.7% have access to open pit and bucket latrines respectively. However, a good number (954) making 31.9% have access to VIP latrines whilst 7.1% and 14.1% use flush toilet and Pit latrine with slab respectively. Composting toilet forms a minority as only 0.1% of the respondents use them. This is presented in table 5.1. On the aggregate, 53.3% of households had access to improved sanitation facilities whilst 46.7% do not.

Table 5.1 Distribution of sample by type of sanitation and sources of drinking water used by household

Sanitation Facility	Frequency	Percentage	Cummulative
Improved facilities			
Flush toilet	213	7.12	7.12
VIP latrine	954	31.89	39.01
Pit latrine with slab	423	14.14	53.15
composting toilet	4	0.13	53.28
Unimproved facilities			
Open pit latrine	287	9.59	62.87
Bucket latrine	22	0.74	63.61
No facility	1089	36.4	100
Total	2,992	100	
Drinking Water Sources			
Improved			
Piped into dwelling/yard/plot	239	7.99	7.99
Public tap/standpipe	693	23.16	31.15
Tube well/ borehole	1,224	40.91	72.06
Protected well/ spring	132	4.41	76.47
Rain water harvest	11	0.36	76.83
Unimproved			
Unprotected well/ spring	115	3.85	80.68
River/dam/stream	418	13.97	94.65
Tanker truck/small truck	11	0.36	95.01
Sachet/ bottled ²	149	4.98	100
Total	2,992	100	

Source: Author's computation from GDHS, 2008

With the issue of sources of drinking water of the household, a reasonable number of them draw water from improved sources. This confirms the water supply coverage within the country is encouraging though there may be inter-regional differences. Table 5.3 presents the information on drinking water sources. From the table, many households representing 40.9% draw water from a tube well or borehole and 7.9% have access to water piped into the dwelling, yard or plot. Besides, 23.2% draw water from public

² The quality of such water is not known hence it is added to the unimproved category

tap/standpipe whilst 4.4% and 0.4% get their drinking water from protected well/spring and rainwater respectively. On the whole, 76.8% have access to improved sources of water for drinking and 23.2% use unimproved sources of water

Table 5.2 presents a summary of the descriptive statistics of the explanatory variables employed in the study. The socioeconomic status of households are distributed as follows, 24.2% of households fall within the lowest quintile whilst about an equal percentage (20%) fall within the lower and middle quintiles respectively. The higher and the highest wealth quintiles made up 18.6% and 17% of the households respectively. With maternal education, as many as 1,132 of the total sample of mothers have had no formal education and thus constitutes 37.8% whilst as few as 68 have had higher education making up 2.3%. Also, 24.1% and 35.8% of these women have had primary and secondary education respectively.

The breastfeeding status of children under-5 within the household revealed that about 5.3% of them were never breastfed, 17.1% were breastfed up to the first 6 months of age and the remaining 77.6% were breastfed for more than 6 months.

Of the total sample of households, 33.4% were located in urban centres whilst 66.6% were in rural areas of the country.

The number of male and female children in the sample was 1,526 and 1,466 representing 51% and 49% respectively.

The non-categorical covariates used in the study include age of mother at birth, child's age and child's weight at birth. The mean age of the women in the sampled household is 30.08 with a minimum and maximum of 15 and 49 years respectively whilst the average of the weight of the children at birth is 1.53 kg with a minimum weight of 0.22 kg and a maximum of 9.99 kg. Moreover, the mean age of the children (in months) in the sample was 27.7 with a minimum and maximum of 0 and 59 respectively. This is summarised in table 5.3

Table 5.2 Sample Distribution of selected covariates

Variable	Frequency	Percentage	Cummulative
Household Wealth index			
Lowest quintile	724	24.20	24.20
Lower quintile	600	20.05	44.25
Middle quintile	601	20.09	64.34
Higher quintile	557	18.62	82.95
Highest quintile	510	17.05	100
Maternal Education			
No education	1,132	37.83	37.83
Primary	722	24.13	61.97
Secondary	1,070	35.76	97.73
Higher	68	2.27	100
Child's Breastfeeding Status			
Never breastfed	158	5.28	5.28
First 6 months	510	17.05	22.33
Above 6 months	2,324	77.67	100
Place of Residence			
Urban	1,000	33.42	33.42
Rural	1992	66.58	100
Gender of child			
Male	1,526	51.00	51.00
Female	1,466	49.00	100

