SCHOOL OF PUBLIC HEALTH
COLLEGE OF HEALTH SCIENCES
UNIVERSITY OF GHANA

FACILITY BASED UNDER-FIVE MORTALITY IN BRONG AHAFO REGION OF GHANA

BY

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DECEMBER, 2018
DECLARATION

I, Daniel Adu Asomaning, hereby declare that, apart from specific references which have been duly acknowledged, this thesis is my own work produced from research under supervision and that it has not been presented elsewhere in part or whole.

Daniel Adu Asomaning
(Student)

Dr. Anthony Danso-Appiah
(Supervisor)

DATE
DEDICATION

I dedicate this work to my entire family especially my beloved wife Abigail Fosuua, my wonderful children Donel Adu Asomaning and Nana Afia Nhyira Asomaning for their sacrifices and support and also to my course mates for motivation and support.
ACKNOWLEDGEMENT

I am most grateful to the Almighty God for my life. A special appreciation to my supervisor, Dr. Anthony Danso-Appiah without whose guidance, correction and counsel, this work could not have been completed. I am really indebted to him for his immense knowledge imparted. I am most grateful to my family and friends, my wife and kids for your support in diverse ways. All those who space will not be enough to mention God richly bless you.
ABSTRACT

BACKGROUND
Mortality among children less than five years is a major public health problem in the developing world which includes sub-Saharan Africa. To develop an appropriate public health intervention, adequate knowledge in the trend and spatial distribution of mortality is required to enable in proper planning and execution of interventions.

OBJECTIVE
This study analysed the trend and spatial distribution and clustering of facility based Under-five mortality from 2013 to 2017 in the Brong Ahafo Region of Ghana. It also analysed the cause of death among under-fives for 2017.

METHODS
A secondary data analysis of DHIMS 2 data on facility based under-five mortality from the Brong Ahafo Region was reviewed. Data that has been entered into the DHIMS 2 platform was extracted and analyzed with excel to observe trend. All the 27 districts were used as geographical units for this study. GPS coordinates of the main referral health facility in districts was taken and under-five mortalities recorded for those districts was used to determine the geographical distribution the cases. Arc GIS was used to determine the spatial distribution and clustering of facility based under-five mortalities from 2013 to 2017. This statistics test aided in the identification of clusters of under-five mortality. A further analysis was conducted on the cause of death with emphasis on the top ten causes for 2017.

RESULTS
Results of the study revealed with cases of facility based under five mortalities was low initially but increased drastically which was not consistent with what was reported in literature. However, a continues reduction was observed from 2015 to 2017. Five district were responsible for 63.1% of all U5 mortalities from 2013 to 2017.
Five condition; intrauterine hypoxia and birth asphyxia, malaria, perinatal conditions, prematurity, pneumonia were responsible for 51.2% of cases.

CONCLUSION
Under-five mortality is reducing in the Brong Ahafo Region. majority of the U5 mortalities occurred in urban district. Only 10 out of 36 conditions were responsible for 68.6% of all U5 mortalities in 2017. Intrauterine hypoxia and birth asphyxia are the highest cause of under-five mortality.
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### DEFINITION OF ACRONYMS

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<th>Full Form</th>
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<tbody>
<tr>
<td>ARI</td>
<td>Acute Respiratory Infection</td>
</tr>
<tr>
<td>GDHS</td>
<td>Ghana Demographic and Health survey</td>
</tr>
<tr>
<td>CHAG</td>
<td>Christian Health Association of Ghana</td>
</tr>
<tr>
<td>CHNTS</td>
<td>Community Health and Nursing Training School</td>
</tr>
<tr>
<td>CSDH</td>
<td>Commission on Social Determinants of Health</td>
</tr>
<tr>
<td>DHIMS</td>
<td>District Health Information Management System</td>
</tr>
<tr>
<td>GHS</td>
<td>Ghana Health Services</td>
</tr>
<tr>
<td>GPS</td>
<td>Geographic Positioning System</td>
</tr>
<tr>
<td>HATS</td>
<td>Health Assistants Training School</td>
</tr>
<tr>
<td>LBW</td>
<td>Low Birth Weight</td>
</tr>
<tr>
<td>MEBCI</td>
<td>Making Every Baby Count Initiative</td>
</tr>
<tr>
<td>MDG</td>
<td>Millennium Development Goals</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
</tr>
<tr>
<td>NMTC</td>
<td>Nursing and Midwifery College</td>
</tr>
<tr>
<td>NTC</td>
<td>Nursing Training College</td>
</tr>
<tr>
<td>SES</td>
<td>Socio Economic Status</td>
</tr>
<tr>
<td>SSA</td>
<td>Sub-Sahara Africa</td>
</tr>
<tr>
<td>UN</td>
<td>United Nation</td>
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<tr>
<td>UNICEF</td>
<td>United Nations Children Fund</td>
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<tr>
<td>U5</td>
<td>Under five</td>
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<tr>
<td>U5MR</td>
<td>Under-five Mortality Rate</td>
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<td>WHO</td>
<td>World Health Organization</td>
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DEFINITION OF TERMS

Under-five: Any child who is below the age of five (5) years

Mortality: Death that occurs from any cause

Clusters: A cluster is defined as a geographical area that reports greater than expected number of under-five mortality cases within a specified period of time

GPS Coordinates: Exact point or location where an incidence occurs

Trend: Pattern of under-five mortality
CHAPTER ONE

INTRODUCTION

1.1 Background

Under-five mortality Rate (U5MR) is a measure of the likelihood that a new born will die before their fifth birthday (Nettey, Zandoh, Sulemana, Adda, & Owusu-Agyei, 2010). The factors that influence U5MR include geographical location, access to health and family’s economic status. It is an important measure of the health status of the population pneumonia, birth complications during labour and delivery, diarrhoea, sepsis, and malaria the major causes with malnutrition contributing to 50% of them (World Bank, 2015).

Socioeconomic determinants, environmental determinants, nutritional status, personal illness control and growth faltering are some of the risk factors known to have a strong relation to child mortality (Mosley and Chen (1984).

1.2 Causes of U5M

The major causes of U5MR include, serious infections, acute respiratory infections (ARI), malnutrition and measles. Other causes such as asphyxia, diarrhoea and prematurity and Low Birth Weight (LBW) also account for significant proportion of deaths (Arifeen, Akhter, Chowdhury, Rahman, & Chowdhury, 2004). Neonatal and child mortality according to (Black, Morris, & Bryce, 2003), are caused by events such as undernutrition, infectious diseases and injuries among others.

A success measure of interventions aimed to drastically reduce under-five mortality depicts a tremendous improvement in every region of the world with a declined by 53 per cent by the years 2000 (WHO, 2015).
On minute basis, 21 children die as a result of preventable causes. Poor sanitation alone accounts for 28% of all childhood mortalities (WHO/UNICEF, 2010). Diarrhoea is one of the commonest cause of death as a result of inadequate safe water and sanitation. It accounts for half a million deaths among U5.

