

**THE CORRELATES OF CHILDHOOD HEALTH
OUTCOMES IN GHANA: DOES CHILDHOOD BIRTH
WEIGHT MATTER?**

BY

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**THIS THESIS IS SUBMITTED TO THE UNIVERSITY
OF GHANA, LEGON IN PARTIAL FULFILMENT OF
THE REQUIREMENT FOR THE AWARD OF MASTER
OF PHILOSOPHY ECONOMICS DEGREE.**

JULY, 2015

DECLARATION

I Ernest Kwame Anku hereby declare that aside from the references to other studies that have been duly acknowledged, this thesis is my own original work carried out under the supervision of Dr (Mrs) Nkechi Owoo and Dr. L. Boakye-Yiadom.

No part of this study has been reproduced or has been accepted for the award of any degree of the university. I am therefore solely responsible for any shortcomings that may be found in this research work.

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ABSTRACT

Survival of children under age five has been a global concern over the years. It is therefore very important to identify the determinants of some adverse childhood health outcomes including perinatal mortality and acute respiratory infection prevalence so as to guide policy on addressing this global concern. Though a number of studies have been carried out on the afore-mentioned health outcomes globally, they received low attention among Ghanaian researchers especially in the direction of their demographic and socioeconomic correlates. This study therefore investigated the association between perinatal mortality, acute respiratory infection prevalence and their determinants including birth weights and birth sizes of babies in Ghana.

The study used a binary logistic regression to estimate the demographic and socioeconomic factors influencing perinatal mortality and acute respiratory infection prevalence in Ghana with a combined data of 1998, 2003 and 2008 Ghana Demographic and Health Survey.

The results showed that both demographic and socioeconomic factors have varying association with the perinatal mortality and acute respiratory infection prevalence in Ghana. Child's sizes at birth especially average birth sizes, breastfeeding for the first time within hours or immediately after birth, normal vaginal delivery, delivery at health facility are inversely and significantly related to perinatal mortality. The implication is that the above factors are more protective against perinatal mortality. Mother's age however, increases perinatal mortality. Child's sizes at birth especially larger than average and average birth sizes, child's age, mother's age, geographical region of residence are inversely and significantly related to ARI prevalence. Also, no antenatal

care visit and rising birth weight are positively and significantly associated with ARI prevalence.

Based on the results indicated in this study, there is an urgent need to adopt strategies that would ensure that good feeding practices are promoted among mothers during pregnancy so that they can give birth to babies whose weights and sizes at birth are desirable.

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LIST OF ABBREVIATION

ARI	Acute Respiratory Infection
ANC	Antenatal Care
NM	Neonatal Mortality
NHA	National Health Account
NHIS	National Health Insurance Scheme
PAHO	Pan American Health Organization
SSA	Sub-Saharan Africa
UN	United Nation
UNFPA	United Nations Fund for Population Activities
GDHS	Ghana Demographic and Health Survey
GSS	Ghana Statistical Service
GHS	Ghana Health Service
MDG	Millennium Development Goal
WHO	World Health Organisation
NMR	Neonatal Mortality Rate
SNAP	Score for Neonatal Acute Physiology
NICHD	National Institute of Child Health and Human
Development	
CRIB	Clinical Risk Index for Babies
LBW	Low Birth Weight
TBA	Traditional Birth Attendant
NGO	Non-Governmental Organisation
UNICEF	United Nations Children Fund
CEE	Central and Eastern Europe
CIS	Commonwealth of Independent States
PPME	Policy, Planning, Monitoring &Evaluation

DEDICATION

I dedicate this piece of work to the Almighty God for seeing me through this thesis writing. It is also dedicated to my former Headmaster M.K.G Aku of Kpedze Senior High, my lovely wife Gladys Zometi, my children Eugene Sedem Adipah and Juliet Aku Adipah as well as to my lovely mother Lydia Abra Akoto.

ACKNOWLEDGEMENT

I wish to express my profound gratitude to the Almighty God for His love, grace and protection throughout the course of my study in University of Ghana.

I also wish to express my deepest appreciation to my supervisors Dr. (Mrs) Nkechi Owoo and Dr. L. Boakye-Yiadom for reading through the work and making the necessary contributions to the realization of the success of this work. I am indebted to all the Senior Lecturers at the Department of Economics (UG), especially Dr. Nketiah-Amponsah for the immense knowledge impacted during the course work.

Finally am very grateful to my wonderful family for their prayers that gave me the peace of mind to be able to undertake this thesis work to a successful end. I cannot forget my wife Gladys for her support and encouragements, my son Sedem and my daughter Aku.

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Economic development has been the target of many developing countries in Africa including Ghana in most recent years. These targets could not be achieved without considering the health status of children who are prone to adverse health outcomes. Successful education depends on adequate health of the child. Moreover, health and education which are social indicators can be seen as vital components of growth and development. According to Sen (1989), factors like education and health are among the basic capabilities that give value to human existence. The childhood health outcomes of interest in this study are perinatal mortality and acute respiratory infection among children under age five. Even though these are important areas of study, they received little attention from researchers in Ghana.

Paying attention to issues concerning perinatal mortality is important because it indicates the state of a country's population, especially that of mothers during child bearing over a given period. The extent to which health care services are utilised by women in Ghana as well as how they are able to cope with the demands of childbirth could be assessed using the country's perinatal rates (GDHS, 2008). Perinatal mortality comprises stillbirth and death in first week of life (early neonatal death) (World Health Organization 2006). The rate of perinatal mortality is estimated as the sum of all stillbirths and death of children within the first week of life (early neonatal deaths) divided by total number of births (sum of stillbirth and live births) over a period GDHS (1998). The perinatal mortality as an indicator plays an imperative role in providing the information needed to improve the health status of pregnant women, new mothers and newborns.

That information allows decision-makers to identify problems, track temporal and geographical trends and disparities and assess changes in public health policy and practice. Perinatal mortality is an important indicator of maternal care as well as maternal health and nutrition. It also reflects the quality of obstetric and pediatric care available. Although social factors may exert some major influences on the outcome of a birth, as societies advance, good medical care tends to play a greater role (World Health Organization, 2006).

The adverse health outcomes attributable to acute respiratory infection (ARI) among children under age five could not be over accentuated in Ghana since most developing countries are found to have children under age five suffering from such complications. According to Lye et al. (1994) and WHO (1989), acute respiratory infections can be expressed in three major forms (mild, moderate and severe ARI). Mild ARI exist when the child is found to have cough with running nose and sore throat. Children with any of the symptoms above in addition to fast breathing could be indicated as moderate ARI. The severe ARI arises when the child turns blue and found to have difficulty in taking fluid or have chest in drawing accompanied with or without fast breathing. In the year 2000, 1.9 million children died out of acute respiratory infection globally of which about 70% is located in Africa and Southeast Asia (Williams et al. 2002).

Rahman et al (2001) and Williams et al. (2002) have indicated that 90% of deaths attributable to ARI globally, are as a result of complications from pneumonia. According to Bryce et al. (2005), pneumonia complications among under-five children between 2000 and 2003 accounted for 19% of the 10.6million annual child death worldwide. The impact of ARI in developing countries is more severe than

experienced in developed countries because of disparities in access to health services in these countries. Whilst on average, deaths due to pneumonia among under-five children are estimated around 1% to 3% in developed countries; the developing countries could record as much as 10% to 25% of such deaths annually (PAHO, 1999). Socioeconomic factors, environmental and nutritional factors are found to contribute to pneumonia deaths among these children in both developing and developed countries Victora et al. (1999).

Low birth weight, low income, overcrowding and biomass-burning stoves are some of these risk factors. Lehmann et al. (1996) also identified that in Guinea, pneumonia mortality has a correlation with birth weight among children within the 1-5month age group and this declines with an increasing birth weight. In Ghana, pneumonia is the second largest single cause of neonatal and under-five deaths aside from malaria infections. It caused about 16% childhood deaths in the year 2010 (WHO/UNICEF, 2011). According to a Ghana Health Service Report (2010), pneumonia has been rated as one of the leading causes of under-five morbidity and mortality in Ghana, with an annual death toll record of 16,200 children, representing 20 per cent deaths per year. The implication is that pneumonia, aside from malaria would have to be looked at carefully if Ghana intends to reduce childhood death drastically.

1.2 PROBLEM STATEMENT

Ghana is divided into 10 administrative regions which are further divided into 170 District Assemblies. Ghana is currently a middle income country based on the rebasing estimate of the GDP in 2010. To further transform the economy, a policy drive which is based on infrastructural and human development was employed. The human development aspect of this policy concerns the Ministry of Health since

human health is important in economic development (NHA, 2013). The mission of the Ministry of Health is to contribute to socio-economic development and wealth creation by promoting health and vitality, ensuring access to quality health, population and nutrition services for all people living in Ghana and promoting the development of a local health industry. This mission puts the concept of health beyond the confines of curative care to other socio-economic determinants of health (Ghana Health Policy, 2007).

The Ministry of health realising that health production is beyond curative care and moreover the disease profile as well as mortality patterns of the country are directly linked to factors other than medical care, decided to adopt a more comprehensive health policy in 2007. This policy was geared towards improving environmental hygiene and sanitation in terms of proper housing and town planning, provision of safe water, provision of safe food and nutrition. The policy also aimed at encouraging regular physical exercise among the citizens, immunization of mothers and children, prevention of injuries in work places, prevention of road accidents and practising of safe sex. The overall purpose of this policy was to focus on the promotion of healthy lifestyles through good nutrition, regular physical exercise, recreation, rest and personal hygiene.

The healthy lifestyle was to be ensured via access to potable water, sanitation and safe food, housing and safe roads. (Ghana Health Policy, 2007). In order to address problems confronting child survival and development in the country, Government, development partners as well as non-governmental organizations have been collaborating to reduce under-five morbidity and mortality. This brought about the formulation of a child health policy that aims at caring for mother and child;

pregnancy, birth as well as immediate newborn period, neonatal period, etc. For example the policy has the reduction of maternal mortality ratio by 75% by 2015 (MDG5), halting or reversing by 2015 the incidence of malaria and other major diseases (MDG6), halting or reversing by 2015 the spread of HIV/AIDS (MDG6) as well as halving by 2015 the proportion of people without sustainable access to safe drinking water as its major goals (Child Health Policy MOH, 2007).

The child health policy also recommended antenatal care visit (ANC) for pregnant mothers as an intervention package where the first visit was to commence as soon as pregnancy is suspected. During the first antenatal visit, tetanus toxoid vaccination as well as HIV test and counseling were to be carried out for pregnant mothers. Distribution of insecticide treated nets at subsidized rate for use by mothers and their babies at night was also encouraged. Three dose of sulphadoxine pyrimethamine was also to be introduced on pregnant mothers at regular schedule during these visits. Major interventions were put in place to address the killer diseases such as malaria, diarrhoea, dysentery, pneumonia, etc. (Child Health Policy MOH, 2007).

Certain financial measures were also adopted to ensure the sustenance of the policy and to achieve the set goals i.e. promoting the enrolment of all caretakers and their children in the NHIS, adopting cost-saving approaches for child health training packages, improving productivity of existing staff as well as better coordination of donor resources, etc.

In spite of the numerous commitments put up by MOH in Ghana, the impact especially on child health is generally low. It is, however, estimated that the MDG 4 could only be achieved by 2015 if Ghana reduces child mortality at a rate of 12.2% annually (MOH/PPME Ghana, 2007).

The share of neonatal mortality (death before reaching 28 days of age) is increasing and the millennium development goal for child survival cannot be met without a substantial reduction in this mortality. Some studies have indicated that more than one million mortalities that occur in Africa are within the first week of life, half of them at the first day of life. According to Lawn et al. (2006) as indicated in a study by Fengxiu Ouyang et al. (2013), between 3 to 4 million stillbirth that occur annually across the world, almost 97-99% could be found in low and middle income countries. The most challenging situation with records on perinatal deaths in developing countries is that deaths occur at home unseen and therefore could not be registered (Lawn et al.2005). Lawn et al. 2008 and Carlo et al. 2010 have concluded that over 70% perinatal deaths occur at the blind side of registries and hence accurate records are lacking.

The perinatal rate in Ghana as at 2008 was 39/1000 of all pregnancies in the five years prior to the survey (GDHS, 2008). In 2009, WHO/UNFPA/World Bank have estimated that stillbirth was as high as 22/1000 pregnancies. The Ghana Demographic and Health Survey report in 2008 identified about 6% of children under age five with ARI symptoms in the two weeks prior to the survey. The report also indicates that only half of children with these symptoms were taken to a health provider. The prevalence is more pronounced among under-five children in Northern and Upper West regions. UNICEF report, 2014 has shown that children under age five suspected with pneumonia were about 51% in Ghana.

Access to improved drinking water and improved sanitation received low attention. As at 2011, 86% and 13% of the entire population of Ghana had access to good drinking water and improved sanitation respectively whereas Cape Verde could boast

of 89% access to good drinking water and 63% access to improved sanitation same year. Between 2005 and 2012, 55% of mothers had access to skilled attendants during delivery whilst Botswana and Namibia recorded 99% and 81% of such attendants respectively. Though Ghana has been noted to have more women attending antenatal care as compared to some middle income Sub-Saharan African countries such as Cape Verde, Botswana and Namibia, it is still important for women to increase the number of these visits (World Health Organization, 2013).

Childhood birth weight which is the main factor of concern in this study cannot be over accentuated globally and in Ghana to be specific. This is because abnormal birth weight especially low birth weight which is a global phenomenon has been a leading cause of death at neonatal stage and below age five (Lawn et al. 2005, WHO 20013). In spite of all the measures and policies adopted in most UN member states to reduce the prevalence of low birth weight across the world, the rate is non-declining in most developing countries including Ghana. It has been established in World Health ranking report in 2014 that 160 per 1000 births in Ghana were identified with low birth weight. Ghana statistical service in 2009 too, estimated low birth weight to be 10% of all births. These rates are quite phenomenal and could raise a lot of concern among researchers.

There may be more of such babies whose birth weights could not have been estimated since they could not have been weighed at birth. According to Multiple Indicator Cluster Survey report in 2006, only 2 out of 5 babies were weighed at birth prior to the survey. World Health Organization report in 2004 confirmed that about 40% of babies were delivered outside health facilities without skilled attendants and therefore the babies are rarely weighed at birth. A study conducted by Kayode et al. (2014) established that low birth weight babies are prevalent among the rural communities

and areas with high level of poverty in Ghana. A number of studies conducted outside Ghana especially that of Bale et al. (2003), Behrman et al. (2006) have shown that the birth weight or the size of a child at birth is an important indicator of the extent to which the child survives at perinatal and neonatal stages.

According to these studies, a child whose birth weight is below 2.5kg or who is said to have a very small size at birth stands the risk of dying at the early stage of life. The World Health Organization report in 2014 indicates that about 7,876 or 4.21% deaths in Ghana could be attributed to low birth weight. The idea indicated by the aforementioned studies and the current trend of birth weight in Ghana were the motivations for this study.

Realizing the efforts toward child survival and the need to further reduce childhood deaths such as neonatal mortality and under-five deaths in order to achieve MDG 4 in Ghana, the researcher intends to address the questions below:

1. To what extent do birth weights and child's sizes at birth determine childhood health outcomes (perinatal mortality and acute respiratory infection) in Ghana?
2. What are the effects of some other demographic and socioeconomic factors on child health outcomes such as perinatal mortality and acute respiratory infection in Ghana?

1.3 SIGNIFICANCE OF THE STUDY

Many studies were conducted into child health outcomes in Ghana such as the impact of public health expenditure on infant mortality, child mortality and life expectancy where time series data were used. Some other studies also used data from Ghana Demographic and Health Surveys, Multiple Indicator Cluster Survey and district or

community-based surveys to illustrate the impact of certain risk factors on childhood deaths. Though Engmann et al. (2011), Kwofie et al. (2012), Ofori Fosu et al. (2013), Kanmiki et al. (2014) and Kayode et al. (2014) as well as some other studies have identified the risk factors of adverse childhood health outcomes in Ghana, much needed to be done in terms of the effect of birth weight (kg) and mother's size evaluations of their babies on perinatal death and acute respiratory infection prevalence among under-five children. Taking all these into account, this study seeks to accomplish the following:

1. Provide a guide to child health policy makers in making appropriate policy decisions with regard to perinatal mortality, acute respiratory infection among children.
2. Indicate measures relevant for minimizing the risk factors toward improving childhood health outcomes in the country.
3. Add to literature the effect of the mother's subjective evaluation of the size of the baby as well as recorded birth weight on child health outcomes in Ghana.

1.4 OBJECTIVES

General Objectives

The general objective of this research is to assess and analyze the risk factors of acute respiratory infection and perinatal deaths in Ghana in order to suggest some interventions that can be used in order to improve the survival of newborns in the country.

Specific objectives

- To examine the demographic factors including (birth weight and child's birth sizes) and some other socioeconomic factors that influence perinatal mortality.
- To find out the demographic factors including (birth weight and child's birth sizes) and socioeconomic factors that impact acute respiratory infection among children under-five in Ghana.

1.5 LIMITATIONS

This study is limited in terms of data collection, such that whereas the researcher would prefer using data that cover up to at least 2013, the available dataset is just up to 2008. The study used data from three different survey periods because of insufficient information on the perinatal and acute respiratory infection for each single survey period. The GDHS data used also lack information on substance abuse, alcohol abuse, smoking, inherent obstetrics and gynaecological conditions that could influence adverse pregnancy outcomes and ARI prevalence as indicated in the literature. In spite of the challenges associated with cross-sectional datasets such as misreporting or omission, GDHS datasets provide more representative and accurate information than others (GDHS, 2008). The study therefore deems it fit to pool the data of 1998, 2003 and 2008 GDHS to derive the knowledge relevant enough for future or current decision making.

1.6 ORGANIZATION OF THE STUDY

Chapter 1 looked at the background, statement of the problem, objectives of the study, significance of the study, limitations and organization of the study. **Chapter 2** would look at the trend in perinatal mortality, acute respiratory infection among children under-five and low birth weight globally. **Chapter 3** will review the

literature, i.e. both theoretical and empirical studies. **Chapter 4** will describe in detail the methodology and the estimation procedures that would be used in analyzing the data, while **chapter 5** will present collinearity diagnostic test, distribution of the two childhood health outcomes by the selected background characteristics and analyses of the data results. Chapter 6 will focus on the conclusion, summary of the research findings as well as the recommendations.

CHAPTER TWO

THE TREND IN PERINATAL MORTALITY, ACUTE RESPIRATORY INFECTION AMONG CHILDREN UNDER-FIVE AND LOW BIRTH WEIGHT GLOBALLY

2.0 INTRODUCTION

Childhood health outcomes being considered in this study include the perinatal mortality and acute respiratory infection (pneumonia prevalence) in Ghana. This section intends to illustrate trends and the spread of these child health situations across the WHO categorized regions and that of Ghana. The same shall be established in terms of birth weight situations across these regions globally. The survival of children and mothers is a global agenda since the establishment of the Millennium Development Goals (MDGs) in 2000. Amongst the eight MDGs, two goals directly aim at improving maternal and child health. The fourth MDG is geared toward reducing the under-five mortality by two thirds between 1990 and 2015, whilst the fifth MDG aims at reducing maternal mortality ratio by three quarters and ensuring universal access to reproductive health by 2015.