Source: Author's computation from GDHS, 2008

Table 5.3 Descriptive statistics of the explanatory continuous variables

Variable	Maternal age at birth	Child's weight	birth- Child's age
Number of observations	2685	2685	2685
Mean	30.08	1.53kg	27 months
Standard deviation	7.02	1.88	17.56
Minimum	15	0.22kg	0 month
Maximum	49	9.99kg	59 months

Source: Constructed from 2008 GDHS

5.4 Results from the Logit Estimation

To investigate the association between under-5 diarrhoeal morbidity and improved sanitation, responses from the GDHS were subjected to a logit model regression analysis in two separate models. The first model is a simple model with improved sanitation and safe drinking water source as the explanatory variables. The second model saw the inclusion of the other controlled variables reviewed in the study. Here the dependent variable assumes a value of one (1) if a child suffered from a bout of diarrhoea two weeks preceding the interview and zero (0) if otherwise. The results from the logistic regressions are presented in table 5.4a and 5.4b. Standard errors are in parenthesis in table 5.4a

Table 5.4a A simple logit on the probability of childhood diarrhoea in Ghana

MODEL 1			
Variable	Coefficient	Marginal Effects	P > Z
Household sanitation			
Improved	-0.23** (0.09)	-0.04 (0.02)	0.01
Household drinking water			
Improved	-0.13 (0.12)	-0.02 (0.02)	0.25
Number of observations = 2,685			

LR chi2 (2) = 9.17

Prob > chi2 = 0.0102

Pseudo R2 = 0.0032

***Significant at 10%, **Significant at 5%, ***Significant at 1%**

Source: Author's computation from the GDHS, 2008.

Table 5.4b A Multivariate Logistic Model on the Probability of Childhood Diarrhoea in Ghana.

MODEL 2					
Variable	Coefficients	Std. Err	Marginal Effects	Std. Err	P > Z
Household Sanitation					
improved	-0.07*	0.04	-0.01	0.007	0.09
Household drinking Water source					

Improved	-0.11**	0.05	-0.02	0.006	0.02
Maternal Age at birth	0.00	0.00	0.00	0.004	0.19
Child's age	0.81***	0.04	-0.13	0.006	0.00
Maternal Education					
Primary	-0.19***	0.05	-0.03	0.008	0.00
Secondary	-0.31***	0.05	-0.04	0.007	0.00
Higher (ref. no education)	-1.22***	0.19	-0.14	0.015	0.00
Household Wealth index					
Lower	-0.19***	0.05	-0.02	0.008	0.00
Middle	-0.11**	0.06	-0.03	0.009	0.04
Higher	-0.12*	0.06	-0.04	0.01	0.07
Highest (ref. Lowest)	-0.21***	0.07	-0.04	0.011	0.00
Child's Breastfeeding status					
First 6 months	-0.77***	0.12	-0.08	0.015	0.00
Above 6 months (ref. Never breastfed)	-0.5***	0.11	-0.08	0.014	0.00
Place of Residence					
Rural (ref. Urban)	-0.03	0.05	-0.005	0.007	0.45
Child's Birthweight	-0.02**	0.10	-0.0004	0.000	0.02
Sex of child					
Female	-0.04	0.03	-0.007	0.005	0.2

Number of observations = 2,685

Prob> chi2 = 0.000

Pseudo R2 = 0.0467

LR chi2 (17) = 894.78

*Significant at 10%, **Significant at 5%, ***Significant at 1%

Source: Author's Computation from the GDHS, 2008.