Diarrhoea diseases are infections caused by bacteria, viruses and other parasitic organisms. These pathogens are mostly spread through water contaminated with faeces. Infections are very common in areas with inadequate supply of water, poor sanitation and hygiene (WHO, 2017). Provision of adequate sanitation and safe water has been the focus of many governments. Interventions such as provision of toilet facilities, provision of boreholes and extension of pipe borne water are earmarked towards aversion of these consequences.

In 2016 alone, 216 million cases with 445,000 deaths resulting from malaria occurred in 91 countries only (WHO, 2017). Malaria over the years has been the leading cause of ill health. The parasite is transmitted through bite of an infective female anopheles’ mosquito. The provision of LLINS help to reduce the incidence of malaria. The National Malaria Control Program of Ghana provides LLINS for every pregnant woman who visit the health facility and also for every child who attains 18 months and visits the Child Welfare Clinic. Occasionally other catch up campaigns are done to serve the general population with LLINS.

1.3 Prevention of U5M

To achieve an acceptable under-five Mortality Rate (U5MR), continuous and sustainable efforts towards immunization, oral rehydration therapy, and maternal and child nutrition should be available and accessible. Also, there should be an improvement in general health and reduction in the number of high-risk births (Browne, Nelson, & Courtesy, 2005; WHO 2017).
Annually, 4 million babies die within their first week of life (UNICEF, 2018). According to WHO, 45% of all U5 deaths are as a result of malnutrition. Interventions earmarked to avert this is for mothers to practice exclusive breastfeeding, continue breastfeeding for two years, supplementation of vitamin A and providing appropriate complementary and weaning feeds.

The initiation of breastfeeding must be done within the first 30 minutes after delivery to enable the baby to receive colostrum. Colostrum is the first milk that flows after delivery. It is sticky and yellowish in nature and very rich in nutrients. Expects recommends that no baby misses it since is the most perfect food every new-born requires due it its wealth in antibodies. Nutritious diets are also very necessary to provide children with the required energy and nutrients proper growth and development.

Immunization has proven to be one of the most cost-effective and efficient public health interventions. Globally, immunization have prevented more than 2.5 million children from dying annually (Golding et al., 2017). Vaccines does not only prevent diseases but also complications such as deformity, loss of productive time and other serious consequence. The Ghana Immunization schedule targets 13 diseases. All children are expected per schedule to be protected from all the 13 diseases before they are two years. Occasionally, catch up, mop up and mass vaccination campaigns are conducted to provide better protection for the children.

Making Every Baby Count Initiative (MEBCI) aims to strengthens the capacity and skills to ensure that, the care provided to babies and mothers around the time of delivery is of high quality. The programme has four sets focus. It firstly aims at building the capacity of healthcare providers through a well-structured training. It also works at ensuring the availability of commodities for baby resuscitation at all targeted facilities. It also involves stakeholders those
within and outside health who matter to the wellbeing of the newborn. These stakeholders include national, sub-national, community and the general public. And finally, to build capacity at the higher level in leadership to ensure that newborn care is well planned for at the national level and adequate funding is provide. It is highly focused in addressing asphyxia, infection and prematurity.

1.3 The burden of U5MR

The past 26 years has recorded about 56% reduction globally in U5 deaths. SSA highest reduction in U5MR but still remains at an unacceptable rate beyond 80 per 1000 live births. Europe and South Eastern Asia has the least U5MR of less than 20 per 100 live births followed by Eastern Pacific and Latin America. SSA and South Asia has seen drastic reduction in U5MR with both reporting above 100 per 1000 live births in 1990 to less than 80 per 1000 live births in 2015 (World Bank, 2015).

In 2015 alone, as high as 5.9 million deaths was recorded among children before their fifth birthday, this accounts for 16,000 deaths on daily basis most of these are caused by preventable diseases (WHO, 2017). Under-five mortality remains very high globally with the developing countries contributing to a significant proportion especially in Sub-Saharan Africa (SSA), at least 10 million children die globally every year at various age levels before age five (Sartorius, Kahn, Collinson, Vounatsou, & Tollman, 2011). The United Nation (UN) Inter-agency group For Child Mortality estimated that, by 2015 all high income countries will record an average of 5 under-five deaths per 1000 live birth (The World Bank, 2016). These targets were reviewed and it now comprises A Promised Renewed target of 20 or fewer under-5 deaths per 1000 livebirths by 2035 by all UN member states (Liu et al., 2015).
Bay et al., 2014, estimated that, about 80 per cent of under-five deaths in 2017 will happen Sub-Saharan Africa and Southern Asia, and also an average U5MR of 79 deaths per 1,000 live births will occur in Lower Middle Income Countries (LMIC). According to WHO (2011), the African region still records the highest U5MR of 92 deaths per 1,000 live births, which suggests that, children under-five are at 15 risk of dying than those in the developed regions.

Vast disparities in under-five mortality exist between the various regions ranging from 92 deaths per 1,000 live births in Sub-Saharan Africa (SSA) in 2013, which is as much as 15 times the average for developed regions with 55 deaths per 1,000 exist in the Southern Asia which represents a 9 times the average for the developed world (Bay et al., 2014). Much difference exist between the worlds various economies ranging from 180 deaths per 1000 livebirths in SSA and only 9 per 1000 in the industrial world in 1990 this further increased in 2000 to 175 in SSA and 6 in the industrial world (Black et al., 2003).

Figure 1: Global Atlas on the burden of U5MR 2015
Source: WHO

1.5 Problem Statement

Though there has been a considerable reduction in the incidence of under-five mortality from
1970 to 2010 from 11.9 million to 7.7 million among which 49% occurred in SSA (Julie Knoll Rajaratnam, 2010). However, according to WHO (2017), 19,000 children die globally on daily basis as at 2015. Though this indicates a drastic reduction in the African Region, under-five deaths stood at 81.3 per 1000 live births which are relatively double of the global rate. In 2015, Ghana was unable to meet her Millennium Development Goal (MDG) of reducing the U5MR to 40 per 1000 live births with Neonatal Mortality alone accounting for 40% of all under deaths which stood at 82 per 1000 live birth (Ministry of Health - Ghana, 2014).

Several individual, household and community level factors have over the years been identified as key underlining cause of death for young children. It has also been established that objects in close proximity are often alike, in terms of exposures and may influence mortality rates in households, sub-districts and districts of the same geographical area. It is therefore very necessary to assess under-five mortality with the use of trend and spatial distribution and clustering analysis.