There has been a global decline in under-five mortality rate since 1990. Under-five mortality rate declined from 90/1000 to 46/1000 in 2013. The global estimates indicate that 17,000 children are being saved every day (UNICEF, 2014). The total number of under-five deaths per annum decreased from 12.5 million in 1990 to 6.3 million in 2008. The neonatal mortality rate has also declined from 33/1000 to 20/1000 (4.7 million to 2.8 million) the same period globally. Although under-five and neonatal rates declined globally, half of the current 6.3 million child deaths

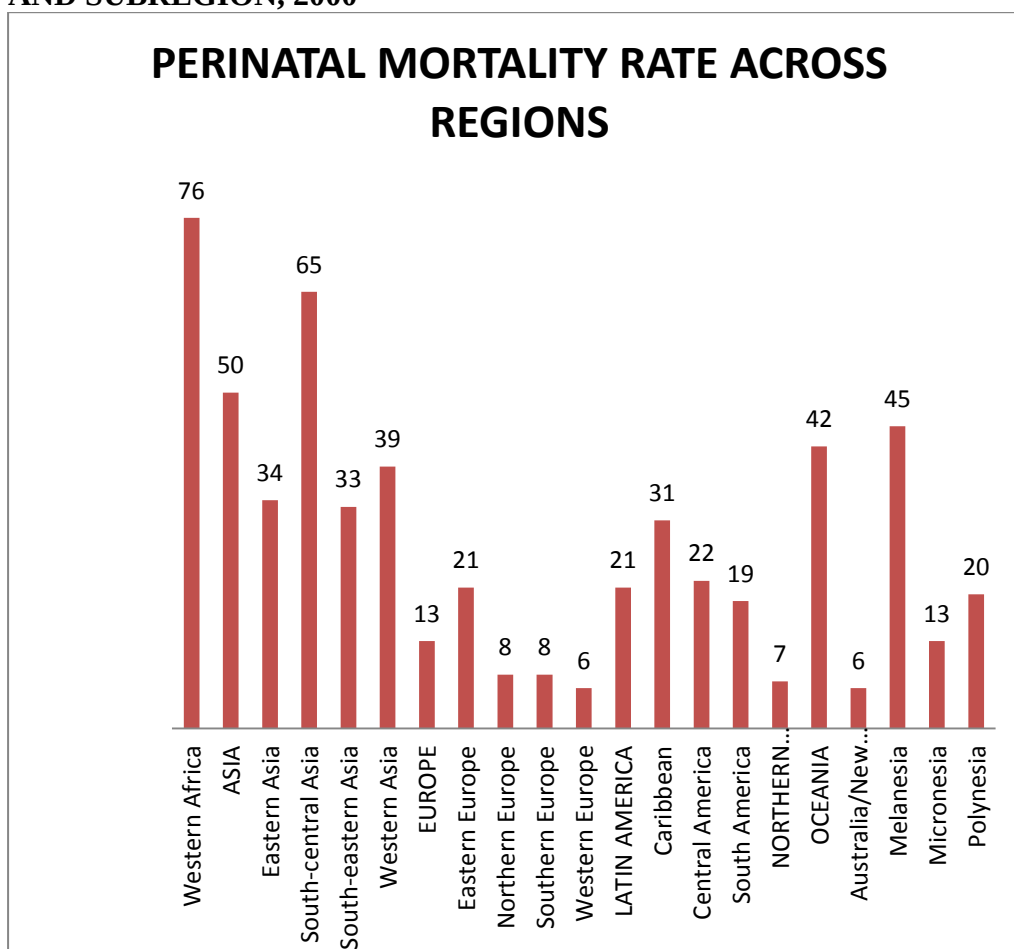
occurred in Sub-Saharan Africa. In sub-Saharan Africa, at least one out of every eleven children dies before their fifth birthday (UNICEF, 2013).

2.1.1 GLOBAL TREND OF PERINATAL MORTALITY

Globally, perinatal deaths were over 6.3 million in the year 2000. Among these deaths, 98% occurred in the developing countries and 27% in the least developed countries. The estimates indicate that half of the perinatal deaths are attributable to stillbirth in developing regions whereas it constitutes 6 out of 10 perinatal deaths in developed regions. Perinatal death rate among the developing regions was as five times larger than that of developed regions across the world. Whereas developed regions had a perinatal mortality rate of 10/1000, developing regions had a rate of 50/1000 and least developed regions had 60/1000. Among this, Africa had about 62/1000, Asia had 50/1000 and Oceania, 42/1000 perinatal deaths. African countries had the highest perinatal mortality followed by Asia and Oceania. The highest of all perinatal mortality rates in Africa can be found in West Africa where about 76/1000 deaths occur WHO (2006).

Middle Africa also had 75/1000 deaths followed by South-Central Asia which had about 65/1000. The Western Europe had the lowest rate among all with 8 per 1000 births. Global estimates also established that about 1 million new-borns died on the first day of birth in the year 2013. Death on the first day of birth accounted for 16% of all under-five deaths across the world. Deaths within the first seven days generally constitute 2 million of all new-born deaths in 2013 which represent 73% of all neonatal deaths (UNICEF, 2014).

Figure 2.1.1 PERINATAL MORTALITY RATES BY LEVEL OF DEVELOPMENT AND GEOGRAPHICAL (UNITED NATIONS) REGION AND SUBREGION, 2000



Source: WHO, 2006

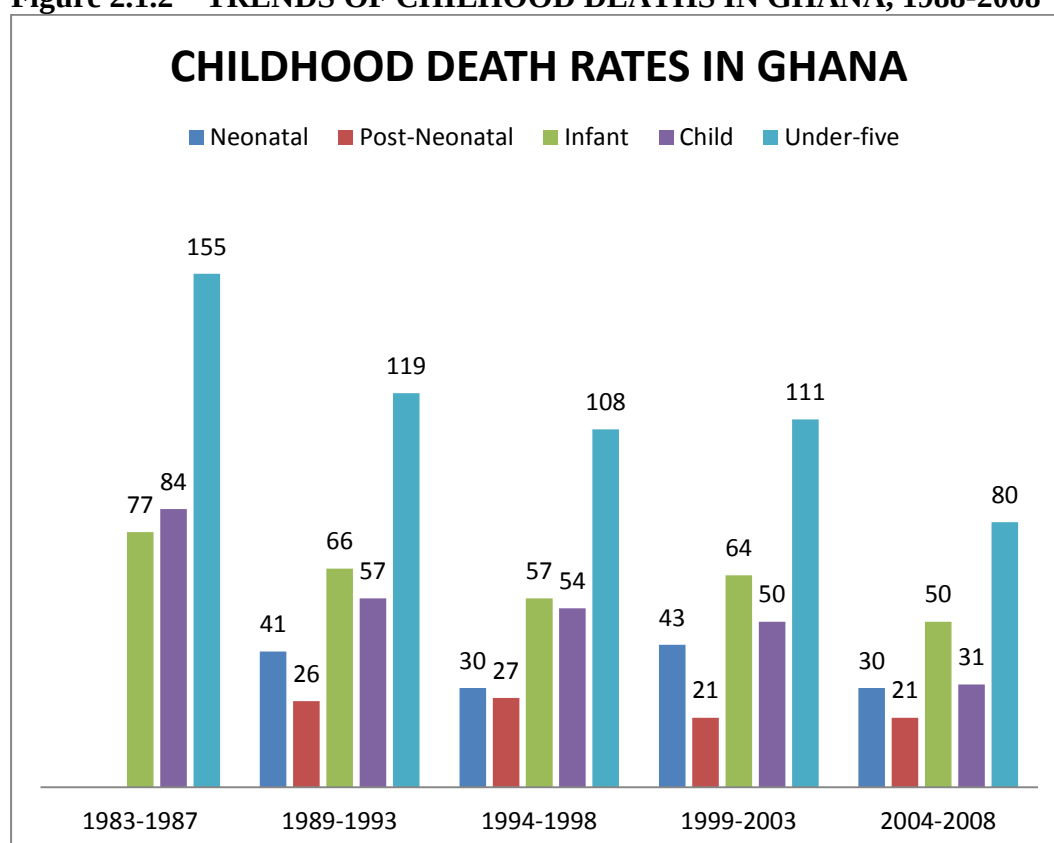
2.1.2 THE TRENDS OF CHILDHOOD DEATHS IN GHANA

The 2008 GDHS report indicates that records of childhood mortality among children born in the five-year period before each survey have been considered. From these records, it has been noted that under-five mortality was 80 per 1000 live births, 50 deaths per 1000 in terms of infant mortality rate, 31 per 1000 and 30 per 1000 live births for child and neonatal mortality respectively in the five-year period before 2008. According to this report, whereas infant mortality was 61 per 1000 live births for 10-14 years period before the survey, it declined to 50 per 1000 in the period 0-4 years prior to the survey. Child mortality also declined from 46 per 1000 children to

31 deaths per 1000 children for 10-14 years and 0-4 years respectively. Under-five mortality moved from 105 to 80 deaths per 1000 children for 10-14 years and 0-4 year's period before the survey respectively.

Neonatal deaths declined from 35 per 1000 live births to 30 per 1000 live births for 5-14 years and 0-4 years correspondingly, preceding the survey in 2008. Post-neonatal deaths were 27 per 1000 live births for 10-14 years and 21 per 1000 live births for 0-4 years before the survey. It could be noted from these trends that childhood deaths generally indeed declined over the 20 years even though there was a sharp increase in 1999-2003. However, the childhood deaths continue to decline after this period.

Figure 2.1.2 TRENDS OF CHILDHOOD DEATHS IN GHANA, 1988-2008



Source (2008 GDHS)

2.1.3 TRENDS OF PERINATAL MORTALITY IN GHANA

In Ghana, perinatal mortality rates are estimated to include pregnancy losses of at least seven months gestation and deaths among live births within the first seven days of life.

According to the 2008 GDHS report, the perinatal mortality for the five-year period prior to the survey indicated a rate of 39 per 1000 pregnancies of at least 7 month gestation. This rate includes 40 stillbirth and 75 early neonatal deaths. Considering the perinatal mortality rates in terms of the mother's age background characteristics, it was realized that childhood death at the perinatal stage was highest among mothers within the ages 30-39 years. They recorded a rate of 45 per 1000 pregnancies prior to the period of survey. Mothers within 20-29 years of age distribution recorded perinatal mortality rate of 33 per 1000 pregnancies which was the lowest among the maternal age categories within the period of the survey.

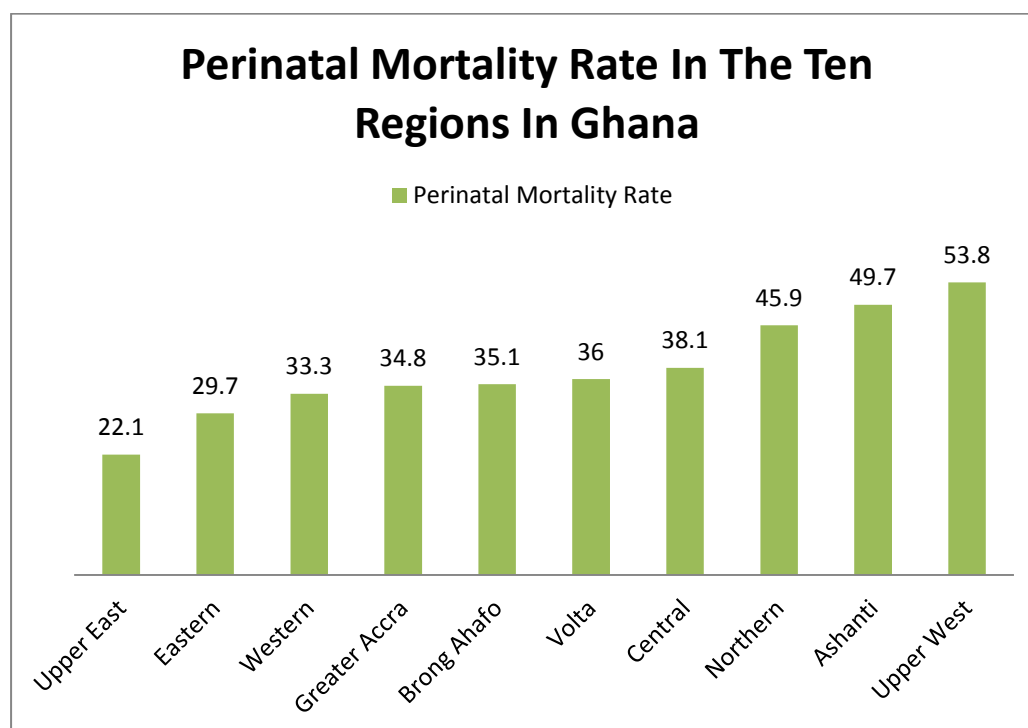
Perinatal deaths were also higher among women with rural residential status than those with urban background. The rates were 42 per 1000 and 34 per 1000 pregnancies respectively. Mothers with primary education background experienced a perinatal rate of 44 per 1000 whereas those mothers with secondary plus education background had 36 per 1000 pregnancies, the lowest among the various levels of educational background of mothers prior to the survey period. Surprisingly, mothers within the middle income bracket rather experienced the highest perinatal mortality rate among the various wealth quintiles. A rate of 61 per 1000 pregnancies was recorded among these categories of mothers. Furthermore, perinatal rate observed among mothers of second wealth quintile was 27 per 1000 pregnancies, the lowest in terms of wealth quintile backgrounds. Perinatal mortality rate was also high among

mothers with 15-26 months of previous pregnancy intervals (45 per 1000 pregnancies)

2.1.4 THE TREND OF PERINATAL MORTALITY AMONG THE TEN REGIONS IN GHANA.

Perinatal mortality was the highest at the Upper West Region followed by Ashanti Region within the five-year period prior to the survey in 2008. The rates were 53.8 per 1000 and 49.7 per 1000 pregnancies respectively. Northern Region also had a perinatal mortality rate of 45.9 per 1000 pregnancies which was followed by Central Region and Volta Region with 38.1 per 1000 and 36 per 1000 pregnancies respectively. Brong-Ahafo Region also experienced perinatal mortality rate of 35.1 per 1000 whilst Greater Accra Region had a rate of 34.8 per 1000 pregnancies. The region with the lowest perinatal mortality was the Upper East Region; 22.1 per 1000 pregnancies (MCA/WHO).

Figure 2.1.3 PERINATAL MORTALITY IN THE TEN REGIONS OF GHANA

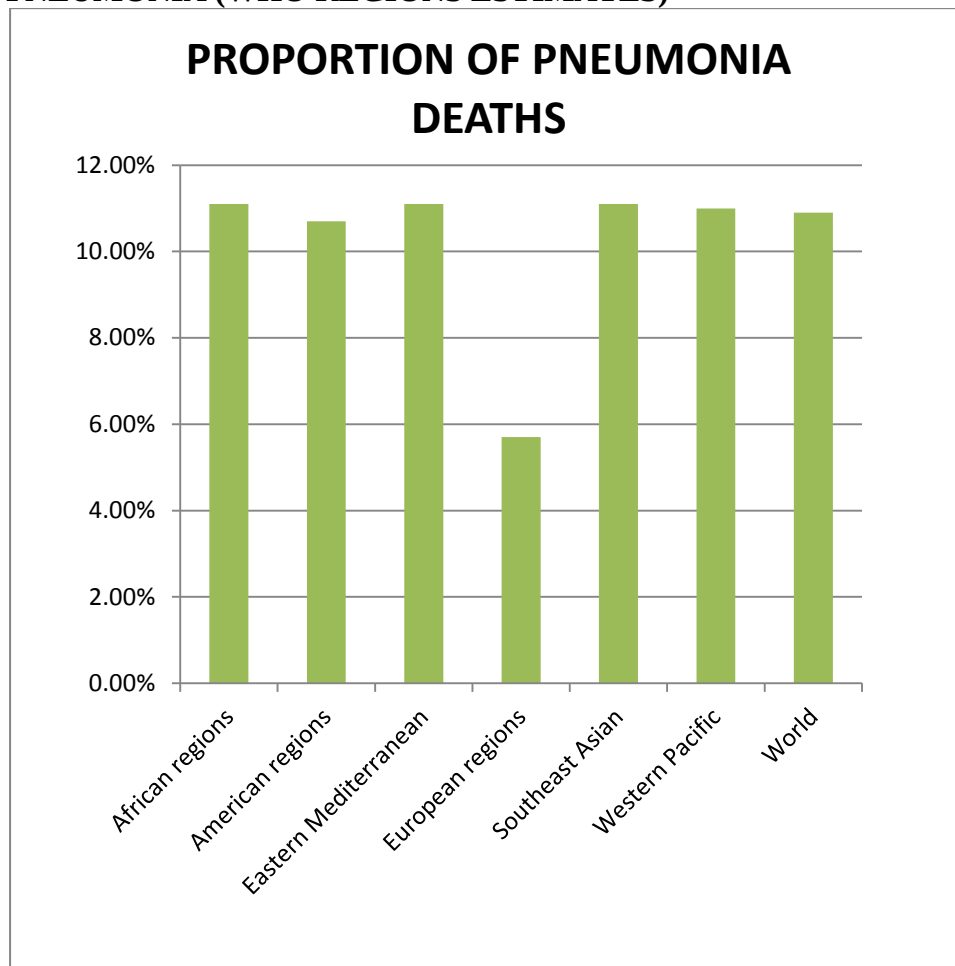


Source: (GDHS, 2008)

2.2.1 PNEUMONIA MORTALITY (GLOBAL SITUATION)

Generally, childhood pneumonia which is one of the severe forms of acute respiratory infection has been found to be the leading cause of deaths among children under-five worldwide and in most developing countries to be specific where access to care is incomplete and interventions to improve care is scarce. According to the WHO (2000) about 1.9 million childhood deaths each year are attributable to childhood pneumonia. Even though implementation of safe and affordable interventions aided reduction in pneumonia deaths over the years, these rates are still high across the world.