As expected, the simple model produced an inverse relationship between access to improved sanitation facility within the household and under-5 diarrhoea. This means that households with safe sanitation are less likely to record cases of diarrhoea among children under-5. From the estimation, the marginal effect of having access to an improved sanitation reduces the probability of diarrhoeal morbidity among children under-5 by 4 percentage points compared to those without access. Sanitation plays a

major role in the morbidity of children under-5. This has been amply demonstrated in the literature (WSP, 2012; Gunther and Fink, 2010; Fening and Edoh, 2009; Meddings et al., 2004; Root, 2001) given that in most of these studies authors found the need to recommend access to improved sanitation in their study areas. However, this result contradicts that of Rahman et al, (1985) in rural Bangladesh.

On the other hand, we do not find any statistical significance of having access to improved source of drinking water and under-5 morbidity due to diarrhoea though the result indicates that improved sources of drinking water places children under-5 at a lower risk of diarrhoea.

With the introduction of the control variables, household use of improved sanitation and safe sources of drinking water puts children under-5 at a lower risk of diarrhoea. This indicates that under-5 children in households with improved sanitation and safe drinking water sources have a lower tendency of falling ill of diarrhoea. The marginal effects (1 and 2 percentage points respectively), compared to the results from the simple model and studies in other developing countries, (Gunther and Fink, 2010; Osumanu, 2007; Root, 2001; and Daniels, 1990) are rather minimal probably due to the manifestation of other factors affecting under-5 diarrhoeal morbidity. Root (2001), for instance, found that children under-5 with access to safe sanitation had 68 percentage points fewer episodes of diarrhoea than those without access. The results confirm the robustness of these household factors and corroborate the hypothesis that children in homes with access to improved sanitation and water facilities are less vulnerable to diarrhea morbidity.

The age of the child is significantly related to diarrhoeal morbidity given the estimation results. There is a 13 percentage points reduction in the probability of diarrhoea morbidity as children grow older. This result confirms those found in Zimbabwe by Root in 2001 and in Ghana by Ahiadeke in 2000 establishing the fact that young children are more likely to be vulnerable and may succumb to most diseases than slightly older ones. This is because, infants are more susceptible to diseases given that their immune system is not well developed to fight against diseases.

With reference to no education, the estimation results indicate that mothers with primary, secondary and higher education have a decreasing probability of under-5 morbidity due to diarrhoea by 3, 4 and 14 percentage points respectively. This means that more knowledge is acquired with increasing levels of education thus mothers become more and more efficient in utilising available resources to improve their health and that of their children as they move up the educational ladder. Several studies have found similar results and some of these include those of Fening and Edoh (2009), Deribew, (2007) Boadi and Kuitunen (2005), Gyimah (2003), Bour (2003). In all of these studies, the authors found a statistically significant relationship between child morbidity and maternal education. This supports the importance of education on the health of the individual. Children do not become sick because their mothers are less educated but mainly because such mothers rarely practice better hygiene and nutrition hence their children are more exposed to diseases (Gyimah, 2003). Throughout their years in school, however, educated women are regularly exposed to the importance of hygiene and nutrition. As a result, they are more aware of disease causation and therefore indulge in good sanitary practices and other preventive measures to reduce the risk among their children.

The socioeconomic status of the household is statistically significant and also negatively related to the dependent variable. The estimation results show that as households move up the wealth ladder, the probability of under-5 diarrhoeal morbidity decreases by 2 percentage points for those in the lower quintile to 3 percentage points for those in the middle quintile to 4 percentage points for households in the higher and highest quintile compared to their counterparts in the lowest wealth quintile. Good economic standing of mothers aids in the care of their children. With high wealth, mothers are more likely to be educated and are also likely to live in areas with less environmental contamination and thus in a better position to acquire those essentials needed for the comfortable living of household members including children. As a result, maximum care is given the child under-5 and therefore the child is protected against many forms of diseases. This result has been sufficiently established in the literature (Fening and Edoh, 2009; Osumanu, 2007; Boadi and Kuitunen, 2005; Gyimah, 2002).