In Ghana, lack of adequate studies on the trend, spatial distribution distribution and clustering of facility based under-five mortality has led to limited policies that are tailored towards peculiar challenges confronting Districts and Sub-districts. This study aims to be among the few provide the blueprint in the provision of knowledge to bring into perspective the geographical distribution of facility based under-five mortality at the National as well as the local level. Findings from this study will provide the knowledge gap and serve the basis for further enquiry into the causes of disparities in the distribution of under-five mortalities among Districts, Sub-districts and communities in the Brong Ahafo Region. It will also set the baseline for the formulation of preventive strategies towards the goal of reducing under-five mortality.
1.6 Justification

Most mortality information of a country, a region, a community or a facility are readily available and exist in demographic and health surveys, censuses, hospital medical records among others (World Bank, 2015).

This study is meant to establish the trend, spatial and temporal distribution of under-five mortality cases that occurred in health facilities from 2014 to 2016 in the Brong Ahafo Region of Ghana. It is established that, environmental factors affect household and communities that are located in similar geographical locations.

Findings of this study will establish the basis for carving specific health interventions for most deprived spatial units (districts and sub-districts) that mostly need them and also allocate necessary budget in order to catch up with the rest of the districts to achieve spatial parity. This will accord the opportunity to establish disparities that may exist within districts and sub-districts. For the fact that this study will be carried out in the Brong Ahafo Region, the outcome will directly provide the basis for the Regional Health Directorate and the District Health Directorates in planning and designing specific policies for locations with special needs. Should the finding of this study depict a substantial variation in death rates within the region, planning for health interventions will consider district and sub-district needs. Most programs have failed due to the incomplete and unreliable nature of these knowledge on trends (Black et al., 2003).

This study is aimed at adding to the literature to increase the knowledge on trend, geographical, temporal disparities in the distribution of under-five mortality among districts in the Brong Ahafo Region of Ghana. Findings of this study are also meant to establish trend, spatial and
temporal distribution of under-five mortality of cases that occurred in health facilities from 2014 to 2016 in the Brong Ahafo Region of Ghana.

1.7 Conceptual Framework

![Conceptual Framework Diagram](http://ugspace.ug.edu.gh)

- **Socio-demographic factors**
  - Age
  - Sex
  - Date of death
  - Birth Order
  - Place of residence

- **Community factors**
  - Road network
  - Distance to health facility
  - Access to safe water
  - Availability of basic sanitation facilities

- **Health Seeking Behaviour**
  - Mothers Age
  - Mothers occupation
  - Mothers level of education
  - Mothers Number of children
  - place of delivery
  - Insurance status
  - Time of arrival

- **Health System**
  - Time treatment commenced
  - Adequacy of skilled staff
  - Ward space and bed situation
  - Cost of treatment
  - Duration of stay in Hospital

**Figure 2: Diagram of conceptual Framework**
1.7.1 Conceptual framework explained

Conceptual framework according to Miles and Huberman (1994), is the narrative, graphical, visual or written product that explains the main idea to be studied. It also addressed the key factors, concepts, or variables, and the presumed relationship among them.

Figure 2 depicts the interrelatedness of factors and highlights on the need to provide quality of care for all children at all levels.

As described in the diagram, socio-demographic factors, community factors, health seeking behaviour and health care system factors influences U5MR.

Socio-demographic such as age of the baby, sex, birth disorders and place of residence and diseases condition/complication determines the severity of illness. Severe conditions require urgent attention and if prompt action is not taken, this may result in death of the child. Younger children such as neonates are most likely to suffer severest form of diseases due to low immunity levels.

Community factors such as road network will hinder the transportation of sick children access health care at the earliest time. Place of residence presents its risk to the babies most children die as a result of indoor air pollution. According to (Bay et al., 2014), Acute Respiratory Infection (ARI) is one of the leading cause of deaths among U5. Pollution levels are higher in communities that are highly industrialized and also rural communities who use biomass as the main fuel source.

In respect to health seeking behaviours Age of mothers has an influence on experiencing U5 mortality. Several studies have revealed that, age of the mother is statistically significant in
explaining infant and child mortality. For example; mothers who had their first birth before attaining 20 years has a higher risk of experiencing child death compared to those who had theirs at ages 20-34 (Ntimba and Mbago, 2005). Place of delivery determines the health seeking behaviour of the mother. Mothers who delivered in the house are more likely to visit the health facility late when conditions of their children are severe. Most children at this stage are likely to die.

Inadequacy of skilled staff logistics may affect the response time timeliness of in service delivery in emergency situations and this affects the health outcome of the child. Child factors may negatively affect the growth of the child leading to growth faltering and its outcome maybe death.

with the introduction of appropriate policies to address these factors by initiating interventions and workable protocols service delivery will be improved and U5MR can be further reduced.

1.8 The Objectives of the study

1.8.1: General Objective

To determine the trend, Spatial distribution of facility based Under-five mortality from 2014 to 2016 in the Brong Ahafo Region of Ghana.

1.7.2 Specific Objectives

1. To analyze the trend of under-five mortalities

2. To determine the spatial distribution of facility base under-five mortalities

3. To characterize the causes of under-five mortalities for 2017.
CHAPTER TWO

LITERATURE REVIEW

2.1 Trend of under-five mortality

The availability of Patterns and trends in under-five mortality will go a long way to help decision makers in assessing programmatic needs, prioritize interventions, and monitor progress made in reducing under-five mortality (Victora, 2015). Regular availability of an updated evidence on levels and trends for age-sex-specific all-cause of mortality is highly essential for the formation of global, regional, and national health policies (Liu et al., 2015).

Records has shown that globally, there has been 53% reduction in under-five deaths since 1990 (World Bank, 2015). In 1990, U5MR was at 91 per 1000 which reduced to 41 per 1000 live births and in absolute numbers stood at 5.9 million in 2015. It is interesting to know that, U5MR in developing countries is as high as 47 per 1000 live births whereas in the developed world, it is as low as 6 per 1000 live births. 49.6% of these occurs in SSA alone notwithstanding the massive reduction of under five deaths from 4.1 million in 2000 to 1.6 million in 2015 (World Bank, 2015).

In Finland a study employed the method of analysing mortality data from the official cause of death statistics of Finland with an aim of evaluating childhood mortality trends from 1969 to 2004. It aimed at ascertaining whether mortality rates decline in the country were continuous and also investigate whether there existed preventable deaths (Lantto, Renko, & Uhari, 2008). It was observed that, congenital malformations were the leading cause of death within the perinatal stages and mortality decline was eminent over the period of review. (Lantto et al., 2008).
A successful measure of interventions to drastically reduce under five mortalities and to improve U5MR indicates that, there has been a tremendous improvement across all ages (Partnership, 2017).

Due to the alarming rate and serious consequence higher U5MR in the third world, it was agreed among united Nations member states to reduce by two-thirds U5MR from 1990 to 2015 and was captured in the Millennium Development Goal (MDG) as goal four. Though there is evidence of success, high U5MR still remains concern globally with countless research done to forestall the situation (alkema & You, 2012).