Figure 2.2.1(a) PROPORTION OF UNDER-FIVE DEATHS DUE TO PNEUMONIA (WHO REGIONS ESTIMATES)

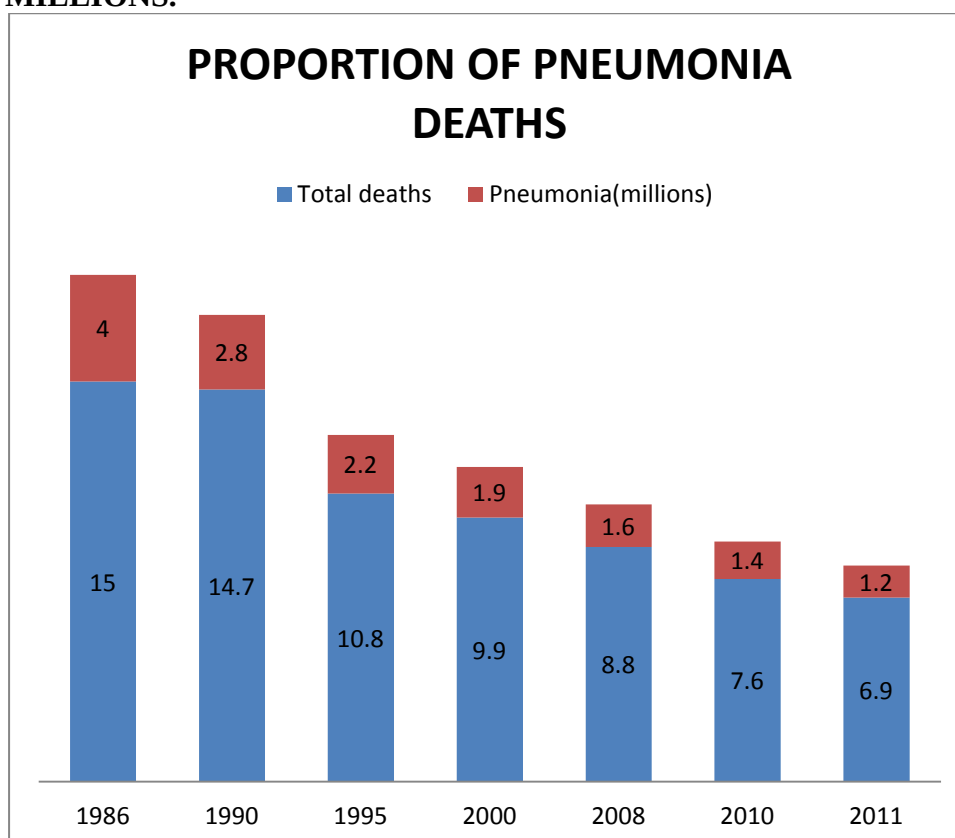


Source: Fischer Walker et al. (2013)

Generally, considering the trend established by the chart above an average of 11% of all under-five deaths worldwide are attributable to pneumonia in African regions,

Easter Mediterranean and Southeast Asian regions recorded the highest proportion of under-five deaths due to pneumonia across WHO regions. About 11.1% of all under-five deaths in these regions are associated with pneumonia. European regions recorded 5.7% of under-five deaths due to pneumonia which is the lowest relative to what occurs in other regions.

Figure 2.2.1 (b) TOTAL UNDER-FIVE DEATHS AND THE PROPORTION DUE TO PNEUMONIA (GLOBAL ESTIMATES) OVER SOME YEARS IN MILLIONS.



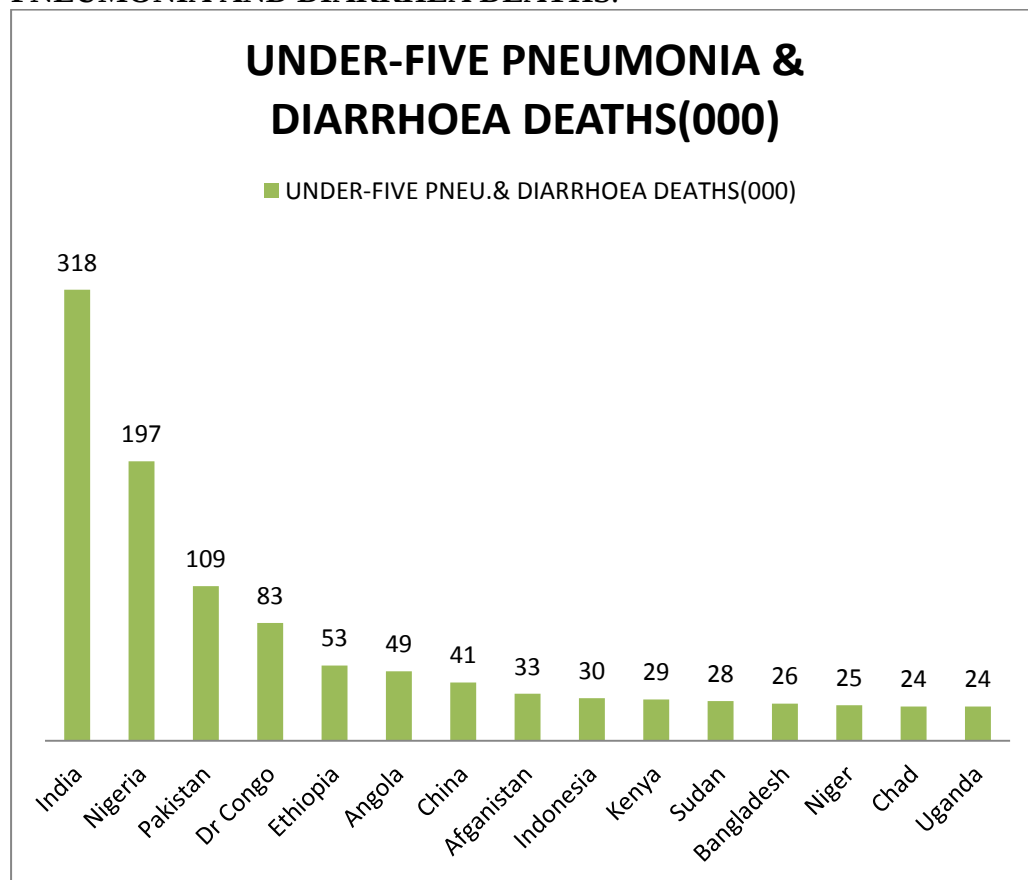
Sources: Rasa Izadnegadar et al. (2013)

The global estimate of the proportion of under-five deaths due to pneumonia prevalence from 1986-2011 indicates a fall in under-five deaths in general, as well as the deaths associated with pneumonia specifically. Total under-five deaths in 1986 were about 15million while those associated with pneumonia were about 4million in the same year. The lowest total under-five deaths and those attributable to pneumonia were recorded in 2011. Out of the 6.9million under-five deaths that occur in 2011,

1.2million could be associated with pneumonia. The trend in the deaths indicated by this data confirms a global decline in the deaths as the years go by.

Pneumonia, diarrhoea and malaria are the three major child killer diseases across the world but the reduction in malaria prevalence is greater than the reductions in pneumonia and diarrhea. Pneumonia, diarrhea and malaria claimed about 3 out of every 10 under-five children across the world in 2013. Pneumonia alone accounts for 15% of all under-five deaths in the world (UNICEF, 2014). The under-five deaths that occur as a result of pneumonia and diarrhoea are found to be concentrated in 15 countries. These countries bore about 71% of the global pneumonia and diarrhea causing deaths (International Vaccine Access Centre, 2014).

Figure 2.2.1(c) THE 15 COUNTRIES WITH THE MOST CHILDHOOD PNEUMONIA AND DIARRHEA DEATHS.



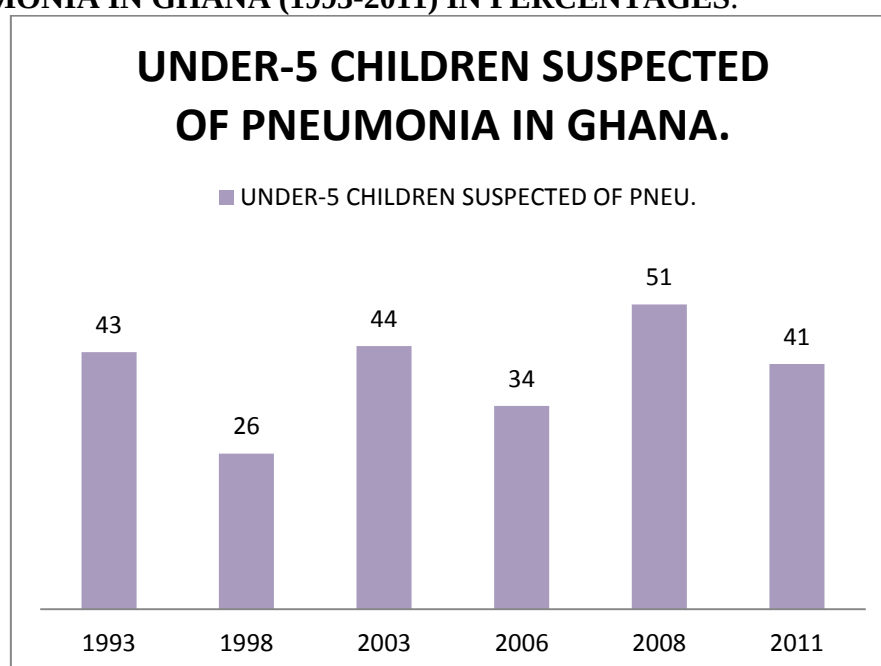
Sources: International Vaccine Access Centre (2014).

2.2.2 PNEUMONIA MORTALITY (GHANAIAN SITUATION)

In Ghana, pneumonia is the second largest cause of neonatal and under-five deaths aside from malaria infections. It caused about 16% childhood deaths in the year 2010 (WHO/UNICEF 2010). The implication is that pneumonia aside from malaria would have to be looked at carefully if Ghana intends to reduce childhood death drastically. Annually, about 16,200 under-five children die as a result of this disease (GHS report, 2010). An estimate of children under-five suspected to have pneumonia in Ghana in certain periods was captured by UNICEF (2014). This estimate indicates that 2008 recorded the highest percentage of suspected pneumonia cases in Ghana. About 51% of these cases were reported in 2008. Suspected pneumonia cases that were reported between 1993 and 2011 were lowest in the year 1998 in terms of percentages.

Only 26% of these cases were reported in the year 1998. Considering this record, it could be realized that cases suspected to be pneumonia almost doubled in terms of percentages in 1998 and 2008. However, 2011 recorded a decline in these cases. It was only 41% of these cases that were reported in this year. The years 1993, 2003 and 2006 recorded 43%, 44% and 34% respectively in terms of the suspected pneumonia cases in Ghana.

Figure 2.2.2 CHILDREN UNDER AGE FIVE SUSPECTED TO HAVE PNEUMONIA IN GHANA (1993-2011) IN PERCENTAGES.



Sources: UNICEF (2014)

2.3.1 TRENDS OF LOW BIRTHWEIGHT (GLOBAL SITUATION)

Birth weight is the first weight of foetus or newborn obtained after birth. It is important to consider a child's birth weight as well as its size at birth since these can help explain the extent to which children can survive. A child with a birth weight less than 2.5kg or those reported to be small or very small in size stand the risk of childhood death (GDHS, 2008). Low birth weight as indicated by World Health Organization is the weight at birth of less than 2500 grams or 2.5kg. Low birth weight is a common phenomenon in developing countries than in developed countries. Low birth weight has been a cause of numerous poor health outcomes among children in these developing countries (UNICEF, 2004). Considering the challenges posed by low birth weight in developing countries especially, the goal of reducing the phenomenon cannot be over emphasized.

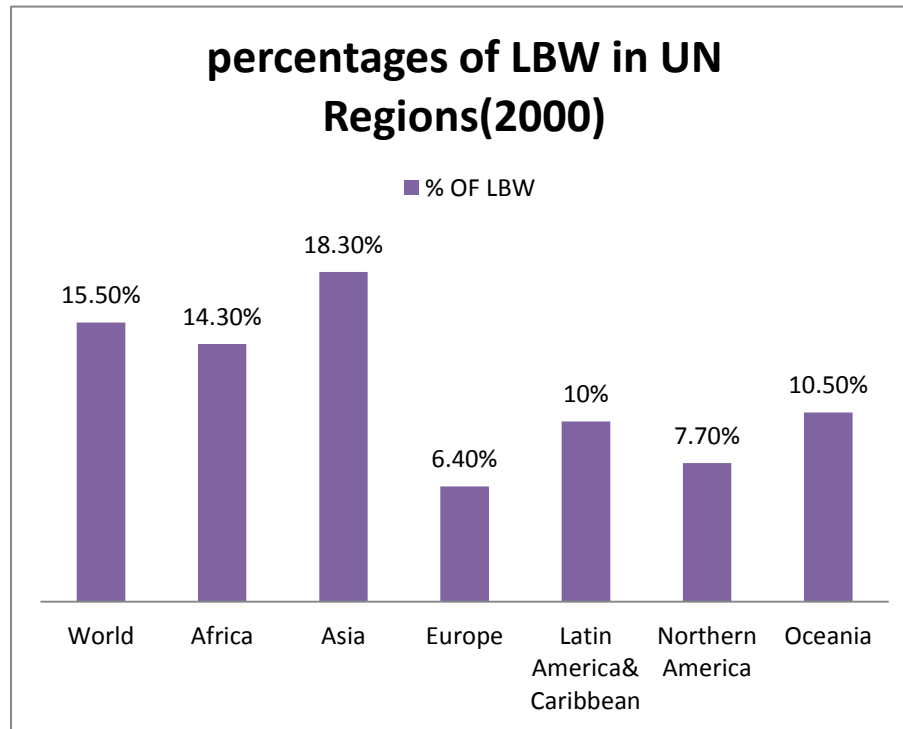
Realizing that this phenomenon is a major threat to achieving the MDG-4, the UN General Assembly Special session on children resolved to reduce low birth weight to at least one-third between 2000 and 2010. Numerous plans of actions have been adopted since then by most countries under the UN membership to ensure a healthy start in life for children. One of these plans of actions is to ensure that pregnant women are healthy and well-nourished throughout the period of pregnancy. In 1992, low birth weight rates were 7% for industrialized countries but an average of 17% for developing countries. Some of these developing countries experienced rates of low birth as high as 33% whilst some had as low as 5%. Globally, over 20 million children, representing about 15.5% of all births, were born with low birth weight in 2000.

About 95.6% of these conditions can be linked to developing countries. For all the low birth weight babies, half of them could be found in South-Central Asia. This region has about 27% of all their infants born with birth weight less than 2.5kg. The sub-Saharan African countries are also associated with 15% rate of birth below 2.5kg. Central and South America, Caribbean as well as Oceania have 10%, 14% and 10% respectively as rate of children born with low birth weight. Asia and Africa indicated about 72% and 22% respectively of infants with low birth weight in developing countries. India alone also recorded 40% of low birth weight in developing countries (UNICEF/WHO, 2004). However, these rates may have been underestimated according to the WHO. This is because about 40% of babies are often delivered outside health facilities without skilled attendants, and therefore babies are rarely weighed at birth.

Considering the chart below, it can be observed that whereas the whole world recorded 15% of babies with low birth weight, Asia alone constitute 18%. Africa also

followed with 14.3% of the world's rate of babies with low birth. Oceania is the third region in terms of infants with low birth weight (10.5%) whilst Europe recorded the lowest with 6.4%

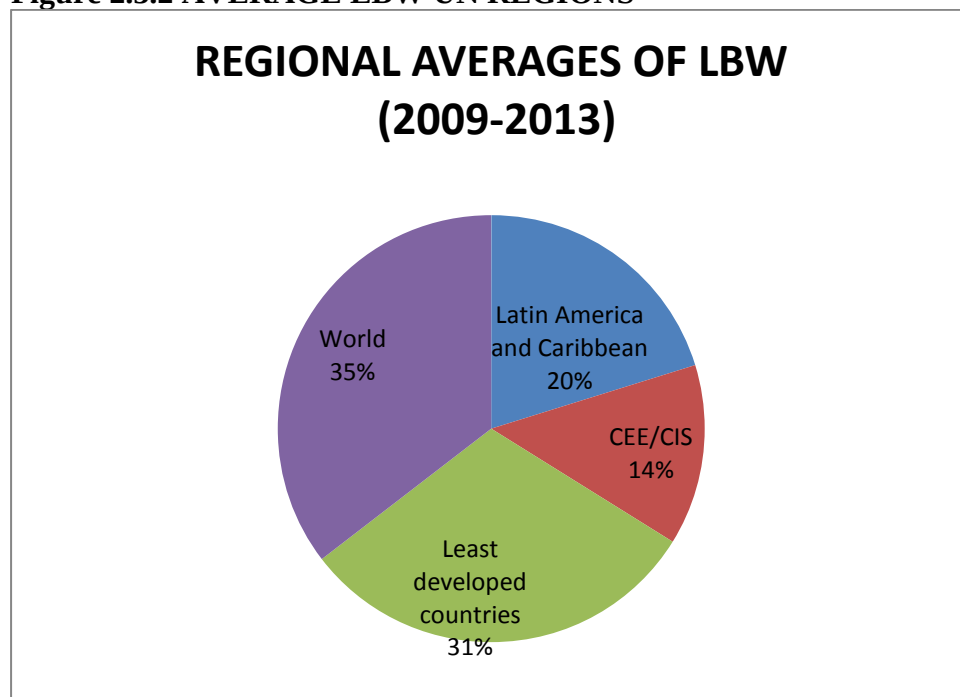
Figure 2.3.1 TRENDS OF LOW BIRTHWEIGHT IN UN REGIONS (2000)



Source:
UNICEF/
WHO,
2004

2.3.2 AVERAGE RATE OF LBW INFANTS IN UN REGIONS (2009-2013)

On average between 2009 and 2013, according to the 2014 UNICEF estimations, the world had 35% of infants with low birth weight; least developed countries had 31%, and Latin America and Caribbean together had 20% whereas Central and Eastern Europe/Commonwealth of Independent States (CEE/CIS) also had 14% of all the babies born with low birth weight.

Figure 2.3.2 AVERAGE LBW UN REGIONS

Source: UNICEF, 2014

2.3.3 THE TREND OF BIRTH WEIGHT IN GHANA

The distribution of birth weight in general as reported in 2003 and 2008 covered only 28% and 43% of births respectively in the five years preceding each GDHS survey. The report was concerned with both the child's birth weight and the size of infants at birth as reported by their mothers. Since records on the birth weights of a number of children in developing countries are not known, birth sizes of these babies are used as proxies of their birth weight.