Breastfeeding is an important component of under-5 morbidity due to diarrhoea. As expected, the result from the estimation revealed that children who are breastfed for the first six months and more have a reduced probability of morbidity due to diarrhoea by 8 percentage points respectively compared to their counterparts who were never breastfed. This happens to conform to some studies both in Ghana and other parts of the world. In Bangladesh, Briend et al (1988) found a negative and strongly significant association between breastfeeding and under-5 morbidity and mortality and concludes that breast milk is capable of protecting the child from diseases up to 5 years of age. In Ethiopia, Deribew, et al, (2007) found that children who were not breastfed were 6 times more likely to die compared to those breastfed and in Ghana, Ahiadeke, (2000) have also found

the protective effect of breastfeeding to be highest in households where the poorest sanitation conditions prevail.

The weight of the child at birth shows a decreased probability of morbidity due to diarrhoea by 0.04 percentage points as children's birth-weight increases. This means low birth-weight babies are more likely to fall ill due to diarrhoea given that they are less strong and healthy and thus less capable of standing against some diseases (Alderman and Behrman, 2006; Gissler et al, 1999; Ashworth, 1998). The estimation results may be minimal but once there is a reduced probability of sickness, it is great news given that the life of the individual is priceless.

Though rural place of residence decreased the probability of under-5 diarrhoeal morbidity, the variable was statistically insignificant. The sex of the child and mother's age at birth were also not statistically significant.

5.5 Conclusion

This chapter discussed the result obtained in the study. With regards to sanitation, the study revealed that improved facilities within the household reduce the probability of under-5 morbidity due to diarrhoea in both models. The effect of water supply, on the other hand, was not significant in model 1 but had a consistent influence on under-5 diarrhoeal morbidity. Moreover, most of the controlled variables were found to be statistically significant and most of them assumed their expected signs. Maternal age at birth, place of residence and sex of the child were not significant indicators of child morbidity. These notwithstanding, maternal education, household economic status,

child's breastfeeding status, age and the child's weight at birth assumed their proposed signs and were statistically significant.

CHAPTER SIX

SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

6.1 Introduction

The chapter concludes by giving a sum-up of the entire study. The findings from the study are also summarised in this chapter. These findings serve as foundation on which recommendations have been made for policy makers to consider and the final section gives the limitations of the study.

6.2 Summary of the study

Diarrhoea happens to be the world's leading cause of death killing tens of thousands of people each year. This fatal but preventable disease has been proven to be caused by poor sanitation conditions. Like most developing countries, Ghana is not an exception to this problem.

A review of the literature revealed that poor sanitation is the leading cause of most diseases and paramount among them being childhood diarrhoea. As a result, most of these studies have employed under-5 diarrhoeal morbidity as a measure of health outcome. A review of the theoretical literature showed that the health production functions have been widely employed for such studies. Reviewing the empirical literature revealed that studies have been conducted in different parts of the world to show the effect of poor sanitation on child diarrhoea.

Taking an overview of sanitation in Ghana indicated that the use of safe sanitation in the country is on a low side. Institutional structures of the sub-sector were also discussed.

The study made use of the population based data from the Ghana Demographic and Health Survey and employed the theoretical framework propounded by Grossman (1972) to come out with an empirical model. Also informing the formulation of the model are environmental, maternal, household and child characteristics that are dominant in the literature. The variables that were controlled for in the model were access to improved sources of drinking water, maternal age at birth and educational level, economic status of household and the location, child's weight at birth, breastfeeding status of child, child's age and sex.

A logistic regression analysis was undertaken on two models. First sanitation and water supply were regressed on under-5 morbidity due to diarrhoea to estimate their effect on the dependent variable. Whilst both had an inverse relationship, water supply was not statistically significant. The second model saw the inclusion of the controlled variables to determine their interactive effect on the dependent variable. Although all the variables except maternal age at birth assumed their a priori expectations, access to safe sanitation and water facilities, maternal education, household wealth, child's age, breastfeeding status and birth-weight were significant determinants of under-5 morbidity due to diarrhoea.