Due to failure to meet the MDGs targets by set dates, a much ambitious set of targets were agreed on and under Sustainable Development Goals (SDG) which sets to reduce U5MR to 25 per 1000. Amidst these efforts, 16,000 children still die from preventable causes before attaining the age of five years (World Bank, 2015).

Regions with geographically diverse ecology and socioeconomic circumstances may have different disease exposures and child health outcomes (UNICEF, 2013). A study in Nigeria suggested that the risks of death in children under age 5 across regions of Nigeria and characteristics at the individual and community levels explains a possible variations among regions (WHO, 2011).

According to the (DHS, 2014) under-five mortality rate was 60 deaths per 1,000 live births in Ghana which is still at an unacceptable rate. There has been a decreasing trend of under-5 mortalities for the past 15 years from 1988 to 2014 with reducing under five mortalities from 115 to 60 in 2014. In this period, sixty-eight percent of all deaths among children under age 5
in Ghana take place before a child’s first birthday, with 48 percent occurring during the first month of life.

Neonatal deaths alone represent half or more of all deaths among children under 5 years of age in all WHO regions in 2015 (WHO, 2017). In Ghana neonatal mortality alone accounts for 40% of all under five deaths which stood at 82 per 1000 live birth in 2013 (Ministry of Health - Ghana, 2014). According to reports on demographic and health surveys in 44 countries, only 20% of all child deaths occurred in the neonatal period however, in countries with lower than 35 per 1000 livebirths more than 50% of child deaths were in neonates (Black et al., 2003).

The fact that a higher proportion of the under-five deaths in Ghana are neonates most it alarming. This has aroused the necessity for the inaction of timely intervention. It is also important to reassess the policy on new-borns aimed at integrating all existing interventions employing a “child centred approach” in improving the health of all mothers and babies in the continuity of health care (UNICEF, MOH, GHS, 2014).

Ghana in its strive towards attaining this goal has made much gains in reducing U5MR (GDHS, 2014). However, there is the need for improvement since the success is insufficient with U5MR at unacceptable level. Much pragmatic approach is required to meet the SDG goal of 20 per 1000 livebirths by 2030 (UNDP, 2014). In 1988 U5MR in Ghana stood at 155 deaths 1000 live births and has reduced drastically in the past 25 years 60 per 1000 (GSS, 2014). A massive intervention is required to further reduce U5MR to an appreciable level, there need to be an audacious effort in planning, prioritizing, resourcing and evaluate activities earmarked towards the achievement of these goal (UNDP/GOG, 2015).
There has been a reduction in institutional based U5MR due to child health interventions since 1990. The reduction has been faster since the year 2000 and this can be attributed to the several maternal and child health interventions in the country (MOH, 2015).

Since the adaptation of the MDGs into the country’s health implementation framework there has been policies and strategies to improve child survival thereby reducing child mortality. Ghana developed the Under – Five’s Child Health Policy 2007 – 2015 and the Under 5 Child Health Strategy 2007 – 2015 to help in integrating and scaling up interventions using the “child centred approach” organized along the continuum of care for mother and child from pregnancy, birth, immediate newborn period, neonatal period, infants and children (MOH, 2015).

Place of Delivery and Infant Mortality Proper medical attendance and hygienic condition during delivery can reduce the risk of complications and infections and possibly deaths for both the mother and the baby (Gyimah, 2004). Gyimah contented that, mothers who delivered at health facilities were less likely to experience infant mortality than those who delivered at home. Thus, for sound reduction of health risks of the mother and the child, the health-facility-based deliveries should be increased. Environmental Contamination and Infant Mortality Improved sanitation lowers mortality by the mechanism of less exposure of the children to contaminated environment. In turn, this makes them less susceptible to disease and eventually death. Various studies have established the effects of type of toilet facility on infant mortality. Incidence of infectious diseases such as diarrhoea is seen to be influenced by the state of the environment. This type of toilet facility may facilitate pollution and contamination of the environment and consequently affect infant mortality.

According to a study conducted by Wak, (2002) in the Kassena-Nankana district in Ghana, it was found that, infant mortality is experienced by children whose compounds have no toilet
facilities while those who use water closet or pan toilet latrine experience the lowest infant deaths. This study further indicated that children born to mothers whose drinking water is from unprotected sources, experience high infancy deaths than children born by mothers whose drinking water is from protected sources.

Maternal Age and Infant Mortality Several studies revealed that, age of the mother is statistically significant in explaining infant and child mortality. For example; mothers who had their first birth before attaining 20 years are 2.4 times more likely to have child death compared to those who had theirs at ages 20-34 (Ntimba and Mbago, 2005).

2.2 Clustering of Under-five mortality

According to the guiding ethical principle for the Commission on Social Determinants of Health CSDH, health equity is defined as the absence of unfair and avoidable or remediable differences in health among social groups (WHO, 2010). Disparities that exist in health care provision experienced during childhood can result in a wide variation in health and health care outcomes. Such outcomes may include childhood and adult morbidity and mortality. Such facts prompts that, a crucial enquiry must be establish into the factors that influences these disparities across the life course (Cheng, Goodman, Committee, & Pediatric, 2017).

A research conducted by Black et al., 2003, concluded that, there is the need to actively focus on interventions at the community-level which should be aimed at increasing maternal and child health care utilization and also foster the improvement of socioeconomic status of mothers with much emphasises on disadvantaged areas. According to a study in Nigeria, it was made known that, community-level variables such as place of residence, community infrastructure, community hospital delivery and community poverty level and also certain
individual factors which are child’s sex, birth order, birth interval, maternal education, maternal age and wealth index were major determinants of infant/ child mortality in Nigeria. (Ononokpono & Ibisomi, 2015).

It was also revealed that the risk of not incompletely immunizing children in Nigeria was not only as a result of individual factors but also community has a role to play with immunization as one of the cheapest and best intervention for under-five mortality. Therefore interventions to improve child survival such as immunization uptake must be planned to consider all these determinants (Adedokun, Uthman, Adekanmbi, & Wiysonge, 2017).

It was observed that, districts with clusters and those without mostly shared boundaries which confirms the assertion communities may not be very cohesive communities, but due to their shared experiences as a result of closeness due geographical location and exposure to the similar social (Alam, Zahirul Haq, & Kim Streatfield, 2010).

Person who live in the same community shares the one market, mosque, churches, schools, and other facilities education. These social amenities have a lot of influence knowledge, values, lifestyle and other determinants of health(Alam et al., 2010)

Studies has shown that geographic and social stratification often go hand in hand, such that lower socio-economic groups often live in more deprived regions within countries Rural areas, for example, exhibit higher childhood mortality rates than urban areas, though with some exceptions (Houweling, 2005). In areas with the greatest number of under five deaths there is the need to maintain effective programmes at the local levels to be able to accelerate progress (Rajaratnam etal, 2010). An updated evidence on levels and trends for age-sex-specific, all-cause and cause-specific mortality is essential for the formation of global, regional, and national health policies (Liu et al., 2010).
A study in Nigeria revealed that most neonates died within 24 hours of birth with a decline in U5MR over the years with inequality in outcomes within the sub groups; neonates, infants and child deaths (G. A. Kayode, Adekanmbi, & Uthman, 2015).