The reported sizes of babies at birth do not vary so much with the background characteristics. Generally, large proportions of babies were reported to be either average or large in size at birth. Mothers with ages < 20 years reported 5.3% as a proportion of live births with very small birth sizes which is the worst in this category. About 4.9% of babies reported with very small birth sizes were among mothers within age ≥ 35 years. Mothers of ages 20-34 years at birth have reported the lowest percentage of babies with very small birth sizes i.e. 3.9%. Mothers in this age category have babies with normal birth sizes. More babies were reported to have very

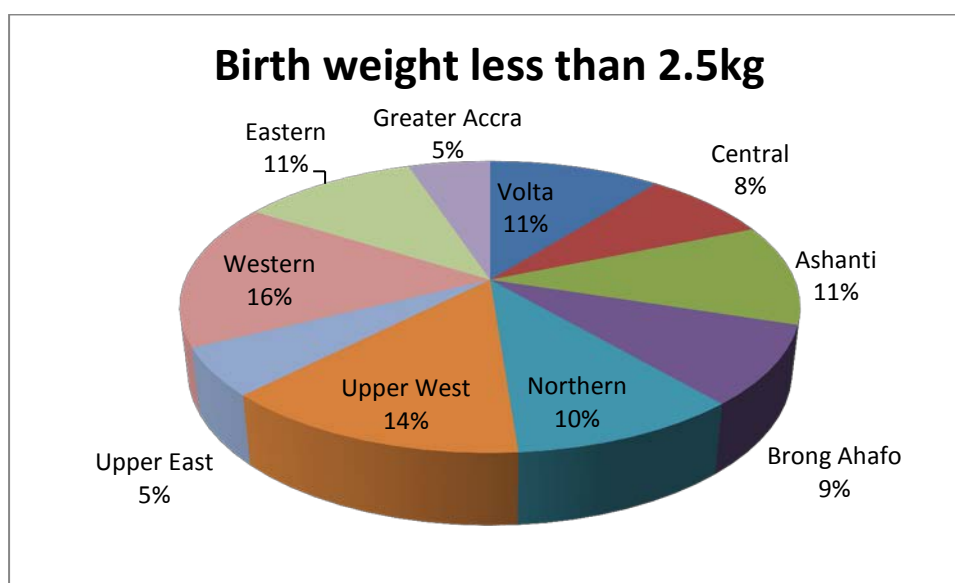
small sizes at birth in rural areas than in the urban areas i.e. 4.6% and 3.4% respectively. In the urban areas, more babies were reported to be either average or large size at birth i.e. 86.7%. Northern and Upper East regions had 5.9% and 6% babies with very small sizes respectively. Babies with average or large sizes at birth do not vary much in percentages across the regions but Western Region had about 91.8% as the best in that category.

Mothers with secondary plus level of education reported about 5.6% babies with small size at birth, the poorest in that group whilst mothers with middle/JSS background reported 87.7% babies with average or large birth sizes as the highest in that category. Households in the lowest wealth quintile had 4.7% of babies with small birth size which is the lowest in that category. Those in the fourth wealth quintile also reported 87.7% babies with average or large birth sizes as the best in wealth quintile category (GDHS, 2008).

The records from health facilities also indicated a trend in which more children had birth weights less than or equal to 2.5kg. However, the percentage distribution of babies with low birth weight does not vary much with the background characteristics. Mothers whose ages at birth were between 35 and 49 years had 12.4% babies with low birth weight which is the poorest relative to babies of mothers at ages less than 20 and from 20-34 years at birth (9.8%) of low birth weight babies. About 11.2% babies with low birth weight were from rural communities as against 9.3% from urban areas. Mothers with primary level of education had 12.9% babies with LBW which is the poorest relative to birth weight of babies of mothers with other levels of education. Households in the middle wealth quintile had 13.7% of babies with LBW which is the poorest relative to the birth weight of babies from households in other levels of wealth quintile (GDHS, 2008).

Most of the low birth weight babies in Ghana during the five year period prior to the survey were registered in Western Region (16%). This is followed by the Upper West Region with 14%. The Ashanti, Volta and Eastern Regions registered 11% each for the same period. The Greater Accra and Upper East Regions had 5% each as the lowest of all the low birth weights registered over the period.

Figure 2.3.3 REGIONAL DISTRIBUTION OF BIRTH WEIGHT IN GHANA



Source: Author's calculations, GDHS, 2008

A number of studies investigated the determinants of the relatively high prevalence of low birth weight in Ghana including that of Nketiah-Amponsah et al. (2012). In their study, socioeconomic and biological factors in terms of multiple births, gender of children and secondary or better level of education were found to significantly determine both low birth weight and perceived birth sizes of babies. Aside from mother's level of education beyond primary and birth order that were inversely related to LBW, other socioeconomic and geographical factors were positively related with LBW. In spite of the fact that antenatal care utilization was not significant in determining LBW, it was significant and inversely related with small size of babies. Location, antenatal care utilization, maternal age and education were significant risk

factors associated with LBW (Ofori-Fosu et al., 2013). Ibrahim et al. (2014) also established that babies of first-time mothers highly stand the risk of LBW.

Conclusion:

The perinatal mortality and the ARI prevalence among under-five children generally, even though have been declining globally would still be considered a threat to the survival of children in developing countries. These adverse childhood health outcomes could be a hindrance to many developing countries attaining the MDG4 at the end of 2015 as expected. The 2000 WHO report indicated that 3 million out of the 4 million child deaths globally were within the perinatal state. It has also been established that in each year, 3.3million babies are stillborn, of which 98% of these health outcomes are found in developing countries. Perinatal deaths in Ghana also constitute 84% of all neonatal deaths in Ghana (GDHS report, 2008). Many studies including that of Bryce et al. (2003) also established that about one-fifth of childhood deaths were attributable to ARI with pneumonia complication origins. Pneumonia which is the major complication in terms of ARI health outcomes accounts for 15% of deaths among children globally (UNICEF report, 2010). The 2010 GHS report also indicates that 16,200 under-five children die from pneumonia in Ghana.

CHAPTER THREE

LITERATURE REVIEW

3.0 INTRODUCTION

This chapter intends to point out the various studies that have been conducted in the area of health production and its consumption by individuals as identified by health economists such as **Grossman, Wagstaff, Feldstein, Newhouse, Behrman**, etc. The empirical literature on the correlates of perinatal mortality and ARI prevalence among children under-five as well as the impact of low birth weight on childhood health outcome shall also be included in this chapter.

3.1.0 THEORETICAL LITERATURE

Prior to the contributions of Grossman and others in the field of health, medical care or health care issues were considered to be in the domain of only medical practitioners. Health Economics became relevant when Grossman in his model indicated that health is an asset capable of being produced and consumed by individuals. As it is in the production of goods and services, health production comprises the use of inputs to arrive at an output. The inputs in health production, according to Grossman, entails medical care which is curative as well as one's own effort in the form of engaging in aerobic exercises, improving on diet, sanitation and other environmental factors. The output is the healthy days available to the individual.

3.1.1 HEALTH PRODUCTION FUNCTION

Grossman (1972) explained that an individual, who produces or demands health, is born with an initial stock of health that diminishes overtime but can be augmented through investment. The available health stock provides healthy days as the pay offs

for the investment. Grossman, however, indicated that the choice of an individual as to producing more health is limited to a lifetime period.

Grossman generally assumed that:

- i. the individual that produces health is always certain in terms of wage rate and flow of wealth, optimal health stock which determines demand for health care and the rate at which his or her health stock depreciate over time.
- ii. the individual, who is an isolated health producer, has full information as well as perfect knowledge on health capital, marginal benefit of both his current and future investment into health, interest rates as well as rate of depreciation in health stock. One also has full insight into his or her income substitution between healthcare and time inputs.
- iii. absence of health insurance such as the health costs are only covered by one's personal income or wealth.
- iv. educational level, prices of health inputs as well as wage rates are exogenously determined and hence are constant throughout one's life
- v. one has the choice of when to die i.e. length of individual's life is exogenously determined and hence does continuous investment into health to ensure the steady flow of healthy days.
- vi. there is a minimum amount of health stock below which one dies.

According to the investment framework model of demand for health developed by Grossman in 1972, where health status is the outcome of health production process, health production function is in the form:

$$H_i = H(H_0, \partial, M, t^l, X_i) \dots \dots \dots 3.1$$

Where

H_i = the health outcome of the individual in the production process.

H_0 = the initial health stock that could be inherited or derived from the environment

∂ = rate of depreciation in health stock over time as one gets older

M = medical care or inputs

t^I = time invested into increasing health stock

X_i = vector of other factors

Aside from rate of depreciation which reduces health stock with time, the model stipulates that good initial health stock, medical or health care, time invested in health production as well as other biological factors of the individual could result in better health outcome. Lack of the ability to ensure good investment into the various inputs relevant for the health production would result to an adverse health outcome.

Grossman realizing the tradeoffs between maximizing the utility of consuming other goods and services and the disutility that may arise from sick times for the rational consumer of both health and other products, decided to illustrate how this rational individual makes choice to maximize his utility overtime subject to both production function and budget function. From Grossman's illustration, the individual makes a choice such that utility could be maximized by optimal management of his or her stock of health over lifetime.

The model indicates that this individual maximizes a discounted utility that is time independent to explain that the marginal rate of substitution between sick time and consumption of other products in life remains constant with ageing.

$$\text{i.e. } U = U(t^s(H_0), X_0) + \beta U(t^s(H_1), X_1) \dots\dots\dots 3.2$$

Where

t^s = sick time, H_0 = initial health stock, H_1 = change in health stock,

X_0 = consumption of other products aside from health or medical care

$$\text{With } \frac{\partial U}{\partial t^s} < 0, \quad \frac{\partial^2 U}{\partial (t^s)^2} > 0 \text{ and } \frac{\partial U}{\partial X} > 0, \quad \frac{\partial^2 U}{\partial X^2} < 0, \quad \frac{\partial t^s}{\partial H} < 0$$

The model further indicates that health capital depreciates at a rate δ , thus a worsening health over time. However, an individual could increase health stock by either purchasing medical services or spending more time on preventive efforts. For that matter, the constraint below would be included in the individual's maximization problem.

$$H_1 = H_0(1 - \delta) + I(M_0, t^I) \dots\dots\dots 3.3$$

$$\text{With } \frac{\partial I}{\partial M} > 0, \frac{\partial I}{\partial t^I} > 0, \frac{\partial^2 I}{\partial M^2} < 0, \frac{\partial^2 I}{\partial t^{I^2}} < 0$$

Aside from the changes that occur in terms of health over time, wealth and wisdom (skills) also do. The wealth and subsequently consumption over time could be influenced by initial saving that yields interest (RS0). However, from the constraint function above, investment into health occurs during the initial period only. The implication is that medical care expenditure (PM) would have to be financed out of initial wealth (A0) that also depends on initial wage rate (W0). With the idea that consumption price (c) is positive in both periods and the total time available is normalized at 1 in both periods, a budget constraint such as below is deduced after discounting to present value.

$$A_0 + W_0(1 - t^s_0 - t^I) + \frac{1}{R}W_1(1 - t^s_1(H_1)) = PM + cX_0 + \frac{1}{R}cX_1 \dots\dots 3.4$$

Constituting Lagrangean function using the utility function and the constraints the model below is deduced.

$$\begin{aligned} L(H_1, t^I, M, X_0, X_1) = & U[t^s(H_0), X_0] + \beta U[t^s(H_1), X_1] + \mu[H_0(1 - \delta) + \\ & I(M_0, t^I) - H_1] + \lambda[A_0 + W_0(1 - t^s_0 - t^I) + \frac{1}{R}W_1(1 - t^s_1(H_1)) - PM - cX_0 - \\ & \frac{1}{R}cX_1] \dots\dots\dots 3.5 \end{aligned}$$

Further computation of the above model by Grossman indicate the results below

$\lambda = \frac{P}{\partial I / \partial M}$ and $\mu = -\beta \frac{\partial t^s}{\partial H_1} \left[\frac{W_1}{C} \cdot \frac{\partial U}{\partial C} - \frac{\partial U}{\partial t^s} \right]$ representing marginal utility of investing into health (pure consumption model and investment components respectively).

From the model above, Grossman established that for optimum conditions to be achieved, both μ and λ must be greater zero i.e. marginal utility of an investment into health as consumption good and pure investment good respectively should be greater than zero. Investment into health should have positive pay off, it must reduce sick time. One continues to invest into health production until the marginal benefit of health is equal to marginal cost of health production.

Wagstaff in 1986 developed conceptual machinery that is geared towards analysing the interaction of socioeconomic determinants of health based on economic concepts. The demand for health approach used by Wagstaff was built around three economic concepts. These are the indifference map, the health production and the budget constraint. According to Wagstaff, whereas good health is desirable it could not be the only desirable thing in life. It is upon this background that resources are not allocated toward health care activities alone. Wagstaff established that individuals value their health but not beyond other consumption activities. The individual is assumed to face an indifference map that indicates the possible combination of a unit of health and other consumption activities that give him the highest level of well-being in life.

These indifference maps are convex to the origin to signify that in as much as more of any of these needs are pursued at a point in time less of the other would be obtained. Obtaining more of one would compensate for the other until a limiting level is attained where none could be given out for other (diminishing marginal utility). The individual seeks to attain the highest indifference map which could only be

determined by the constraints he or she operates on. These are the technological (health production function) and the financial (budget function) constraints. Wagstaff established that an individual exerts control over their health by influencing their health care utilization and environment, i.e. the individual produces health. The bundle of health inputs that the individual uses to produce health as identified in this apparatus are food, health care, housing and working environment.

As more of the inputs are used, more health is produced. Health production as in the production of other goods is prone to the law of diminishing return. The implication is that given the state of technological knowledge, health production declines beyond a point in one's life time. However, as medical science progresses, more efficient ways of producing health is acquired. Wagstaff indicated that one's level of education could influence his or her state of technological knowledge and hence the variations in health production by individuals. An increased state of technical knowledge of an individual would reduce the utilization of health inputs but with a higher demand for health. Using the financial constraint to indicate how the individual behaves such that optimal level of welfare is obtained, Wagstaff stipulates that the health inputs and the other consumption activities are obtained at a cost.

The individual is said to have limited resources available for him to finance both the health production and other consumption activities over life times. The various combinations of health inputs and consumption activities that exactly exhaust individual's resources are illustrated by the budget constraint. The budget constraint function also indicated an inverse relationship such that to obtain more input, less of other consumption activities would be obtained. An increase in the individual's resource could lead to more of the health inputs and other consumption activities being obtained.

Feldstein (1967) in developing a framework that is geared towards analysing demand for health services conceded that innumerable factors could help shape a person's decision on how and what to spend on medical care. In this framework, Feldstein considered the factors that influence both demand and supply of medical care. It was established that knowledge of the value of demand and supply factors could aid forecasting the use of these health services. Demand for medical care is said to be the demand for a treatment which varies in terms of number of treatments or their quality. According to the framework, patients are the initiators of demand for medical care whereas the physicians combine the inputs in providing treatment of a given quality. The demand for the inputs are said to be derived demand which implies that they are demanded for treating illness other than for direct consumption.

The choice of the inputs and how care components are combined for treatment are subject to the level of the medical knowledge of the physician and the financial or resource constraint of the patients. The implication is that both demand and supply of health care services depend on the patient's financial resources as well as the extent of the physician's knowledge of the efficiency of the various components of care available.

Feldstein modelled demand for medical care based on the following assumptions:

- i. there is a choice in both the amount of medical care to be purchased and how the components of care are combined to produce a given treatment. The existence of this choice establishes the variations in how individuals use medical care as compared to the use of other economic factors such as income and prices.
- ii. there is a degree of choice which depends on knowledge and availability of substitutes, i.e. patients' ability to differentiate between the levels of impact of each

component of care on their health could influence their level of medical care utilization.

iii. the service provider is cognizant of the financial resources and the medical needs of the patients. The physician is also aware of the various ways of combining the components of care to produce a given treatment.

iv. the physician combines these components of care relative to their cost to the patients and how they may benefit the patients. E.g. an insurance coverage can influence the relative price of treatment inputs to the patients and the provider.

Based on the above assumptions, the model established that demand for medical care is always influenced by incidence of illness, cultural-demographic characteristics and economic factors. Incidence of illness generates the need for medical care whereas the interrelationship of the illness and other factors generate the demand for medical care. Individual's illness is considered a random event but for a society as a whole, it is quite predictable based on given characteristics of the people. The cultural-demographic factors include physiological conditions such as the impact of the illness on the patients and the attitude towards seeking medical care. Certain characteristics such as age, sex, family size, education and residence of the people could serve as a measure of this factor. Prices and income, which are the economic factors, affect the extent of care whilst treatment is undertaken as well as the patient's decision on whether or not to seek medical care.

Fuchs (1972) in his study that investigates the factors that influence the growing demand for medical care in USA, realised that aside from the combined effects of the growing size of the population in terms of changes in age group that seeks medical care, changes in per capita income and price that determine demand for medical care,

there are some other unexplained determinants. The study established that a large part of demand for medical care is determined by the physician. The physician is able to prescribe hospitalization, drugs and other components of care to the patients. The physician is also constrained by the fear of legal suits against him or her in case of poor result and the sense to be up- to-date. For that matter the physician does explain all the available options to the patients in order to make a decision. The physician also weighs the marginal benefit of the care as against the marginal cost in order to ensure efficient allocation of scarce resources.

Turrel (1999) developed a conceptual framework based on the determinants of health in which multi-level determinants of socioeconomic health inequalities were identified among the Australian population. This framework considered these determinants in the context of three different levels or stages. The first stage which is the upstream level entails the international influences and government policies that end up influencing social, economic and environmental determinants of health. The midstream stage which is the second level comprises psychosocial factors and health-related behaviours by which social, physical and environmental factors influence health. Health care system that determines the extent of socioeconomic health inequalities within the society was linked to this stage. The third stage (downstream) according to this framework consists of changes to physiological systems and biological functioning that occurs due to the other factors operating at the first-two stages.

For instance, illness and diseases are as a result of poor biological reactions pertaining to disrupted physiological systems. Turrel's framework indicates that the population with adverse socioeconomic factors are more likely to suffer in terms of

health. These people are associated with high risk factors of mortality since they are unlikely to use health care or act swiftly in preventing any disease. It also established that at every stage of life, there exist differences in health among males and females.

Lindgren (2003) developed a theoretical model in which the family is the producer of health and social capital. Health and social capital, according to Lindgren have the ability of enhancing the welfare of individuals. This aspect of gain from the production process by the family is what he termed the consumption motive. The aspect of health capital which generates more healthy days for higher productivity as well as the aspect of social capital that enhances the efficiency of the level of technology required in producing health capital formed the investment components of the production process. Lindgren in his model stipulates that social capital has a direct relationship with one's level of health. The implication is that people with increasing level of social capital are healthier than others holding other things constant. The level of social capital decreases with age and it is lower among those who are married or cohabiting as well as lower among men than among women.

3.2.0 EMPIRICAL LITERATURE

A number of studies have been concerned with the extent to which social status of households complement other medical inputs to impact child survival throughout the world. It has been a concern because a study conducted by Millard (1994), indicates that household socioeconomic status determines the amount of resources available in terms of food, health care as well as good sanitation for child development. This section seeks to throw light on some of the studies that investigated the extent to which socioeconomic, biological, environmental and geographic factors influence both perinatal mortality and prevalence of acute respiratory infection among children.

3.2.1 LITERATURE ON PERINATAL MORTALITY

Varied data sets have been employed in the study of the determinants of perinatal mortality. In most of these cases, institutional or facility-based and cross-country published datasets were used in analyzing this phenomenon. Most of these studies confirmed that biological, socioeconomic and other environmental factors do influence perinatal death across the world.

In investigating the impact of biological factors on perinatal mortality, Susser et al. (1972) employed the Mantel-Stark method and graphical representation to analyze different data sets from New York, Canada and United Kingdom. Their study supported the hypothesis that both birth weight and fetal age affect perinatal mortality. However birth weight appeared to be the predominant factor in determining this phenomenon. Fetal age only contributed to perinatal death in the period of 37-42 weeks of gestation.