It is evident from the empirical work done in this study that, all things being equal, household sanitation facilities are important indicators of the general well-being of its immediate members as well as the health of neighbourhood community members due to reduced community contamination. Among the socio-economic factors, maternal education and household wealth were significantly associated with under-five morbidity.

Also, child factors such as breastfeeding, age and birth-weight pointedly affect under-5 morbidity due to diarrhoea.

6.3 Policy Recommendations

On the basis of the findings, the following recommendations are made for policy consideration.

Improving household level sanitation situation in addition to safe drinking water supplies will go a long way to improve the health of all people in the country especially children. Evidence shows that under poor sanitary conditions, solitary socioeconomic improvements may be necessary but insufficient for affecting health status. Hence policy should be directed at providing safe sanitation to households especially in the urban areas of the country where overcrowding has led to many health hazards. This can be done through enforcement of laws that sees to the provision and use of safe sanitation at the household level. The activities of the CWSA which sees to issues of sanitation in rural areas should be improved by appropriately addressing the main challenges that seems to mitigate the proper functioning of the agency. One of the ways to go is for government to release proposed budgetary funds allocated to the sector both in full and on time in order for the agency to be able to implement their proposed programmes.

Going further, public-private partnership between government and household heads, especially in the rural areas, to share the cost of latrine construction for those households that have space will be beneficial since the cost of such projects are often deterring. Also, due to overcrowding in slum areas of the country, policy should aim at providing communal sanitation facilities for people in such communities, as this happens to be the

only viable option, which will be properly maintained and managed by stakeholders in these areas to ensure commitment in its maintenance. Though toilet sharing falls outside the WHO definition of access, this may help reduce the percentage of the population without any facility and thereby reducing open defecation which cause environmental contamination.

Household socioeconomic status has a strong negative relationship with under-5 morbidity due to diarrhoea. As such to increase households' ability to cater and protect their children from diarrhoea, measures should be undertaken to increase the incomes of the households. Such measures may include increasing the national daily minimum wage so that incomes will go up significantly. By so doing households will be able to acquire the basic amenities and durable goods that will contribute positively towards their household wealth index. In order to avoid the consequent unemployment resulting from increased minimum wage, policy should see to it that this is matched equally by increased productivity. Measures should also be undertaken to provide jobs for the unemployed. This way, the incomes of previously unemployed persons who now have jobs will add to their households' wealth to enhance their livelihood.

The study further showed that mothers with increased levels of education had a lower probability of under-5 morbidity due to diarrhoea. It is therefore recommended that the national agenda on girl child education be taken seriously. Besides, not only basic education should be made compulsory as it stands at the moment; but also, secondary education should be made a requisite for the girl child to further increase the percentage

of the female population who attain tertiary education. With the current situation where a greater percentage of mothers have never had formal education, regular community public health education on preventable diseases, particularly child diarrhoea, should be undertaken. Here, education on the importance of practicing personal and domestic hygiene should be made key to particularly benefit such mothers to help promote and encourage such practices at the household level.

Furthermore, expectant mothers should be encouraged to patronise antenatal care services by making the service accessible. By so doing, most of the medications needed for safe and healthy delivery will be given to ensure that children born are not under-weight. During such visits, education on the relevance of breastfeeding is also given mothers which will encourage them to extend the period for breastfeeding and discourage early weaning. Presently, the National Health Insurance Scheme makes antenatal care free for expectant mothers but the problem with accessing the service still remains. Adequate measures should be put in place to put up clinics and resource such clinics at areas where they are needed.

6.4 Limitations of the study

In most of the influential studies on sanitation and child health, the case control design methods have been employed. This has a number of merits. Firstly, authors' choice of variables to be measured in these studies suffers little or no limitation. Secondly, variables that appropriately determine the health outcome to be measured are used in such studies. Employing population based data such as the GDHS for this study limited the inclusion of some equally important determinants of under-5 morbidity due to

diarrhoea. Notwithstanding these limitations which could be the basis for further research, the results of the current study are still valid and could be used as the basis for policy formulation.

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