Newborn health is tied to the health of the mother, strategies to improve the health and care of women in low-resource communities and countries are also expected to improve both pregnancy and neonatal health outcomes. However, poverty, illiteracy, poor status of women and dysfunctional health systems are important underlying factors that adversely affect maternal and child health in many developing countries.

Hand washing of birth attendant before birth, clean birth surface, clean perineum, cutting of the umbilical cord using a clean implement, clean cord tie, clean cloth for drying are practices may be influenced by a number of programmatic approaches including behaviour change communication, commodity provision, or training of attendants, or both. Hand-washing with soap results in a large reduction in hand contamination, even when washed with unclean water, and birth attendant and maternal hand washing have been associated with reductions in neonatal mortality. However cultural factors frequently dictate practices and may influence willingness to adopt new clean practices. Many populations commonly rub potentially harmful substances on the umbilical cord or skin despite WHO recommendations for dry cord care Chlorhexidine, a broad-spectrum topical antiseptic, has residual effect for up to 72 hours and may be a used in addition to basic cleaning practices in home and facility level. Although such hygienic practices at birth and during the postnatal period are accepted as a standard of care but there is very limited evidence regarding their effect to guide policymakers in the potential mortality effect size (Blencowe et al., 2011).
U5MR in sub- Saharan Africa, is a devastating epidemic of human immunodeficiency virus (HIV)/acquired immuno- deficiency syndrome (AIDS) threatens to reverse many of the gains achieved during decades from child survival programs. Pragmatic reality in most developing countries dictates the need for wide scale implementation of evidence-based, cost effective health programs and interventions to improve child health outcomes. Moreover, achievement of MDG goal 4 to reduce U5MR by two thirds by the year 2015 could have dependent on a substantial reduction in neonatal mortality over the next decade. (Bhutta, Darmstadt, Hasan, & Haws, 2005).

In Nigeria, it was revealed in a study that the high incidence of unbooked patients, multiple pregnancies and low birth weight babies are the main explanations for the rising perinatal mortalities in the environment. The study identified asphyxia, immaturity and macerated stillbirth as the most common causes of perinatal deaths (Kuti et al, 2003).

A case control study was conducted in the Builsa district in the Upper East Region to identify the determinants of under – five mortalities in the Builsa District Hospital from January 2003 to June 2005. A total of 60 cases and 120 controls were matched for age, sex and place of residence. It was observed with mothers who had previous history of child death that their children were 8 times more likely to die whiles children who had not had vitamin A supplementation were 10 times more likely to die (Osei-Kwakye, Otupiri, Dabo, Browne, & Adjuik, 2010).

Risk factors observed that were protective included exclusive breastfeeding, insecticide treated net usage and the number of children alive a mother had. In conclusion, it is possible to improve child health in areas where poverty is evident and health staff should be trained and well
equipped to prevent further under – five deaths among mothers who have had previous child death (Osei-Kwakye et al., 2010).

Particularly striking was insignificant progress during the last decade in reducing deaths during the first week of life (the early neonatal period) in low-income countries. U5MR (including early neonatal mortality) have continued to decrease rapidly in high-income countries, resulting in a widening gap in survival chances for infants.

Despite increasing attention to neonatal data, child-survival programs and funding continue to focus primarily on important causes of death after the first 4 weeks of life, particularly malaria and vaccine-preventable diseases, whereas maternal health programs have focused primarily on the mother. However, newborn deaths can be reduced by strengthening care within existing maternal and child health programs and including evidence based interventions to target the main causes of neonatal deaths. However, improvement on neonatal death data and making better use of existing and future data in selecting and implementing the best practices to curb with the problem. Available information is often not used effectively to strengthen existing programs, especially at district level.

Fertility Factors and Infant Mortality The length of birth interval is one of the important biodemographic factors that influence infant and child mortality; and it is a common problem in most developing countries. Mortality theories indicated that short birth interval is associated with high risk of infant and child mortality due to physiological and nutrition depletion of the mothers which relate to premature child births and the mothers exposed to pregnancy complication (Boerma and Bicego, 1993 in Dube, 2012). According to Mustafa and Odimwegu, (2011) births of order six or higher with short preceding birth intervals have the highest mortality risk, that is multiple births are associated with an elevated mortality risk. In
general, short birth interval raises the vulnerability of infectious and parasitic diseases and exposing children to malnutrition.

2.3 Cause of Death

Child survival is dependent on several factors which includes on the prevailing health challenges in the study area. Some major causes of child mortality may include birth complications, malaria, diarrhoea, measles, HIV/AIDS (Abu, Madu, & Ajaero, 2015).

A study in Konfo Anokye Teaching hospital revealed that most neonates who died within 24 hours after delivery were as a result of prematurity, birth asphyxia, neonatal sepsis, neonatal jaundice and respiratory distress identified as the five topmost causes of these deaths (Siakwa et al., 2015).

Causes of institutional based under – five mortalities are an important indicator of the health system and wellbeing of children. It also measures the health status of a nation (World Bank, 2015). Most deaths in children under-five are due to causes/factors that are readily preventable and treatable using proven quality delivered interventions that are cost effective (World Bank, 2015). The three leading causes of death in children under – five are preterm birth complications, pneumonia and intrapartum – related complications (Liu et al., 2015).

According to the UNDP/NDPC/GOG, 2015) report, one of the leading causes of under – five morbidity and mortality in Ghana is pneumonia, accounting for 20 percent of the deaths in this category. A study in South Africa examined the causes of institution based under – five deaths in a tertiary institution in the Limpopo province. Death certificates of children younger than 5 years were obtained from the hospital, between January 1, 2008 through December 31, 2010.
and retrospectively reviewed (Natali et al., 2013). The findings showed leading causes of
deaths in neonates were prematurity/low birth weight, birth asphyxia and pneumonia. For that
of infants were pneumonia, diarrhoea and HIV/AIDS and that of the children were injuries,
diarrhoea and pneumonia. Majority of the deaths in the under – five children (26.8%) was due
to prematurity/low birth weight. Conclusions were that, congenital conditions, malnutrition and
unintentional injuries contribute significantly to the deaths of children under – five of which
most of these causes are preventable using a mix of multi – faceted interventions such as
providing specialized care through the establishment of intensive care units together with
highly trained personnel to manage neonatal conditions, strengthening of health care aspects
relating to children, improving safe and secure playgrounds and the support to home caregivers
to children (Natali et al., 2013).