Mavalankar et al. (1991) investigated levels and risk factors for perinatal mortality in Ahmedabad, India using institutional surveillance conducted in three teaching hospitals and a population-based survey. This study provides corroborating evidence that biological factors including birth weight, maternal anaemia, antenatal care visits, vaginal bleeding during pregnancy, nutritional status of the mother, mother's age at birth, prolonged labour and congenital malformations independently determine perinatal mortality. However, the multivariate analysis indicates a contrary view on the effect of socioeconomic factors after controlling for the biological factors. According to them, the perceived diminishing independent effect of socioeconomic factors may be due to the fact that both the controls and the cases were selected from public hospitals that were often patronized by the poor or low middle class in the community.

In Bangladesh, Kusiako et al. (2000) investigated the proportion of perinatal mortality associated with the complications during child birth using a logistic regression model to analyze community-based demographic surveillance (1987-1993). This study also found that maternal biological factors such as prolonged or obstructed labour, hypertensive diseases during pregnancy and abnormal fetal position could significantly increase perinatal deaths by fivefold. After controlling for biological factors, Kusiako et al. (2000) also confirmed that demographic factors such as maternal age at birth, an upper-arm circumference of a mother and thinness of mother significantly affect perinatal mortality. The study recommends that improved care for newborns and the use of qualified health care providers during delivery could substantially reduce perinatal mortality.

Using multiple logistic regression models to analyze Mbulu and Hanang District Health surveillance (1995-1996) in Tanzania, Hinderaker et al. (2003) investigated the risk factors of perinatal mortality. In controlling for the obstetric factors, they concluded that perinatal mortality increases significantly among babies with low birth weight or perceived small birth size. Their study has also supported the idea illustrated by Kusiako et al. (2000) that small arm circumference of mother, nutritional deficiency and history of previously lost baby are significant risk factors that determine perinatal mortality. The study recommends that infections and nutritional deficiencies would have to be addressed at the antenatal clinics.

A retrospective cohort study conducted by Armson et al. (2006) into the determinants of perinatal and neonatal mortality among second twins relative to first twins in Nova Scotia, Canada from 1988-2002 using matched-pair analysis and relative risk process found that second twin was at greater risk of composite adverse health outcome than

the first twin in general. They specifically found strong and significant association between early neonatal deaths and second twin who was born via planned vaginal delivery or prolonged inter-delivery interval as well one with low birth weight. Asphyxia and respiratory distress syndrome also significantly contribute to neonatal death among second twins. The study also recommends that elective caesarean delivery at term may improve perinatal outcome for second twin.

Benjamin et al. (2009) found significant association between maternal socioeconomic status, biological factors and perinatal death in their study that investigated the major risk factors of perinatal mortality in Ludhiana Punjab. In this study, confidence interval and relative risk (RR) level approach was adopted in analysing community-based demographic and health surveillance (2006-2007). They specifically identified mother's age, mothers with primary or no education, mothers with irregular paid employments, mothers who reside in urban slums, mothers from nuclear families as factors that significantly influence death of newborns at the perinatal stages. The other significant factors include multigravidity and maternal anaemia, birth spacing less than 3 years, lack of antenatal care services such as tetanus and anaemia prophylaxies, low birth weight, gestational age less than 37 weeks and delivery done by untrained attendants. The study recommends that women empowerment through education, ensuring late marriages, spacing and reducing childbirth, improving maternal nutrition can help reduce perinatal mortality in that population.

Tachiweyika et al. (2009) conducted a study into the determinants of perinatal mortality in Marondera District of Zimbabwe. This study applied stepwise logistic regression in analysing facility-based survey data from the said population. They identified socioeconomic, biological, environmental and even religious affiliation to be significant in determining perinatal mortality in general. These observations

actually contradict the findings of Mavalankar et al. (1991) that socioeconomic factors per se were insignificant determinants of perinatal deaths in Ahmedabad, India. The study specifically found primary or no maternal education, home delivery, labour complications as well as preterm delivery to have significant and positive association with perinatal deaths in that population. Antenatal care visits, having gainfully employed husbands, women who were within 5km of health facilities have significant and inverse relationship with perinatal deaths. The study also found that women of apostolic background, having home delivery, experiencing labour complications, maternal HIV infection and low birth weight were the independent determinants of perinatal mortality in Marondera.

Using both Univariate and multiple logistic regression models to analyze data collected between January 2001 and December 2006 from the records on hospital delivery and birth, death certificates as well as necropsy reports in Brazil, Moura et al. (2014) found that biological factors such as primiparity, male sex, prematurity, low 5-minute Apgar score and pregnancy complicated by arterial hypertension or intrauterine infection have positive significant association with perinatal death in the teaching hospitals rather than non-teaching hospitals. Their study was based on data collected from health facilities with two different levels of care in terms of the complexities of the treatments they provide and hence the variation in their findings.

Employing both bivariate and multivariate analysis to investigate the impact of maternal sociodemographic, infant's biological and economic characteristics on perinatal mortality using Navrongo Health and Demographic Surveillance (Ghana), Engmann et al. (2012) confirmed a significant association between them. They specifically found prematurity primary or no education, first time delivery and

multiple births to be significant and positively associated with perinatal death. They however could not access any information on the birth weight of the perinatal deaths and hence its effect could not be ascertained.

In Ghana, Pool et al. (2014) conducted a study into violence during pregnancy and pregnancy outcomes where a logistic regression model was used to analyze the 2008 GDHS data. After using mothers' socioeconomic and demographic characteristics such as education level, wealth status, marital status and place of residence as controls, they found strong and positive association between physical violence during pregnancy and perinatal death

3.2.2 LITERATURE ON ACUTE RESPIRATORY INFECTIONS.

A number of studies employed country specific (DHS) datasets as well as facility-based case-control datasets to investigate the determinants of prevalence of acute respiratory infection in both developed and developing countries. Most of these studies confirmed that biological, socioeconomic and other environmental factors do influence this phenomenon across the world.

A study conducted by Azad (2009) into the risk factors of acute respiratory infection among children under-five in Bangladesh, where stepwise logistic regression was used in analysing 2004 Bangladesh Demographic and Health Survey data established significant association between prevalence of ARI among children under-five and biological factors such as child's age, child's gender, birth weight, vitamin A deficiency. The study also established that mother's characteristics in terms of her nutritional status during pregnancy and her educational level correlate with the prevalence of ARI. According to this study, when poor adolescent mothers are introduced to health issues especially those pertaining to ARI prevalence, a favourable condition could be achieved. They added that vitamin 'A' supplementation especially

to poor teenaged pregnant women could end up reducing the prevalence of low birth weight and thus a reduction in ARI prevalence.

According to a study conducted by Bbaale (2011) into ascertaining the determinants of diarrhea and acute respiratory infection among children under-five in Uganda, both biological and socioeconomic factors have significant impacts. In employing a maximum likelihood probit regression model to analyze the 2006 Uganda Demographic and Health Survey data, the study found significant association between the said child health outcomes and factors such as child's age mother's level of education, regional and location differentials, wealth status, type of dwelling, mother's occupation and child's nutritional status. Exclusive breastfeeding and first hour initiation were found to be significant and inversely influence both diarrhea and ARI occurrence among these children.

Jones et al. (2011), in conducting a systematic review into studies that assess parental and household smoking and the increased risk of bronchitis, bronchiolitis and other lower respiratory infections in infancy, found a weaker effect of pre-natal maternal smoking on the lower respiratory infections (LRI). However, exposure to smoking by either parents or other household members influences LRI among infants significantly. In all, passive smoking was found to have stronger and significant effect on LRI among infants especially on bronchiolitis. The study recommends that preventing the exposure of infants to passive smoking could help reduce the LRI among infants.

Lehmann et al. (1996), in investigating the effect of birth weight on pneumonia mortality and infant mortality in the highlands of Papua New Guinea using Cox's proportional hazard model, observed that birth weight coupled with child's age significantly affects childhood pneumonia mortality. Birth weight specifically has

inverse relationships with these mortalities. According to them, the rate of low birth weight prevalence in the said population was about 15% of all births. While controlling for infectious diseases, they explained that birth weight affects infant mortality in general only in the short term. The study recommends that interventions aimed at improving socioeconomic status in the long-run should be adopted. The nutritional status of adults and children would also have to be improved to ensure lower mortality among young ones.

In employing Logistic regression with relative risk approach to analyze facility-based data collected between 1999 and 2001, Djelantik et al. (2003) evaluated the predictive factors associated with mortality among children less than 2 years hospitalised with severe pneumonia in Lombok Island, Indonesia. They discovered that children less than 2 years of age that were hospitalised with severe-pneumonia died before discharge. Oxygen saturation less than 85% as well as ages less than 4 month significantly influence survival of children.

Lamberti et al. (2013) also conducted a review into studies that assess risk factors of selected pneumonia mortality and morbidity outcomes among infants and children less than 24 months of age. Using random effect meta-analyses to generate pooled effect estimates by outcomes, age and breastfeeding exposure, the review concluded that suboptimal breastfeeding have significant impact on pneumonia morbidity and mortality outcomes. The study further indicates that not breastfed infants suffered pneumonia deaths than the exclusively breastfed infants.

Using Univariate and multiple regression models to analyze facility-based data which was collected and categorized into clinically diagnosed pneumonia, radiologically diagnosed pneumonia as well clinically and radiologically diagnosed pneumonia in

Chennai, India between 2006 and 2008, Ramachandran et al. (2012) indicate that assisted ventilation, child's age less than 6 months, birth weight, altered level of consciousness and congenital heart disease significantly influence pneumonia mortality among the children.

In applying pooled logistic regression with rate ratio estimates to analyze community-based health surveillance data (2002-2004) in rural Guatemala, Smith et al. (2011) investigated the effect of a reduction in household air pollution on childhood pneumonia. The study considered the households that used wood stove with open fire as control group and households that used woodstove with chimney as intervention group. In each of these households, three severe outcome groups were considered. This study found a significant reduction in terms of air pollution exposure for the three severe- outcome groups in the intervention household. There was no adverse effect in the intervention household. On average, reduction in the pollution exposure was associated with physician-diagnosed pneumonia. It was however noted that using wood fuel in open fire, chimney stove did not significantly reduce physician-diagnosed pneumonia in children.

In a study that investigated the prevalence of respiratory viruses in children hospitalized for acute respiratory infection in Ghana, Kwoffie et al. (2012) explained that these patients actually exhibit positive sign of more viruses especially during the rainy seasons. The viruses found with the patients include syncytial virus, adenoviruses and parainfluenza virus.

An unpublished work of Siaw Apreh (2003) established that factors such as unhygienic environment and cold air significantly influence ARI prevalence after

conducting a study into the management of childhood ARI among people of Larteh, Ghana.

Boco et al. (2010) in a study that investigates the effect of low birth weight on the risk of dying before age 5 confirms a significant impact of birth weight. They applied a multivariate piecewise constant hazard model with gamma-shared frailty to analyze Demographic and Health Survey data for Benin (2006), Congo Brazzaville (2005), Congo Democratic Republic (2007), Lesotho (2004), Namibia (2006), Swaziland (2006), and Zimbabwe (2005/06). The effect of low birth weight on childhood deaths varies with the age of exposure to low birth weight in most of these countries.

It is evident that most studies have confirmed the theories that stipulate the impact of biological, socioeconomic and demographic factors on the two childhood health outcomes of interest globally. However less has been identified in terms of the risk factors of both perinatal mortality and ARI prevalence in Ghana. Even though Engmann et al. (2012) and Pool et al. (2014) established the influence of socioeconomic status of mothers and some maternal as well as infants' biological factors on perinatal mortality in Ghana, no emphasis was placed on birth weight and child's birth size since there was no such record from the data sets they used. Most studies on ARI in Ghana were more focused on infection incidence rather than the risk factors. Studies in the area of perinatal and ARI disease were carried out based on regional surveys, but not with a national cross-section survey like the GDHS. In view of these observations, much needed to be done to ascertain the impact of birth weight and mother's perceived size of babies on perinatal and ARI prevalence in Ghana.

As a result of low sample size of the perinatal deaths as well as ARI prevalence in the 2008 Ghana Demographic and Health Survey (GDHS) which is nationally representative, this study intends to use the combined dataset of the 1998, 2003 and

2008 that have been acquired from the macro-DHS on Ghana under permission to throw more light on the effect of mother's subjective evaluation of the size of the baby, the recorded birth weight in kilograms, birth weight as recalled by mothers, socioeconomic, geographic and demographic factors on perinatal mortality and ARI prevalence among under-five children in Ghana. Less attention has been placed on perinatal mortality in Ghana to the best of my knowledge even though it constitutes about 84% of all neonatal deaths (GDHS, 2008). Contrary to other studies conducted on childhood health outcomes in Ghana, this study would place much emphasis on the relationship between birth weights in the various forms indicated by the GDHS data sets and the two childhood health outcomes.

The study would employ logistic regression models to analyse the correlates of the two childhood health outcomes since the variables on the child health outcomes would be binary choice i.e. probability that a child dies at a perinatal stage as well as the probability that a child suffered ARI (pneumonia). A logistic regression model also ensures that relative effects of various explanatory variables are obtained with ease.

Conclusion:

There were a number of studies that have been conducted in line with demand for health as well as determinants of perinatal mortality, ARI prevalence in both developing and developed countries globally. The health consequence of low birth weight on child health outcomes also received similar attention. The studies conducted in these areas were mostly evaluations on either cross-sectional or panel data. The cross-sectional data employed in these studies were either community based or institutionally based health surveillance. The demographic and health survey data were also used in some of these studies. Either multi-logistic or stepwise logistics

regressions were employed to analyse the data. In most of these studies, socioeconomic, demographic and biomedical factors were found to significantly predict childhood health outcomes and demand for health in general.

CHAPTER FOUR

METHODOLOGY AND ESTIMATION PROCEDURES

4.0 INTRODUCTION

This chapter examines the conceptual frameworks that support the correlates of perinatal deaths and ARI prevalence. The choice of the explanatory variables in the study, Data sources, estimation procedures and the diagnostic test to be adopted would be provided within the chapter.

4.1 THEORETICAL MODELS OF DETERMINANTS OF PERINATAL

HEALTH OUTCOMES AND DEMAND FOR HEALTH

Based on the data available in the 1998, 2003 and 2008 GDHS, this study would adopt the integrated perinatal health framework developed by Misra et al. (2003) and the demand for health care framework by Grossman that was conceptualized on the idea of health production.

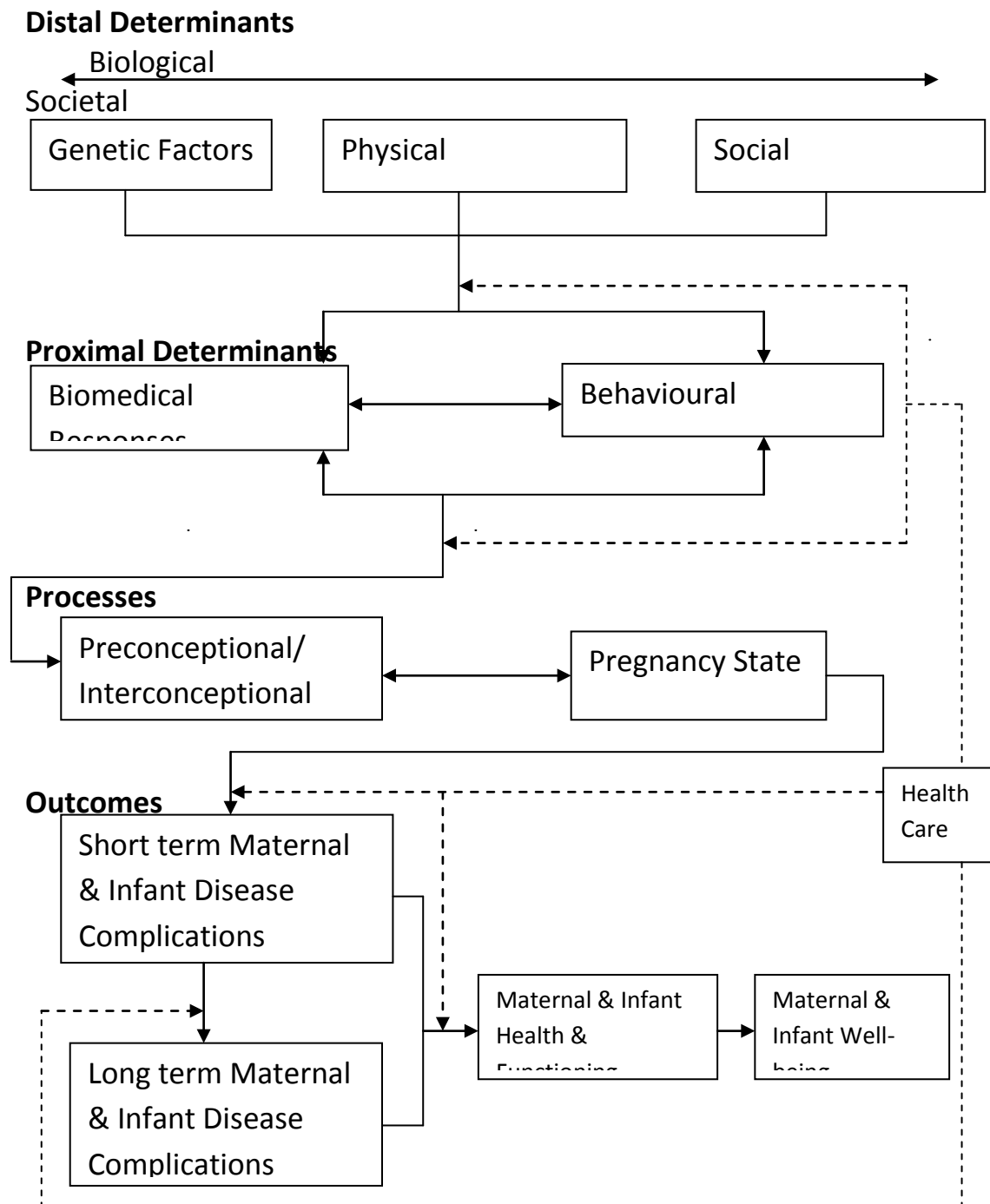
The integrated perinatal health framework by Misra et al. (2003) that employed the model of Evans and Stoddart (1990) on health determinants focused on the idea that perinatal health outcomes are shaped by certain factors including social, environmental and behavioral factors that occur prior to pregnancy and those that occur during pregnancy. This framework incorporates forces that influence the health of women at every stage of their lives. The framework as indicated below followed four major levels in terms of distal risk factor, proximal risk factors, processes as well as outcomes.