A hospital based study was conducted in Nigeria facility based mortality. The aim of the study
was to evaluate the mortality pattern from January 2007 to December 2008 of children 1-
16years admitted into the children’s medical wards of the University of Port – Harcourt
Teaching Hospital. The study reviewed files of all patients, aged 1 -16 years, admitted into the
paediatric wards excluding neonatal and surgical cases admitted during the period. A total of
2,174 admissions were recorded with 61 deaths observed of which 52 (80.3%) were under 5
years (George, Alex-Hart, 2009).

According to (Rashid et al., 2010), preterm births with low birth weight is the major cause of
mortality in neonates in a tertiary institution in Bangladesh accounting for 67.12% of all
neonatal deaths. This was a retrospective study conducted in a paediatric department of
Khulna Medical College Hospital in Bangladesh where all records of neonatal admissions
in the year 2008 were reviewed.
A study in the Cassena – Nangana district described the trend and causes of neonatal deaths in this rural district in northern region of Ghana. 62.7% of the deaths that occurred in 2006 was during early neonatal period. Prematurity alone accounted for 38% and birth injuries 19% were the leading causes of death (Braiden et al., 2006) among U5.
CHAPTER THREE

METHODS

3.1 The study design
This study involved the re-analysis of the DHIMS 2 data on facility based under-five mortality.

3.2 Case definition
Any child who died in a health facility in the Brong Anafi Region of Ghana before attaining the age of five years from 2014 to 2017 whose record has been entered into the DHIMS 2 platform.

3.3 The study area
The study will be carried out in the Bring Anafi Region of Ghana.
Figure 3: Map of the Bring Anafi Region

Source: Google maps
3.3.1 Area boundaries and demography

The Region occupies a total land mass of 39,557 square kilometres. The Bring Anafi Region is the second to the Northern Region with respect to total land size. It sits on 16% of the total land size of Ghana. The Region is bounded in the south with Ashanti and Western Regions, at the south eastern part is the Eastern and Volta Region at the eastern side. It also shares an international boundary with La Cote d’Ivoire in the west. Kintampo is the central point of the entire country which is found in this region. The region has the Black Volta at its north which is dominant and The dominant occupation in the Region is farming and farming related jobs. Farming employs about 70% of residents in the Region. Quite majority of the working group in the Region are involved in active production, Sales workers, transport operators, and other professions. The largest market in the Region can be located in Techiman Municipal with quite substantive economic activities occurring in its environs.

Several other rivers in the southern part. These rivers include Tano, Tain, Bia, and Pru as the main water bodies in the Region. The region has a diverse vegetation with both savannah and forest. And therefore crops like cocoa, timber and other which are grown in the forest region in are produced here. Also due to the savannah vegetation, grains and tubers are also produced in abundance in the region. And therefore the Region is referred to as the bread basket of the country.

3.3.2 Economic activity

The most urbanized in districts in the Region are Brekum and Sunyani Municipals. Most of the populace in this districts in are into sales and other Professions, Technical and other highly skilled jobs. Most services are not available in several districts but can be found in Sunyani and Brekum and occasionally Techiman.
3.3.3 Administration

Sunyani is the capital town of the Region with 27 administrative municipals, and districts.

3.3.4 Current health status

The Ghana Demographic and Health Survey (GDHS) since 1998 has consistently, recorded significant decrease in the occurrence under-five Mortality. Amidst this achievement, U5MR still remains a major health problem. Among this group a considerable proportion occurs to neonates which has not seen any improvement in the previous GDHS. However, the region is the second best among ten for its recognition in its radical approach towards reducing U5MR. This achievement placed the region second to Greater Accra Region of Ghana. However, in neonatal mortality the situation was different. The Region was ranked fourth indicating the need for a more pragmatic approach address the situation. In relation to the uptake of modern family planning contraception, among married women, the Brong Ahafo Region is ranked first with 26%. There is an observed steady improvement in all health indicators except for U5MR. This prompts a radical accelerated approach to avert the situation.

3.3.5 Health Institutions

The region has a total of 690 health facilities. These facilities are;

- Hospitals: 29
- Health Centres: 82
- Clinics: 112
- Private Maternity Homes: 43
- Functional CHPS: 423
Health staff runs 1,393 outreach points in 3,292 communities. Out of the 27 districts, nine of them have no district hospital with three privileged to have polyclinics.

The region is wealthier in terms training of health workforce with fifteen (15) health training institutions. These are; Kintampo (College of Health Sciences), Tanoso (CHNTS), Sunyani (NTC and HATS), Brekum (NMTC), Goaso (Midwifery), Dormaa Municipal (Midwifery), Ntotroso (NMTC), Seikwa (HATS), Kwapong (CHNTS), Yamfo (College of Health), Dadiesoaba (NTC), Sampa (CHNTS), Techiman Krobo (CHNTS), Wenchi (NTC) and Techiman Holy Family Nursing and Midwifery College (NMTC).

The Region has 3,292 communities are within the region. 2800 representing 85% of the population are served in terms of health by the Ghana Health Services (GHS) with remaining served by the CHAG and NGOs.

3.4 The study variables

Variables that were extracted included; district where death occurred, cause of death and year of death, age, sex, district where death occurred, the year of death and districts geographical coordinates. These data were only retrieved on U5 deaths only.

3.5 The study population

The study population was all deaths that occurred in health facilities among children who were below age five in all health facilities in the Brong Ahafo Region that occurred from 2013 to 2017.
3.6 Sample Size

No sample size was done for this study. This is because; the study included all under-five mortality cases that occurred in health facilities in the Brong Ahafo Region from the period of 2013 to 2017.

3.7 Sampling Method

No sampling technique was used because all under-five mortality cases that occurred in health facilities from 2013 to 2017 were included in the study.

3.8 The inclusion and Exclusion criteria

Only death that occurred among children aged 0-59 months in health facility and recorded on the DHIMS 2 in the Brong Ahafo Region from 2013 to 2017 was included in the study. However, deaths that happened to children 0-59 monthly outside a health facility, deaths among persons older than 59 months and also deaths that occurred before or after 2013 to 2017 were excluded from this study.

3.9 Data Collection Tools

A secondary data analysis was performed by extracting data on under-five mortalities that occurred in health facilities in the Brong Ahafo Region from 2013 to 2017 from the Ghana Health Services (GHS) DHIMS 2 platform. The DHIMS 2 is a web based platform and the main reporting system of the GHS where all reports generated by the service providers are stored and used for planning and evaluation. Data are keyed in from the point of generation and can only be accessed online with authorization.

This data was first entered on a specially designed reporting template. GPS coordinates of District’s with reference to their main referral facilities was collected using a GPS device and
entered on that specially designed template. These facilities were used to represent the central location of each district.