The distal determinants are the risk factors that expose individuals or the entire population to the proximal risk factors. These risk factors include genetic and environmental factors such as air pollution, exposure to toxins, family violence,

stress, crowding and socioeconomic status. The proximal factors were looked at in terms of behavioral and biomedical factors e.g. nutrient deficiencies, maternal factors (mother's age at birth, birth interval) as well as personal illness control measures in the form of the use of antenatal care and immunization. According to the model, proximal risk factors are the factors that have direct impact on the individual's health status. This framework also established that the interaction between the distal and proximal risk factors determines the overall health status of individuals. The processes level indicates how the framework is linked with the life course of a woman.

The processes level comprises preconceptional or interconceptional as well as conceptional and pregnancy states. The last level of this framework is concerned with three outcome categories. The first consists of disease and complication outcomes at conceptional stage such as low birth weight. The second and the third group entail health functioning as well as well-being of mothers and infants. The health functioning can be measured by considering the life expectancy and self-reported health status whilst the well-being of mothers and infants could be measured by considering mother's autonomy and self-acceptance in the family and the society, Ryff and Singer (1996).

Figure 4.0 MULTIPLE DETERMINANTS FRAMEWORK FOR PERINATAL HEALTH



Source: Misra et al. (2003)

The model developed by Grossman (1972) on demand for health capital and health care stipulates that individuals make informed choices over their life time in order to achieve good health by investing into health care or adopting health enhancing practices and behaviour. Achieving improved health, according to this model, is

subject to the initial health stock of individuals that is assumed to be inherited from parents and the environment. This idea has been supported in the model developed by Misra et al. (2003) on the determinants of perinatal health outcomes where they established that the health status of an infant including the fetus could be influenced by behavioral or environmental factors prior to or during pregnancy.

The choice and the utility maximization that is made by an individual as established by Grossman's model, for the purpose of this study would be made on behalf of the infants and the fetus by their parents. Though the model followed how the individual's investment decisions affect their health outcomes directly, it could also determine the health outcome of their babies. The model of Grossman was based on the idea that the individual makes intertemporal choices in maximizing their utility. Grossman (2000) presented this utility function in the form:

$$U = U(\varphi_t H_t, Z_t), \text{ where } t = 0, 1 \dots n \dots \dots \dots 4.1$$

Where H_t = Health stock at a particular age of an individual,

φ_t = health service flow at each unit of health stock,

Z_t = vector of other commodities consumed by the individual over life time,

$\varphi_t H_t = h_t$ = total health service consumption.

The model also assumed that the individual would die whenever the health stock at any age falls below what is required for survival. The length of life is influenced by the unit of health capital that maximizes one's utility. The utility function is therefore subject to both the resource and production constraint functions of the individual in the form:

$$\text{Health depreciation function} \quad H_{t+1} - H_t = I_t - \delta_t H_t \dots\dots\dots 4.1.1$$

$$\text{Health production function} \quad I_t = I_t(M_t, TH_t; E) \dots\dots\dots 4.1.2$$

$$\text{Production function for other goods} \quad Z_t = Z_t(X_t, T_t; E) \dots\dots\dots 4.1.3$$

$$\text{Time constraint} \quad \Omega = TW_t + TH_t + T_t + TL_t \dots\dots\dots 4.1.4$$

Where H_t = health investment at time t,

I_t = gross investment at time t,

δ_t = the rate of health depreciation that is age dependent,

X_t = inputs for the production of other goods,

TH_t = time input to produce health

T_t = time input to produce other goods,

TL_t = lost time due to sickness

TW_t = time allocated for work,

E = stock of knowledge of the individual is predetermined,

M_t = vector of inputs bought to produce health.

The model that combines the expenditure and the flow of income as well as time constraint of the individual established an asset constraint in which present value of returns on goods are equal to the present value of earnings over life cycle plus initial asset. The wealth constraint as indicated below was based on the idea that $TL_t = 0$ such that the individual's healthy time equates total amount of time at his or her disposal.

$$\sum_{t=0}^n \frac{P_t M_t + Q_t X_t}{(1+r)^t} = \sum_{t=0}^n \frac{W_t \Omega}{(1+r)^t} + A_0 \dots\dots\dots 4.1.5$$

Where r = discount rate, P_t = prices of medical inputs, M_t = medical services

X_t = other goods Q_t = prices of other health inputs W_t = wage rate per hour

A_0 = initial asset.

The motive of this individual according to the model is to maximize his or her utility subject to all the stated constraint functions. An individual who exhibits zero marginal utility for healthy time is said to have health as a pure investment good such that he or she would continue to invest in health care until the marginal benefit derived from health equates the marginal cost of producing health.

The Grossman model of demand for health was designed with the individual in mind as the producer and the direct consumer of health. It is however evident from numerous studies conducted into health outcomes in general such as those by Wagstaff (1986) and Fuchs (1972) as well as others that the decision of individuals that aimed at improving their health status end up improving the health status of their babies. For the purpose of this study, the decision of a mother to combine the necessary health inputs such that a baby with a normal birth weight ($\geq 2.5\text{kg}$) is produced could end up ensuring that her baby survives at the early stage of life. This study intends to offer insight into the correlates of childhood health outcomes in terms of perinatal mortality and ARI prevalence in Ghana. The correlates such as birth weight, mother's age, mother's education, type of residence (urban, rural), region of residence, wealth status, antenatal care usage etc have been employed in a logistic regression model for the purpose of this study. These determinants have been adopted based on the evidences illustrated by empirical studies that these inputs could affect the childhood health outcomes in both developing and developed countries.

4.2 THE DEPENDENT VARIABLES.

This study seeks to offer more insight into the correlates of childhood health outcomes in terms of perinatal mortality and ARI prevalence among children in Ghana. The perinatal mortality was estimated as the sum of stillbirth and early

neonatal mortality. Information on stillbirth was recorded as loss of the last pregnancy after at least seven month gestation and early neonatal mortality as the mortality of all children between birth and seven days of life (GDHS report, 2008). The perinatal mortality would be estimated for the purpose of this study in a discrete form i.e. whether perinatal death (PND) occurred prior to the period of the surveys in 1998, 2003 and 2008 or not (yes=1, otherwise = 0).

ARI prevalence among children in Ghana was recorded by asking mothers whether a child of theirs suffered from a cough associated with short and rapid breath for at least two weeks prior to the surveys in 1998, 2003, 2008. The implication is that ARI prevalence is also a discrete variable. According to Greene (2003), given these types of dependent variables i.e. dichotomous dependent variable, it is evident that logistic or probit function could be the most appropriate technique of analysis. This study intends to employ a logistic model in the estimation of the relationship between the mother's subjective evaluation of the size of the baby, birth weights as well as other risk factors and child health outcomes of interest in Ghana. Though both logistic and probit regressions allow estimation on both continuous and categorical variables and also guarantees that probabilities range between zero and one, logistic model would be used in this study based on the assumption that the error term is logistically distributed and the probability density is symmetric. Logistic regression models estimate coefficients by maximum likelihood.

The explanatory variables of interest in this study are identified in two major categories i.e. demographic and socioeconomic factors. The demographic factors are in the form of child's birth size, birth weight, preceding birth interval, antenatal care visit, when child put to breast, duration of breastfeeding (DBF), sex of a child mothers' age, Childs' age, place of delivery, Type of delivery (caesarean/normal) and

mothers' body mass index. The socioeconomic factors include maternal education; Mother is working, type of residence and geographic regions (G) and Wealth index.

4.3 ECONOMETRIC MODEL SPECIFICATION

Logit model employed in this study could generally be formulated in the form below as indicated by Gujarati (2003):

Setting P_i as the probability of a baby dying at perinatal stage in one instance and a probability of a child under age five experiencing ARI. $1-p_i$ could then be a probability of a baby did not die at perinatal stage and a child under age five not experiencing ARI. Basically, $1-p_i$ is unobservable but instead the outcome $Y=1$ if any of the childhood health outcomes occurred and $Y=0$ if otherwise. The probabilities could therefore be expressed in equations as;

$$\Pr(Y_i=1) = P_i \dots\dots\dots 4.2.0$$

$$\Pr(Y_i=0) = 1-p_i \dots\dots\dots 4.2.1$$

According to Gujarati (2003), the probability of any event occurring, such as a baby dying at perinatal stage in one instance and a child suffering from ARI in the other instance could be expressed as;

$$P_i = E(Y = 1/X) = \frac{1}{1+e^{-(\beta_0+\beta_1 X)}} \dots\dots\dots 4.2.2$$

Where: P_i represents the probability of an event occurring. In this study, it would represent the probability of any of the childhood health outcomes occurring i.e. a child dying at perinatal stage in one instance and the probability a child less than five years experiencing ARI.

X represents the vector of the various explanatory variables to be used in the study,

'e' is the base of natural logarithm and the

β s are the regression coefficients to be estimated.

Equation 4.2.2 could further be expressed as;

$$P_i = E(Y = 1/X) = \frac{e^{(\beta_0 + \beta_1 X)}}{1 + e^{(\beta_0 + \beta_1 X)}} \dots\dots\dots 4.2.3$$

The non occurrence probability is also expressed as;

$$(1 - P_i) = E(Y = 0/X) = \frac{1}{1 + e^{(\beta_0 + \beta_1 X)}} \dots\dots\dots 4.2.4$$

Logit model therefore combines these probabilities and expresses them as odds ratio in the form:

$$\left(\frac{P_i}{1 - P_i} \right) = \frac{1 + e^{(\beta_0 + \beta_1 X)}}{1 + e^{-(\beta_0 + \beta_1 X)}} \dots\dots\dots 4.2.5$$

Simplifying equation 4.2.5, the following is deduced;

$$\left(\frac{P_i}{1 - P_i} \right) = e^{(\beta_0 + \beta_1 X)} \dots\dots\dots 4.2.6$$

Since the Xs and the parameters are non-linear, it is important to transform the above model by taking the natural log as shown below:

$$\ln \left(\frac{P_i}{1 - P_i} \right) = L_i = \beta_0 + \beta_1 X \dots\dots\dots 4.2.6$$

Where

$$\left(\frac{P_i}{1 - P_i} \right) = \text{the odds ratio of the child health outcomes occurring.}$$

According to Anjali (2001), determinants of health outcomes could also be estimated using a logistic regression model in the form:

$$\ln\left(\frac{P_i}{1-P_i}\right) = L_i = (\beta_0 + \sum \beta_{1i}X_{1i} + \sum \beta_{2i}X_{2i}) + \varepsilon_i \dots\dots\dots 4.2.7$$

X_{1i} = vector of demographic factors (birth weight, child's birth sizes, mother's age and marital status, gender of the child, etc.)

X_{2i} = vector of socioeconomic factors (mother's education, wealth quintiles, etc.)

ε_i = the error terms.

4.4 DATA DIAGNOSTIC AND ESTIMATION PROCEDURE

In order to ensure that the data to be used for the estimation of the econometric models meet statistical assumptions, a Variance Inflation Factor (VIF) procedure would be adopted to test for the presence of multicollinearity among the explanatory variables. Gujarati (1995) expressed Variance Inflation Factor in the form:

$$VIF(X_j) = (1 - R_j^2)^{-1}.$$

Where R_j^2 = coefficient of determination after regressing one of the explanatory variables on other explanatory variables. According to Gujarati (1995), a VIF exceeding 10 or $R_j^2 > 0.90$ implies an existence of multicollinearity. In the likelihood of existence of heteroscedasticity that may result from co-dependent observations, the robust standard errors of the model coefficients would be estimated to minimize it. Models in this study would be estimated using Stata 13.0.

4.5 DATA SOURCES:

This study intends to use data from the Ghana Demographic and Health Surveys (GDHS, 1998-2008). The three datasets are nationally representative in nature and they comprise information on women at 15-49, men at age 15-59 as well as that of households. The GDHS are usually conducted by the Ghana Statistical Service and the Noguchi Memorial Institute for Medical Research with technical assistance from ORC Macro, USA. The datasets of interest in this study are the third, fourth and fifth

surveys conducted since 1988. Out of 6,003 households, 4,843 women and 1,546 men were interviewed in 1998 whilst 5,691 women and 5,015 men from 6,251 households were interviewed in 2003. In 1998 GDHS, out of 1870 pregnancies, 697 were still birth and 340 early neonatal deaths in the five years prior to the survey. Out of 776 children who suffered from cough two weeks prior to the survey same year, 429 of them had short rapid breath accompanying it.

The 2003 GDHS data also indicate 509 early neonatal deaths and 131 still births out of 2,009 pregnancies. There were 350 children with ARI symptoms (short and rapid breath) out of 653 children with cough in 2003. In the 2008 GDHS, 4,916 women and 4,568 men from 6,141 households were interviewed. The 2008 GDHS also recorded 377 early neonatal deaths and 132 stillbirths out of 2949 pregnancies prior to the survey. 303 children with ARI symptoms out of 601 children with cough were also found the same year. The overall perinatal deaths in 1998, 2003 and 2008 were 1037, 640 and 509 deaths respectively. In combining the three data sets, sample sizes of 2,186 perinatal deaths out of 6,828 pregnancies and 1,082 children with ARI symptoms out of 2,196 children with cough within two weeks prior to the surveys were estimated. The 1998 survey employed a two-staged stratified nationally representative sample of households, whilst both 2003 and 2008 surveys employed same sampling measures but were based on the 2000 Population and Housing Census for the data collection. The three surveys have obtained detailed information on fertility preferences, childhood mortality, maternal and child health, awareness and use of family planning methods, HIV/AIDS and other STIs.

4.6.0 THE EXPLANATORY VARIABLES

The regressors of interest in this study have been chosen based on the prior knowledge of determinants of child morbidity and mortality including perinatal

mortality and ARI prevalence to be specific in the literature discussed in the earlier chapter.

4.6.1 DEMOGRAPHIC FACTORS:

Birth weight (BW)/Birth sizes (BS) which is the control variable in this study can be defined as the first weight of a baby taken just after he or she is born (WHO). Any birth weight below 2.5kg is considered low birth weight. This may result when during pregnancy, the mother abused substances such as smoking or there were nutritional challenges. Birth weight is deemed important in this study because a number of researchers have found it a significant factor that influences childhood health outcome across the world. According to Butler and Alberman (1969), MacDorman et al. (1999), children with low birth weight are more likely to become sick in the first days of life or even are likely to develop infections as well as learning disabilities in future. In Ghana, records on birth weight in general have been difficult to obtain since a lot of babies are delivered outside health facilities. For that matter, retrospective data like GDHS data capture birth weight as indicated by facilities or as mothers are able to recall and also the mother's subjective evaluation of the sizes of babies at birth. Records on birth weight in the GDHS datasets increase from survey to survey. For example in 2003 GDHS dataset, only 28% of all births have their birth weights captured and this increases to 43% in the 2008 survey. In this study, the perceived birth sizes (**BS**) would be categorized and coded in the form Very large (1), larger than average (2), average (3), smaller than average and very small (4) with Very large as the reference category in the study. The actual birth weight in (kg) would be used instead of its categories

Antenatal care visits (AC) is another important factor since utilization of antenatal care services promotes safe motherhood and delivery. According to Addai (2000), utilization of maternal care services could reduce maternal mortality substantially in Ghana. Lincetto et al. (2010) also indicate that a good care during pregnancy aids the health of both mother and the full growth of the baby yet to be born. W.H.O recommends that a pregnant mother without any complication would have to make at least four antenatal care visits before delivery where warning signs would be detected for appropriate interventions such as tetanus toxoid vaccination could be administered. Monthly antenatal visits within the first seventh months of pregnancy as well as weekly visits after the eighth month of pregnancy was recommended for pregnant mothers in Ghana (2003 GDHS). Though not many studies have indicated clear impact of antenatal visits on child survival, Fayissa (2001) established that prenatal care has significant correlation with childhood health outcomes. Benjamin et al. (2009); Hong et al. (2008) Tiwarat Torjarern et al. (2014) have also found a positive association between child mortality and no antenatal visit. In order to solicit for this information from mothers, they were asked to tell the number of antenatal care visits they had during last pregnancy prior to the surveys. The data would be categorized in the form ≥ 4 visits (1), < 4 visits (2), No visits (3) with ≥ 4 visits as the reference category. Whilst the actual number of visits would be used in estimating perinatal mortality, the categorized form would be used to estimate ARI prevalence.

Type of delivery (caesarean or normal vaginal delivery). Al Mufti et al. (1997) indicated an increasing rate of caesarean section as a method of delivery globally due to the perception that it ensures safety for mother and child. A study conducted by Lumbiganon et al. (2010) however, established that caesarean section without a medical indication could increase the risk of perinatal mortality and morbidity. In

Ghana only 7% of mothers had access to caesarean section prior to 2008 GDHS. To arrive at this data, mothers were asked whether the child they currently have was delivered through caesarean or otherwise. In this study, caesarean delivery would be the reference category.

Place of delivery (home or hospital) is an important factor since it has far reaching effects on pregnancy outcome. Thind et al. (2008) established that home based deliveries could increase the risk of infections and complications because they are often handled by untrained attendants. In Ghana about 57% of deliveries were done in hospitals within the five years prior to the 2008 GDHS. There are however, greater variations in hospital delivery across the regions. For instance, in the northern region only one in each four births occurred in a health facility prior to the 2008 survey. This information was arrived at by asking mothers to report the place of birth for all their children born in the five years prior to the survey. This data shall be categorized into home delivery or health facility. Home delivery would be the reference category.

Preceding birth interval (PBI) which is the length of time between two live births is relevant for this study since it offers more insight into the health status of young ones. A number of studies have shown that children with short birth intervals stand the chance of suffering numerous health complications whereas those with enough birth intervals have improved health status. Bourbina (1995), Mustafa (2008) and Ezeh et al. (2014) confirmed that birth intervals and birth order have significant impact on health outcomes of young ones. The recorded birth interval in months would be used in this study without categorizing the intervals.

When child put to breast (WCB) is very relevant for this study since breastfeeding has been identified by a number of studies including that of Setegn et al. (2011) and

Fosu-Brefo et al (2015) to have far reaching impact on child health in general. The 2010 WHO report indicates that breastfeeding a new born especially within the first hours of birth does improve child health. The report also established that whenever a new born is put to the breast either immediately or within an hour of birth, he or she has the chance to build up a strong immune system. It also helps to curb malnutrition and gastroenteritis among children. This study considers this variable important since it could help explain adverse childhood health outcomes in Ghana. This variable would be categorized and coded in the form Days (1) Within hours (2) and immediately (3) with Days as reference category.

Duration of breastfeeding is a factor that is also relevant for the survival of under-five children. World Health Assembly also recommended that expectant mothers would have to exclusively breastfeed their babies for duration of 6 month. Studies including that of Raisler et al. (1999) and Pugh et al. (2002) have established that increased duration of breastfeeding improves the health conditions of the mothers and their children. It is established by 2008 GDHS report that on average, Ghanaian mothers breastfeed their children for 20 months. In order to arrive at this information, mothers were asked to indicate the number of months they breastfed the named baby. In this study, the actual months stated would be used excluding those who never breastfed and those who were still breastfeeding.

Child's sex (CS) could also be a determinant of childhood health outcomes since a number of studies have stipulated that infant mortality and other adverse health outcomes do increase among boys than girls globally. These differences among children of different gender have been as a result of both their biological and genetic make ups. Boys are identified to be more susceptible to diseases and premature death

including perinatal mortality (Rajora et al., 2013) The 2003 WHO report established that since boys are often treated differently from their female counterparts due to cultural and socioeconomic factors, these differences are likely to occur. Kaldewei (2010), Azad (2009) and Zewdie et al. (2013) have found a child's sex to be a significant determinant of child survival. The responses on this variable have been coded as male (1), female (2) with male as the reference category.

Mothers' age (MA) has always been relevant in studies on childhood health outcomes including that of Grossman (1999) and Muurine (2000). They established that health in general depreciate with one's age. Individuals are healthier whilst young than when old. A number of other studies have also indicated that mother's with ages less than 20 years or ages above 39 years are more likely to give birth to babies who stand the risk of suffering adverse health outcomes. Mothers were asked how old they were at the period of the surveys. The study intends to use the age of mothers without categorizing them.

Mother's body mass index (MBMI) could also be considered as a proxy for mothers' health status. It is important in this study because it is an indicator of nutritional status of pregnant mothers especially. A number of studies including those of Sahu et al. (2007) and Daise et al. (2011) have indicated strong and significant associations between childhood health outcomes and mother's BMI. These studies established that mothers with low BMI ($<18.5\text{kg}/\text{metre square}$) increase the risk of having preterm delivery as well as low birth weight infants. The GDHS data categorized the responses of women on their BMI as thin ($< 18.5\text{kg}/\text{m}^2$), normal ($18.5 - 24.5\text{kg}/\text{m}^2$), overweight or obese ($\geq 25.0\text{kg}/\text{m}^2$). For the purpose of this study it would be coded as $< 18.50\text{kg}/\text{m}^2$ (1), $\geq 18.50\text{kg}/\text{m}^2$ (2), with thin as the reference.

Child's age (CA). This has been identified by a number of studies to affect ARI prevalence significantly. Studies such as those of Lehmann et al. (1996), Azad (2009) and Bbaale (2011) have established that child's age in months and ARI prevalence are inversely related. The implication is that as child's age increases, ARI prevalence declines. They have also indicated that children less than 20 months of age are more likely to suffer from ARI. The ages of children in months indicated in the GDHS data sets would not be categorized but rather the actual values would be used.

4.6.2 SOCIOECONOMIC FACTORS:

Wealth index of a household is one of the important factors that influence usage and access to health care. Nketiah-Amponsah et al. (2013) and Abor et al. (2011), in their study established that women of higher wealth status are more likely to utilize antenatal care than those in the lower wealth quintile in Ghana. There are a good number of studies that also found wealth index significant in determining childhood health outcomes. According to Stekelenburg (2004), women from low income households are not likely to deliver their babies in health facilities since they could not acquire materials that are needed in the facilities during delivery or even able to pay for transportation to the facilities. Since information on people's income are difficult to access, information on household possessions and surroundings such as home ownership, access to electricity, source of drinking water, ownership of car, type of cooking fuel etc. were used as proxies to estimate the wealth index of households in the 2003 and 2008 GDHS datasets. Since the wealth quintiles have not been captured in 1998 GDHS, a new wealth index has been estimated for all the years using principal component analysis with eight household assets (car, radio, television,

telephone, bicycle, motorcycle, electricity and refrigerator). This is categorised and coded as poor (1), middle (2), rich (3) with poor as the reference category.

Maternal education is an essential socioeconomic factor in the sense that individuals with high levels of education are indicated by a number of studies to be endowed with knowledge on how to produce more health at a minimal cost. According to Grossman (1999), an increase in the level of education of an individual would shift his or her marginal efficiency of health production to the right leading to increasing marginal product of health and labour income. Mothers with this human asset are assumed to have some level of autonomy such that they may be able to make decisions relevant for their health and that of their babies (Raghupathy, 1996). They are more likely to seek higher quality services and also to use health care inputs to produce better care than those with lower level of education. Mothers with higher level of education are also more likely to have a large social network that increases their access to information on safe motherhood and thereby improving the health outcomes of their babies (Gage, 2007). In the GDHS datasets to be used, women were asked to state their highest level of education and this would be used as a proxy for mother's level of education. The responses would be categorized into No education (1) and Education (2) with No education as the reference category.

Mother is working (Mo) is another socioeconomic factor that is found to influence childhood health outcomes in general. It is an important factor since it indicates the ability of the mother to seek health care before, during and after pregnancy. Even though not many studies have found a significant relationship between this and the childhood health outcomes, Kanmiki et al. (2014), Benjamin et al. (2009), Kayode et al. (2014) and Bbaale (2011) have established positive relationship between childhood

deaths and mothers in low paid occupations or mothers who are just housewives. In Ghana Demographic and Health Surveys, mothers were asked whether they were working currently or not. This will be categorized and coded in this study as not working (1) and working (2) with not working as the reference category.

Type of residence (RE) is considered as urban and rural place of residence in many studies which has also been adopted and used in the GDHS datasets. Most often, the population sizes are used to do these types of classifications. The 2000 GLSS report recognized areas with a population size of 5000 plus as urban and rural if otherwise. The type of residence of women and their babies is an important factor in determining their health status since access to health facilities, distribution of skilled personnel, access to portable water and good sanitation differ across urban and rural areas in Ghana and many other developing countries. Studies conducted on child health globally including that of Goro (2007), Jacoby and Wang (2004), have indicated that children from urban areas are more likely to survive than their rural counterparts. This variable shall be captured as urban (1), rural (2), with urban as the reference category in the study.

Geographic region (G) is a factor that may affect the survival of children especially in developing countries where there may be varying resource distribution. Under such situations, endowment in terms of health care facilities and personnel differ. A number of studies including that of Addai (2000) have indicated that mothers from Central and Western regions in Ghana were more likely to consult skilled attendants for prenatal care than those from the three Northern regions. Mothers from Eastern, Brong Ahafo and Ashanti region have the chance to deliver at the hospital than mothers from the three Northern regions. It is therefore important to include this variable to see its effect on perinatal mortality and ARI prevalence in Ghana. The ten

regions have been coded in the form Northern (1), Upper East (2), Upper West (3), Brong Ahafo (4), Ashanti (5), Eastern (6), Volta (7), Greater Accra (8), Central (9) Western (10) and with Northern (1) as the reference category.

The main independent variables of interest in this study are the recorded birth weights and the birth sizes of babies as reported by their mothers. Two separate models each are estimated for perinatal deaths and ARI prevalence. Model 1 would include actual birth weight in (kg) with other selected independent risk factors. Model 2 would also comprise qualitative assessment of babies' weight at birth by mothers (very large, larger than average, average small and very small) and other independent factors. The choice of these explanatory variables was informed by the theoretical and the empirical literature discussed earlier.

CHAPTER FIVE

PRESENTATION OF RESULTS AND ANALYSIS

5.0 INTRODUCTION

This chapter presents results on the collinearity diagnostic test of the independent variables and the statistical distribution of each of the two child health outcomes and their background characteristics as contained in the 1998, 2003 and 2008 GDHS data sets. The estimated logistic regression model results on the determinants of perinatal mortality as well as ARI prevalence in terms of demographic and socioeconomic factors are also presented with their interpretations in this chapter.

5.1 COLLINEARITY DIAGNOSTIC TEST

The table below indicates the tolerance level and the variance inflation factor (VIF) of the independent variables to be used in predicting the perinatal mortality and ARI prevalence among children under-five in Ghana. From the table, it could be established that the VIF for each of the independent variables is less than 10 and thus there is no linear relationship or interaction between the variables that might affect the results of the analysis. This implies that all the independent variables are fit to be used to predict the behaviour of the two childhood health outcomes in each of the models. Model 1 comprises the test of birth weight against the other correlates of both perinatal mortality and acute respiratory infection prevalence that do not exhibit any linear relationship. The second model includes perceived birth sizes of babies against the other correlates of the two health outcomes that are not linearly related.

TABLE 1 COLLINEARITY TEST OF INDEPENDENT VARIABLES

Independent Variables	Model 1		Model 2	
	Tolerance	VIF	Tolerance	VIF
Preceding Birth Interval	0.906714	1.10	0.966740	1.03
When Child put to breast	0.925214	1.08	0.932239	1.07
Duration of breastfeeding	0.771558	1.30	0.865039	1.16
Child's Sex	0.948541	1.05	0.982641	1.02
Child's age	0.912708	1.10	0.934141	1.07
Type of delivery	0.949999	1.05	0.956224	1.05
Place of delivery	0.830858	1.20	0.701366	1.43
Mother's MBMI	0.913269	1.09	0.956228	1.05
Mother's age	0.917971	1.09	0.942170	1.06
Antenatal Visits	0.878522	1.14	0.841425	1.19
Wealth Index	0.787616	1.27	0.743191	1.35
Mother is working	0.943978	1.06	0.955240	1.05
Maternal Education	0.858847	1.16	0.754116	1.33
Type of residence	0.714559	1.40	0.700600	1.43
Region	0.778280	1.28	0.761020	1.31
Mean VIF		1.16		1.17

Source: Author's estimations

5.2 RESULTS AND DISCUSSIONS

The distribution of perinatal mortality has been constituted using both stillbirth and early neonatal mortality extracted from the 1998, 2003 and 2008 GDHS data sets. The three data sets together reported 13,059 pregnancies i.e. 6,431, 3,679 and 2,949 respectively. There were 2,186 perinatal deaths which constitute about 17% of all the pregnancies indicated by the survey reports. The perinatal deaths entail 960 stillbirths and 1,226 early neonatal deaths. Early neonatal deaths are about 56% of the perinatal mortality as against 44% stillbirths. About 34% of early neonatal deaths occurred on the first day of birth. It could also be realised that almost 54% of early neonatal deaths happened within the first three days of birth. Stillbirth mostly occurred in the 36th week (54%) whilst 27% happened in the 28th week of the gestation period.

5.2.1 LOGISTIC ESTIMATIONS ON PERINATAL MORTALITY

The measures of birth weight, child's birth sizes, in addition to other explanatory variables, are presented and discussed in detail below.

5.2.2 DEMOGRAPHIC FACTORS

Birth Weight:

The birth weight, even though has a direct (positive) coefficient that could imply increasing effect, it is not significant. Wilcox et al. (1993) however found that babies with low birth weight or very high birth weights are more likely to suffer perinatal death. Other studies such as Piasek et al. (2006) and Oral et al. (2001) have also established that there is a significant increase in the frequency of perinatal complications in fetuses with birth weight greater than or equal to 4.5kg.

Birth sizes:

Mothers' perceived sizes of babies at birth (very large =1, larger than average =2, average =3, smaller than average/very small =4) proved significant in explaining perinatal mortality in Ghana. However there is a threshold effect of this factor on perinatal deaths. While larger than average indicates inverse relationship, it is not significant. Average birth sizes rather indicate a statistically significant inverse association with perinatal death at 5% level (0.035). Babies with average perceived birth sizes are 2.2 percentage points less likely to die at perinatal stage in Ghana relative to those perceived to have very large birth sizes. This finding is consistent with studies such as Hinderaker et al. (2003) and Armson et al. (2006) that established an inverse relationship between babies with average birth sizes (normal birth weight) and perinatal mortality.

Preceding birth interval:

The focus of this factor is on the interval between the prior birth and the present pregnancy. It is relevant since there are biological implications attached to it. It indicates the extent to which a mother fully recuperates from a prior pregnancy. This result suggest that preceding birth interval has no significant effect on perinatal mortality ($p=0.687$) though its coefficient has the desirable negative sign. Other studies including Da Vanzo et al. (2004) and Benjamin et al. (2009) however, found inverse and significant association between perinatal death and preceding birth interval.

When child put to breast:

This factor has shown statistically significant and expected inverse relationship with perinatal mortality. Babies who are breastfed immediately or within hours after birth are less likely to die at the early neonatal stage than those breastfed for the first time after days of birth. From model 1, there are significant results at 5% level ($p=0.023$). Babies who are breastfed within hours after birth are 3 percentage points less likely to die at perinatal stage relative to those who were breastfed for the first time after days of birth. The result corroborates the findings of Fosu-Brefo et al. (2015) and WHO (2010) that initial breastfeeding immediately or within hours of birth improves neonatal survival than after days of birth.

Child's sex:

The gender of a baby is an important determinant of childhood survival generally since there are susceptibility differences between a male child and female child (Legato, 2009). This factor even though has both negative and positive sign in the first and the second model respectively, its effects are not significant. Some other studies have found these inconsistencies in the effect of gender on perinatal death. However,

according to Kaldenei et al. (2010), Rajora et al. (2013) and Moura et al. (2014) female babies are less likely to die at perinatal stage than their male counterparts. They found this effect to be statistically significant.

Type of delivery:

There is significant ($p=0.027$) inverse association between perinatal mortality and normal vaginal delivery in Ghana. Babies who were delivered through normal vaginal process are approximately 6 percentage points less likely to die at the perinatal stage than those delivered by caesarean section. The finding is in line with studies such as MacDorman et al. (2006) and Lumbiganon et al. (2010) who have established that delivery through caesarean section which is without medical complication is more likely to cause perinatal death than normal vaginal delivery.

TABLE 2(A) CORRELATES OF PERINATAL MORTALITY

Dependent Variable Perinatal Mortality	Model 1		Model 2	
	Logit coefficients	Marginal Effect	Logit coefficients	Marginal Effect
Demographic Factors				
Birth Weight	0.0003 (0.259)	5.17		
Birth Sizes: Very Large (ref) Larger than Average.			-0.377 (0.229)	-0.013
Average			-0.748** (0.035)	-0.022
Small			-0.367 (0.348)	-0.011
Preceding Birth Interval	-0.0111 (0.687)	-0.00021	-0.00151 (0.887)	-0.0001
When Child Put to Breast: Days (ref) Within 1hr.				
Immediately	-1.572** (0.023)	-0.028	-0.518* (0.064)	-0.016
	-1.215* (0.088)	-0.021	-0.186 (0.500)	-0.006

Table 2 (B) CORRELATES OF PERINATAL MORTALITY

Child's Sex: Male (ref) Female	-0.332 (0.541)	-0.006	0.00295 (0.989)	0.0001
Type of Delivery: Caesarean (ref) Normal	-0.440 (0.532)	-0.010	-1.022** (0.027)	-0.055
Place of Delivery: Home (ref) Health facility	-1.922* (0.099)	-0.024	-0.508** (0.039)	-0.018
Mother's BMI: <18.5kg/m ² (ref) ≥18.5kg/m ²	-0.799 (0.372)	-0.021	-0.299 (0.372)	-0.011
Mother's Age	0.0192 (0.560)	0.0004	0.0258* (0.099)	0.001
Antenatal Visits:	-0.136 (0.193)	-0.003	-0.0611 (0.240)	-0.0021
Socioeconomic Factors				
Wealth Index: Poor (ref) Middle Rich	-0.135 (0.835) -0.419 (0.460)	-0.002 -0.008	-0.280 (0.322) -0.428 (0.189)	-0.009 -0.013
Maternal Education: No education (ref) Education	-0.490 (0.384)	-0.010	0.379 (0.116)	0.013
Type of residence: Urban (ref) Rural	-0.154 (0.759)	-0.003	0.325 (0.334)	0.010
Constant	-0.698 (0.768)		-1.805* (0.075)	
	Observations = 476 Wald chi2(14) = 27.62 Pro chi2 = 0.0160 Pseudo R2 = 0.1175 Log pseudo likelihood = -58.792442		Observations = 2315 Wald chi2(16) = 35.97 Pro chi2 = 0.0029 Pseudo R2 = 0.0369 Log pseudo likelihood = -372.60535	

Logit estimates of the effects of socio-economic and demographic factors on Perinatal Mortality. ***: Significant at 1 % (p<0.001); **: Significant at 5% (p<0.05) and *: Significant at 10% (p<0.10). P-values are in the parentheses

Place of delivery:

Perinatal mortality is inversely associated with delivery at health facilities which is significant at 5% ($p=0.039$). Babies delivered in health facilities are approximately 2.4 percentage points less likely to die at perinatal stage than their counterparts who were delivered at home. This finding is in support of Kusiako et al. (2000) and Thind et al. (2008) who found that delivery at health facilities reduces child mortality since delivery is more likely to be supervised by a doctor or skilled attendants.

Mother's body mass index:

Maternal body mass index greater than or equal to $18.50\text{kg}/\text{m}^2$ has a negative coefficient that could imply a reduction effect on perinatal death but not significant. Most studies however, established that mothers with body mass index greater than or equal to $18.50\text{kg}/\text{m}^2$ are more likely to lose their babies at perinatal stage. For instance, Dagfinn et al. (2014) established that even a modest increase in maternal BMI is associated with increasing adverse pregnancy outcomes including perinatal death.

Mother's age:

This factor is positively and significantly ($p=0.099$) associated with perinatal mortality in Ghana. An increase in the age of an expectant mother increases the probability of perinatal mortality by 0.1 percentage point. The adverse association between mother's age and perinatal mortality is largely due to health depreciation effect of age as stipulated in the Grossman model. This effect of mothers' age on perinatal death is consistent with Kusiako et al. (2000) and Benjamin et al. (2009).

Antenatal care visits:

The results suggest that increasing antenatal care visit does not significantly affect perinatal death ($p=0.193$) even though it has the desired negative sign. This result

though not significant, a number of studies have stipulated that expectant mothers with more antenatal visits prior to delivery are not likely to lose their babies at perinatal stage. The findings of Tachiweyika et al. (2011) and Engmann et al. (2012) established that those who book more for perinatal care are less likely to experience perinatal deaths than those who had not booked for such care.

5.2.3 SOCIOECONOMIC FACTORS

Wealth Index:

The wealth index (poor, middle and rich) have not indicated a significant association with perinatal mortality. However the middle and the rich wealth quintile groups have shown inverse coefficients. When people's income increases, more is dedicated to the purchase of health inputs and thus the improved health (Grossman, 2000). Nketiah-Amponsah et al (2013) supported the idea that wealthier women are more likely to utilize health care services including antenatal care during pregnancy. The result from other studies such Amouzou et al. (2010) found this factor to significantly influence neonatal mortality especially among lowest wealth quintile households than rich households.

Maternal Education:

The result suggested varying effects of maternal education on perinatal mortality. In the first model, there is the desirable inverse sign, whilst in the second model, there is a positive sign. Both effects are however not significant ($p = 0.384$ and 0.116). Even though the results are not significant, a number of studies including Raghupathy (1996) established that mothers with higher education are more likely to seek health care that ensures safe motherhood and quality health of their babies. The findings of Benjamin et al. (2009) also established that mothers with no education or only

primary level of education have a positive relationship with perinatal mortality in Punjab.

Type of Residence:

The results indicate that rural households have the expected positive sign, but this association with perinatal mortality is not significant. Studies including that of Eldin and Maglab (2003) found significant variations in the effect of rural and urban residence on child survival in general. According to them more babies survive in urban areas than in the rural areas. Rural households, according to the findings of Benjamin et al. (2009) and Ettarh et al. (2012) are more likely to experience adverse child health outcomes including perinatal death compared to urban dwellers due to the differences in their social status. This is in line with studies such as that confirm perinatal mortality to be pronounced in rural households than in urban households.