3.10 Data collection technique

Data was retrieved from the DHIMS 2 platform by the researcher by logging on to the application from the internet through the use of an authorized account. Permission was sought from the Director for Centre for Health Information Management System. A request was made on behalf of the Principal Investor to be granted access by creating an account for him on the DHIMS 2 platform. Data on under-five mortality from 2013 to 2017 was then downloaded. GPS coordinates was also collected from the various health facilities and entered on the reporting template designed by the researcher.

3.11 Quality Control

Because the DHIMS 2 platform has validating functions quality of data to a major extent is controlled. Also data obtained from event capture reporting forms were cross checked with death certification reported on the DHIMS 2. The researcher teased out the records of under-five deaths from the event capture format and cross checked from the death certificates recorded. Data on cause of death was also retrieved and entered on an excel template for analysis.

3.12 Data Processing and Analysis

This study used aggregated data collected by the Ghana Health Services (GHS) through the District Health Information Management System platform (DHIMS 2). Data collection on DHIMS 2 is done at the source of generation and validated by generators and district officers. Data is collected by the use of report formats that are specially designed templates which are used to extract data from registers. Collected data is then entered on the online DHIMS 2
platform. To ensure the quality and completeness of the reports, constraints are put in place to minimize errors during entries. The DHIMS 2 captures data on all health activities and outcomes and therefore for this study, data was extracted from event capture, medical certificate and cause of death. Data was downloaded on the DHIMS 2 platform on the 31st October, 2018 at 5:17 AM.

Data was collected on under-five deaths that occurred at the health facilities in the Brong Ahafo Region. Accessed data were entered on an excel spread sheet for data analysis. It was then analysed by running excel for trend of under-five mortality. Mortality rates were calculated for each district per 10,000 population of children under to make it possible to compare districts. Line graphs was used to access trends of U5MR whereas pareto charts were used to assess the magnitude of the mortalities among the district. Pareto charts was preferred because it rates the magnitude of the U5MR by district for better interpretation.

Arc GIS version 10.4 was used to analysed the distribution of under-five mortality by districts. Maps were plotted by using the facility coordinates. Three categories of the rates were used to determine clustering under-five mortalities. District with rates of more than 40 per 10,000 populations was classified as high occurring district. The software set to identify these districts with red coloured big circles. Districts with U5MR ranging from 20 to 40 per 10,000 was classified moderate with small orange circles. Also districts with less than 20 per 10,000 populations under five were represented by yellow smaller circles. Interpolating analysis will be done to determine similarity in the distribution of mortality cases in nearby districts.

Interpolation of child mortality in the Brong Ahafo region of Ghana will be done. The inverse weighted distance is a predictive tool based on the theory of distance decay and the first rule
of geography. It is built on the concept of near things being similar and the inverse relationship between objects far from each other.

Bar charts were used to present data on the cause. More emphasis on this analysis will be laid on the top 10 causes.

To standardize U5 mortality by districts, rates were determined by dividing the total population of under five in the district by the total under-five deaths and multiplied by 10,000 populations. This was to make room for comparing all districts even though their populations were different.

\[
\text{Formulae} = \frac{\text{Total U5 deaths}}{\text{Total population of children U5 in the district}} \times 10,000
\]

3.13 Data Storage/ security of usage

Reporting forms were kept only by the principal investigator in his bedroom in a locked cabinet. Soft copies were stored on password protected folder on the principal investigators computer. Data collected was only used for this research only and not for any other purpose. This data collected will be strictly stored under lock and key for five years after the end of the study. These templates will only be assessable to only the principal investigator. All records will be destroyed afterwards in an environmentally friendly manner in the presence of a witness and photographic evidence.

3.14 Privacy and confidentiality

Information on traceable identity of cases was not collected to ensure confidentiality. Data was collected in aggregated basis not even names was captured as data for this study. This was to
ensure that confidentiality is guaranteed because study participants cannot be traced using data collected for this study.

3.15 Ethical Consideration/Issues

Ethical clearance was sought from the Ethical Review Board of the Ghana Health Services. Permission was further sought from the Regional Health Directorate of the Brong Ahafo Region before requesting for access to the data.

3.16 Pretest

A test run of the data will be done to ensure that, the software and the data are of quality to yield the expected results.
CHAPTER FOUR

RESULTS

Child mortality has been a global menace for decades. This is particularly eminent in developing countries such as Ghana. Though the high levels of child mortality in developing countries is due to multiple intervening factors, specific factors such as poor health care and high birth rates usually characterize causes of child mortality in developing countries. This study therefore seeks to analyse the trend of under-five mortality from 2014 to 2017 for the Brong Ahafo Region.
4.1 Socio-demographic characteristics

A total of 2139 U5 deaths were retrieved and analysed.

**Figure 4: Distribution of Under-five deaths by sex in percentage**

Figure 4 shows the proportion of U5 mortalities in the region. The proportion of cases by sex was somehow even with females who were 1087 contributing to 51%. this shows a slightly higher proportion of females dying than the males.

**Figure 5: Distribution of U5M by age groups**

Most deaths occurred among children who within the age group of 12-59 years representing 45%. Neonatal deaths alone accounted for 23% out of 2132 U5 deaths from 2013 to 2017 in the Brong Ahafo Region.
Figure 6: U5MR by settlement type

Majority of the under-five mortalities occurred in the urban districts with only a few occurring in the rural districts. In 2013 alone 1.6 per 10000 was reported with zero at the rural district. There was vast difference in 2014 with urban reporting 17.5 per 10,000 and the same for 2015. A sharp decline was observed from 2016 and 2017 with 12.5 and 5.8 respectively. U5MR was steady for the rural districts with virtually no change in trend.
Figure 7: Facility distribution in the Region

Sunyani Municipal had as much as 70 facilities and Banda has as few as 10 health facilities.

Most of the health facilities in the region are found in the Municipal with a few at the districts.

The urban districts had an average of 40 health facilities whereas the rural had an average of 20 health facilities.
4.2 Trend of Under-five mortality

Figure 8: trend of U5MR by year and districts

The figure above displays trends of U5MR from 2014 to 2017. It depicts that, the highest ever peak in the period was recorded by Wenchi Municipal in the year 2015. It was also observed that, the year with the least cases was 2014 followed by 2017.

There are three different peaks displayed in the trend which was recorded by Kintampo North, Techiman Municipal and wenchi Municipal as well.
Figure 9: trend of U5MR per 10,000 populations from 2013 to 2017

The figure above depicts the five-year trend of under-five mortalities in the Brong Ahafo Region. The U5MR reduced to as low as 1.10 per 10,000 populations of children under-five years. There was sharp increase of the U5MR from 1.1 to 12.9 per 10,000 pop of children under five years. A marginal decrease in cases was observed in 2015. In the years 2016 there was a further reduction in U5MR from 9.2 to 4.3 in 2017.
Figure 10: U5MR in 2013

In the year 2013, Kintampo South District recorded U5MR of 12.0 per 10000 as the district with the highest occurrence followed by Jaman North district. 16 out of the 27 districts in the region did not record any case in that year.