5.2.4 LOGISTIC ESTIMATIONS ON ACUTE RESPIRATORY INFECTIONS**5.2.5 DEMOGRAPHIC FACTORS****Birth Weight:**

This factor indicated direct (positive) association with the ARI which is significant at 5% ($p=0.026$). Babies with very high birth weights are more likely to suffer ARI by 0.003 percentage points. It could be realized that an increase in birth weight increases ARI prevalence in Ghana. This result confirmed the effect indicated by Lehmann et al. (1996) that children with birth weights greater than 3.5kg are more likely to suffer from pneumonia just as those with low birth weight. From model 2, ARI is higher among very large size babies than among those of average birth sizes. This is in line with Azad (2009) who concluded that in Bangladesh, babies with birth weights, especially within the range of 2.5kg-3.5kg are less likely to suffer from ARI than babies with birth weight above 3.5kg.

Birth sizes:

Mothers' perceived sizes of babies at birth (very large =1, larger than average =2, average =3, smaller than average/very small =4) proved significant in explaining ARI prevalence in Ghana. Babies with larger than average birth sizes have inverse relationship with ARI and it is significant at the 5% ($p=0.027$). Babies with average birth sizes have also indicated a statistically significant inverse association with ARI at the 5% level ($p=0.001$). Babies with larger than average and average perceived birth sizes are 4 and 5 percentage points respectively less likely to suffer ARI in Ghana relative to those perceived to have very large birth sizes. This findings are consistent with studies such as Azad (2009), Ramachandran et al. (2012) and Awdhesh et al. (2015) that established an inverse relationship between ARI prevalence and babies with average birth sizes (normal birth weight).

Duration of Breastfeeding:

This factor has indicated varying but statistically insignificant effects on ARI prevalence in each of the models. In the first model its coefficient is negative which is desirable but in the second model, the coefficient is positive. The result is quite amazing since the findings of Pugh et al. (2002) have established that extensive breastfeeding of a baby for at least six months has significant effect on the health conditions of the baby and the mother. Studies such as that of Al-Sharbatti et al. (2012) have shown that shorter duration of breastfeeding increases the risk of ARI prevalence in Baghdad (Iraq).

Child's sex:

The results suggest positive but statistically insignificant relationship between ARI prevalence and children who are females in Ghana ($p=0.193$). The sign indicated by the coefficients of a child being female is not unexpected because 2003 WHO report

established that boys are often treated differently from their female counterparts due to cultural and socioeconomic factors in developing countries. However, van Gageldonk-Lafeber et al. (2007) have found ARI to be statistically more pronounced among children who are females than their male counterparts.

Child's age:

Older children are significantly ($p=0.011$) less likely to experience ARI in Ghana. The probability of older children experiencing acute respiratory infection declines by approximately 0.2 percentage points. The implication is that the child's age has a protective effect against ARI prevalence. The result confirms the findings of Bbaale (2011) that older children have lower probability of experiencing ARI compared to children who are less than 12 months of age in Uganda.

Place of delivery:

The result suggests a reduction effect of delivery in health facility on ARI prevalence, but not significant ($p=0.574$). Though this effect is not statistically different from zero in this study, other studies including that of Thind et al. (2008) indicate that delivery at health facilities reduces childhood infections.

Antenatal care visits:

The number of antenatal care visits before delivery is always important in the life of an expectant mother. The results indicate an increasing effect of no antenatal visit on ARI prevalence which is statistically significant at 5% ($p=0.020$). The results suggest that the lower the number of antenatal visit, the higher ARI prevalence. Mothers with no antenatal visit prior to delivery were more likely to have their babies suffering from ARI at the early part of their life by approximately 6 percentage points relative to more than 4 visits. The finding is in line with other studies such as Azad et al.

(2009) that mothers who book more for antenatal care were less likely to experience ARI than those who had not booked for such care.

Table 3 (A) CORRELATES OF ACUTE RESPIRATORY INFECTION PREVALENCE

Dependent Variable ARI	Model 1		Model 2	
	Logit coefficients	Marginal Effect	Logit coefficients	Marginal Effect
Demographic Factors				
Birth Weight	0.000399** (0.026)	0.00003		
Birth Sizes: Very Large (ref) Larger than Average. Average Small			-0.457** (0.027) -0.555** (0.013) -0.227 (0.364)	-0.044 -0.050 -0.021
Duration of BF	-0.0374 (0.148)	-0.0029	0.00965 (0.384)	0.001
Child's Sex: Male (ref) Female	0.417 (0.193)	0.033	0.0684 (0.621)	0.007
Child's age	-0.0223* (0.056)	-0.002	-0.0159** (0.011)	-0.002
Place of Delivery: Home (ref) Health facility	-0.270 (0.574)	-0.020	0.147 (0.376)	0.0144
Antenatal Visits: ≥4visits (ref) <4visits No visits	-0.376 (0.534) 1.408 (0.116)	-0.026 0.188	0.154 (0.374) 0.514** (0.020)	0.016 0.059
Mother's BMI: <18.5kg/m ² (ref) ≥18.5kg/m ²	0.0690 (0.927)	0.010	-0.00411 (0.987)	-0.0004
Mother's Age	-0.0127 (0.569)	-0.0019	-0.0179* (0.064)	-0.002
Socioeconomic Factors				
Wealth Index: Poor (ref) Middle Rich	-0.237 (0.627) 0.224 (0.550)	-0.018 0.017	0.302* (0.094) 0.251 (0.193)	0.032 0.026
Mother is working: Not working (ref) Working	-0.427 (0.418)	-0.029	-0.187 (0.397)	-0.017

Table 3 (B) CORRELATES OF ACUTE RESPIRATORY INFECTION PREVALENCE

Maternal Education: No education (ref) Education	-0.310 (0.434)	-0.026	-0.00639 (0.970)	-0.001
Type of residence: Urban (ref) Rural	0.535 (0.191)	0.043	0.0539 (0.781)	0.005
Geographic regions: Northern (ref) Upper East	-0.341 (0.662)	-0.024	-0.221 (0.435)	-0.020
Upper West	-2.060** (0.046)	-0.079	-0.972** (0.010)	-0.069
Brong Ahafo	-1.494* (0.054)	-0.073	-0.677** (0.039)	-0.054
Ashanti	-1.595** (0.029)	-0.087	-0.765** (0.013)	-0.061
Eastern	-1.589** (0.036)	-0.081	-0.681** (0.028)	-0.055
Volta	-1.570* (0.069)	-0.072	-0.107 (0.717)	-0.010
Greater Accra	-1.432** (0.035)	-0.090	-0.670* (0.055)	-0.054
Central	-3.353** (0.012)	-0.103	-0.387 (0.213)	-0.034
Western	-2.287** (0.019)	-0.086	-0.869*** (0.007)	-0.066
Constant	-0.355 (0.806)		-0.481 (0.399)	
	Observations = 506 Wald chi2(23) = 36.79 Pro chi2 = 0.0342 Pseudo R2 = 0.0932 Log pseudo likelihood = -157.74114		Observations = 2098 Wald chi2(25) = 54.91 Pro chi2 = 0.0005 Pseudo R2 = 0.0330 Log pseudo likelihood = -740.98509	

Logit estimates of the effects of socio-economic and demographic factors on ARI prevalence. ***: Significant at 1 % (p<0.001); **: Significant at 5% (p<0.05 and *: Significant at 10% (p<0.10). P-values are in parentheses

Mother's body mass index:

Maternal body mass index greater than or equal to 18.50kg/m^2 is found to have positive coefficient in the first model. It however indicates negative sign in the second model but both effects are not significant ($p=0.927$ and $p=0.987$). However, according to the findings of Azad (2009) those children whose mothers have body mass index especially above 24.9kg/m^2 are more likely to suffer ARI. Bbaale (2011) also supports the findings that higher maternal BMI significantly increases the risk of children suffering ARI.

Mother's age:

This factor reduces the risk of ARI prevalence and it is significant at 10% ($p=0.064$). An increase in the age of an expectant mother reduces the probability of ARI prevalence by approximately 0.2 percentage points. This reduction effect of increasing mother's age on ARI prevalence is in support of the findings of Rahman et al. (2001), Azad et al. (2009) and Awdhesh et al. (2015) that children of older mothers have at lower risk of suffering from ARI since these mothers have the experience to effectively cater for their children.

5.2.6 SOCIOECONOMIC FACTORS**Wealth Index:**

The middle wealth quintile group has indicated inverse association with ARI but it is not significant in the first model. Children from middle wealth quintile households have indicated significantly ($p=0.094$) higher risk of experiencing ARI relative to those from poor homes. ARI increases among children from middle wealth quintile homes by 3.2 percentage points relative to their counterparts from poor households. The result contradicts those indicated by Bbaale (2011) and Awdhesh et al. (2015)

that ARI is less prevalent among middle and rich wealth quintile households than the poor households. There may be some inherent effects other than the effect of wealth which could not be ascertained directly from the model.

Mother is working:

The results suggest that the coefficient of being a working mother is negative which could imply a reduction effect but are not statistically significant in both models. Rahman et al. (2001) however found positive and statistically significant association between ARI and children whose mothers work in the services. Rahman et al. (2001) stipulated that working mothers who leave their children in the hands of relatives to care for whilst they go to work have their children to be more prone to ARI.

Maternal Education:

This factor exhibits an inverse relationship with ARI prevalence which is desirable but not significant ($p=0.418$). Though this factor is not significant in this study, it is an important factor because the findings of Azad (2009) confirmed ARI to be statistically less prevalent among children whose mothers are educated. The findings of Bbaale (2011) also established that maternal education has inverse and significant relationship with ARI prevalence.

Type of Residence:

The rural households exhibit positive association with ARI prevalence but not significant ($p=0.781$). In spite of the fact that this factor is not significant, Gyamfi et al. (2002) and Kayode et al. (2014) explained that children from rural households are more likely to suffer adverse health outcomes compared to their counterparts from the urban areas due to the inequalities in access to health care and other social amenities.

Bbaale (2011) also found ARI to be more pronounced in rural households than in urban households.

Region of residence:

The findings indicate significant regional variations in ARI prevalence in Ghana. Aside from children in Upper East region, children in all the other regions have shown a significant inverse association with ARI prevalence. Central, Greater Accra, Western, Eastern, Ashanti and Upper West regions significant at 5% whilst Brong Ahafo and Volta are significant at 10% respectively. On average, children in Central, Greater Accra, Western, Eastern, Ashanti and Upper West are approximately 9 percentage points less likely to suffer ARI compared to children in the Northern region. This result is likely since children from Northern Ghana are more prone to harsh weather conditions including air pollution. The finding is in support of the findings of Bbaale (2011) that ARI was more prevalent in north Uganda than other parts of Uganda.

CHAPTER SIX

SUMMARY AND CONCLUSIONS

6.0 INTRODUCTION

This chapter aims to provide the conclusions drawn on the results of the correlates of perinatal mortality and ARI prevalence in terms of demographic and socioeconomic risk factors. Relevant recommendation for policy shall also be included.

6.1.0 PERINATAL MORTALITY

Perinatal mortality is positively and significantly predicted by mother's age (**demographic factor**). Perinatal mortality increases with increasing mother's age by 0.1 of a percentage point. On the other hand, mothers' perceived birth sizes of their babies especially average birth sizes, breastfeeding for the first time within hours or immediately after birth, normal vaginal delivery, delivery at health facility (**demographic factors**) are inversely and significantly related to perinatal mortality. Perinatal mortality declines among children with average birth sizes by 2.2 percentage points relative to those with very large birth sizes. Breastfeeding a baby immediately or within hours after birth in particular is approximately 3 percentage points more likely to reduce perinatal mortality relative to breastfeeding a baby for the first time days of birth. Delivery through normal vaginal process and delivery at a health facility reduce perinatal mortality by 6 and 2 percentage points respectively. Wealth index group especially rich households, birth spacing, female babies, more antenatal visits and maternal education though not significant are inversely associated with perinatal deaths. Babies of mothers residing in rural communities are also more likely to die at the perinatal stage.

6.1.1 ARI PREVALENCE

No antenatal care visit, rising birth weight and middle wealth quintile households are positively and significantly associated with ARI prevalence. ARI is more prevalent among babies whose mothers had no antenatal care visits prior to their birth by approximately 6 percentage points relative to their counterparts whose mothers had more than 4 antenatal care visits. Children who had very high birth weight are more likely to suffer ARI by 0.003 percentage points. Those children who are from middle wealth quintile households are also more likely to experience ARI by 3 percentage points compared to those from poor households. There may be some inherent characteristics in these households rather than the effect of wealth. Child's size at birth especially larger than average and average, child's age, mother's age and geographical region of residence are inversely and significantly related to ARI prevalence.

ARI declines among children with average or larger than average birth sizes by approximately 5 percentage points relative to those with very large birth sizes. Older children are approximately 0.2 percentage point less likely to suffer ARI. Babies with older mothers are less likely to suffer ARI by 0.2 of a percentage point. The probability of ARI prevalence among children below age five in Central, Greater Accra, Ashanti, Western, Eastern and Upper West regions declines on average by 9 percentage points compared to those from the Northern region. Longer duration of breastfeeding, delivery at health facility, children of working mothers and maternal education also indicate inverse association with ARI prevalence but are not significant. Rural residence, being a female child and mother's body mass index are positively related to ARI and are also not significant.

6.2 RECOMMENDATIONS

Considering the findings as well as the conclusions on the risk factors of both perinatal and ARI prevalence, a number of recommendations are worth noting.

Community support health care programmes or systems that influence dietary habits of expectant mothers would have to be strengthened by Ghana Health service and other health related non-governmental organizations such that expectant mothers could appreciate the need to ensure good nutrition for themselves and their children before, during and after pregnancy, since this would help ensure healthy birth weights and birth sizes of babies. In the context of Intensive breastfeeding, expectant mothers should be educated during antenatal care visits on the merits of early breastfeeding. In doing so, mothers would be motivated to always commence breastfeeding immediately after birth for improved immune system of their babies and reduced adverse childhood health outcomes in general.

Women from poor households would have to be empowered to be able to improve on their source of income which will facilitate health care utilization including antenatal care visits. Reproductive health education would have to be intensified in schools so as to reduce the number of girls who become pregnant at younger age and to help improve birth spacing among women in general. Expectant mothers who have no medical complications would have to be encouraged to always have normal vaginal delivery at health facilities so as to reduce perinatal mortality. More Community-based Health Planning and Services (CHPS) facilities would have to be provided in rural communities to promote access to quality health care. It is also important that policy makers direct more resources towards the provision of health facilities in all the regions as well as towards the distribution of trained health attendants such that the goals of universal access to quality health care can be met. Children from the Northern part of Ghana would have to be protected especially during the dry season from air pollution. Bush fire would also have to be avoided to reduce pollution from smoke. It would also be helpful if information on substance abuse, alcoholism and

smoking, inherent obstetrics and gynaecological conditions that could influence adverse pregnancy outcomes are captured in subsequent GDHS datasets.

Concluding remarks:

On a whole, even though the study combines a cross-sectional data over different survey periods for which the effect of time has not been captured, the findings in this study may not be significantly affected by these time factors. Also based on the idea expressed by Hill et al. (2006) that most problems associated with cross-sectional data such as misreporting or recall bias and underreporting have always been minimized in larger data sets such as the one used, the findings may not be affected by these challenges. Counting on the absence of multicollinearity which was confirmed by the Variance Inflation Factor and Tolerance test conducted in the study, the contributions of this study to literature in the direction of the effects of birth weight and its proxy (birth sizes) on perinatal mortality and ARI prevalence is significant and would guide policy towards addressing adverse child health outcomes in the Ghanaian context. The finding in line with the effect of ageing mother on child birth supports Grossman (1972) that age has depreciating effect on one's health.

The study also supports the findings of Fosu-Brefo et al. (2015) that early breastfeeding of a baby for the first time after birth is a protective factor for child survival. The result of study also support the hypothesis that antenatal care visit is important in reducing adverse child health outcome.

The study recommends that further research could be conducted in this area where the actual perinatal mortality rates and mortality associated with ARI would be tested using time series or panel data to cater for their rate of change over time and across countries.

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APPENDIX 1: QUESTIONNAIRES USED TO COLLECT DATA ON THE VARIABLES USED FOR THE STUDY

Variable/Codes	Survey Questions	Responses
Early Neonatal Death (b6)	How old was [Name] when he/she died	Days if less than 1 month Months Years
Stillbirth (v233)	How many months pregnant were you when the last such pregnancy ended?	Months
Acute Respiratory Infection (H31b)	When [Name] had an illness with a cough did he/she breathe faster than usual with short, rapid breath or have difficulty in breathing?	No Yes last two weeks
Birth Weight (Kg) (M19)	How much did [Name] weighed At birth?	Birth weight in Kg from card
Birth Sizes (M18)	When [Name] was born, was he/she very large, larger than average, average, smaller than average, or very Small?	Very large, Larger than average, Average, Smaller than average, Very small?
Other Explanatory Variables		
Preceding Birth Interval (b11)	How long would you like to wait from now before the birth of another child	Months Years
Child's Sex (b4)	Is [Name] boy or girl?	Male, female
Type of delivery (m17)	Was [Name] delivered by caesarean section	Yes or No.
When child put to Breast (M34)	How long after birth did you first put [name] to the breast?	Immediately, Hours Days
Age of Child (hw1)	How old was [Name] at his/her last birth day?	Current age in months
Type of Residence (v025)	Urban/ Rural	Urban Rural
Wealth index (V119) (v120) (v121) (v122) (v123) (v124) (v125) (v153)	Does your household have electricity? Radio? A mobile telephone? A refrigerator? etc	Yes or No
Mother's Education (v106)	What is the highest level of school you attended?	No education Primary JSS/ JHS Middle Secondary higher

Source: GDHS, 2008

**APPENDIX 2: QUESTIONNAIRES USED TO COLLECT DATA ON THE
VARIABLES USED FOR THE STUDY**

<i>Region of Residence (v024)</i>	Region	Western Eastern Central Greater Accra Volta Ashanti Brong Ahafo Northern Upper East Upper West
<i>Number of Antenatal Visit (M14)</i>	How many times did you receive antenatal care for this pregnancy?	No antenatal visit Number of visits Don't know
<i>Mother's age (v012)</i>	How old were you at your last birthday?	Age in completed years
<i>Mother's body Mass index (v445)</i>	During antenatal visits were you weighed or height taken?	Body mass index kg/m^2
<i>Mother is working (v714)</i>	Have you done any work in the last 12 months?	Yes or No
<i>Place of delivery (m15)</i>	Where did you give birth to [Name]?	Home, Health facility
<i>Duration of Breastfeeding (m4)</i>	How many months did you breastfeed [Name]?	Months, still breastfeeding

Source: GDHS, 2008