Figure 11: U5MR in 2014
In the year 2014, Techiman Municipal recorded as high as 74.7 deaths per 10,000 populations and was followed by Sunyani Municipal with 26.2 per 10000 pop. Eight district which were Asutifi North, Banda, Dormaa East, Dormaa West, Nkoranza North, Sene West, Sunyani West and Techiman North recorded zero U5MR.

Figure 12: U5MR in 2015

In the year 2015, Wenchi Municipal recorded 84.6 per 10,000 which was followed by Techiman and Nkoranza South Municipals each reporting 28.1 per 10,000. Followed by Sunyani Municipal and Nkoranza South with 28.6 and 18.1 respectively.

Asutifi North, Banda, Dormaa East, Dormaa West, Nkoranza North, Sene West, Sunyani West and Techiman North reported zero cases each.
Kintampo North Municipal recorded the highest rate of 47.1 followed by Techiman Municipal with 28.4, Sunyani Municipal 2012, Nkoranza South 18.3 and Pru 16.7 per 10,000 populations. District that reported no cases were Asutifi South, Asutifi North, Banda, Brekum, Nkoranza North, Dormaa West, Sene West, Sunyani West and Techiman North districts.

Figure 13: U5MR for 2016
Figure 14: UMR for 2017

In the year 2017, ten districts reported zero U5MR. however, Tain recorded the highest with Sunyani Municipal, Kintampo North, Asutifi South and Techiman Municipals following respectively.
The figure above depicts that, Techiman Municipal recorded the highest U5MR in the five-year period under review with a total of 117.7 per 10,000 populations. Other top five districts and municipals higher cases were Wenchi, Pru, Sunyani Municipal and Kintampo North respectively.

On the other hand, Asutifi North, Banda, Dormaa West, Nkoranza North, Sene West, Sunyani West and Techiman North districts recorded zero cases throughout the entire period under review.

Figure 15: U5MR from 2013 to 2017
4.3 Geographical distribution of U5MR

The figure below shows U5MR per 10,000 in the Brong Ahafo Region. It can be observed that, U5MR was higher in areas such as Kintampo North, Pru, Nkoranza, Nkronza South, Wenchi and Asunafo North. This is indicated in the map by the red and big circles ranging from 40-140 per 10000.

Figure 17: Clustering of U5MR Per 10,000 from 2014 to 2017

The figure below shows U5MR per 10,000 in the Brong Ahafo Region. It can be observed that, U5MR was higher in areas such as Kintampo North, Pru, Nkoranza, Nkronza South, Wenchi and Asunafo North. This is indicated in the map by the red and big circles ranging from 40-140 per 10000.
Figure 18: Geographical distribution of U5MR 2014 to 2017

In the figure above, the total child mortality recorded from 2014 to 2017 is depicted using bars which represent the mortality rates recorded for the respective year. For example, the deep red bar in each district represents the total U5MR recorded for each district in 2017, the light red bars indicate rates recorded for each district in 2016, Yellow also represents the total U5MR recorded for each district in the region in 2015, the blue bars represent mortality rates in 2014, whereas the light blue bars indicate mortality rates in 2014 in that other.

The figure above also indicates the mortality rates of different districts within the Brong Ahafo region of Ghana from 2014 to 2017. From the figure, child mortality can be observed not to be proportional within the Brong Ahafo region. The bar chart in the map represents the level or rate of child mortality in various years.
As at 2013, PRU can be observed to be the district with the highest rate of child mortality which is indicated by the blue bar. The under 5 mortality rates in PRU increased in the years 2014 and 2015 but however decreased from 2016 and 2017. In 2014, the rates of mortality in Techiman Municipal sprang up to be the district with the highest mortality in Brong Ahafo Region which is indicated by the light blue pixel, mortalities in Techiman Municipal decreased in 2015 and remain so in 2016 but further decreased in 2017. By 2015 Wenchi had the highest rates of mortality which is indicated by the yellow bar. As at 2016, Kintampo North was now the leading district in U5MR which is indicated by the light red bar. From the map, mortality in Kintampo North had increased from 2014 to 2016 but decreased in 2017.
Figure 19: Interpolation of U5MR per 10,000 by distance in kilometres.

The figure above is an Inverse Distance Weighted (IDW). From the interpolation map, the red areas show areas of high deaths in the Brong Ahafo region of Ghana, the yellow areas show areas of medium deaths in the region while the blue showcase the areas of relatively low deaths in the region.
4.4 Cause of death for 2017

The figure above reveals that, intrauterine hypoxia and birth asphyxia, malaria, perinatal conditions, prematurity, pneumonia, septicemia, Anemia, Protein Energy malnutrition and Unspecified disease of the respiratory system were responsible for 68.6% of all U-5 mortalities. Intrauterine hypoxia and birth asphyxia were also responsible for 18.3% of U-5 mortalities. Sunyani and Techiman Municipalities alone recorded 52% of the intrauterine hypoxia and birth asphyxia cases.

Figure 20; Top ten causes of U5 mortality for 2017
CHAPTER FIVE

DISCUSSION

The importance of studying facility based under-five mortalities in the Brong Ahafo Region of Ghana is due to the fact that, it is an indicator that determines the health and economic status of a country. It also has a serious consequence since future workforce of the country is lost in their early ages. However, a lot of data is captured but not put to its optimum use in planning for the improvement of the health condition of the population.

Key finding of the study were, there was reduction in U5MR from 2014 to 2017. Higher (90%) of U5MR was reported in Urban Districts (90%). 10 out of 36 conditions were responsible for 68% of all U5 mortalities. Intrauterine hypoxia and birth asphyxia was responsible for 18% of all U5MR in 2017.

45% of the cases were within the age of 12 to 59 month which was contrary to the finding by Ghana Statistical Services (GSS, 2014) which recorded 68% of all under – five deaths within the neonatal stage. Majority of the cases were females who contributed 51% of all under-five deaths in the region for the period under review.

With respect to the distribution of U5MR by type of settlement, district was classified based on the criteria of the Local Government that defines urban districts as those with population size of 95,000 and beyond and with those below this population as rural (Ahwoi, K. ,2010). It was observed that, highest U5MR was recorded in the urban district. with the earlier assertion that access to health care reduces mortalities the situation of the Brong Ahafo Region was different. in that out of 897 health facilities in the Region, 54% of them were located at the urban facilities. This may be due the fact that Rural districts refers sick children who are likely
to die to those facilities. out of 13 rural district, 9 out of them have no hospitals but only depend on health post for care. Therefore, rural districts recording zero or low U5MR may be attributable to referrals to the urban districts for care.

Areas with high populations which represents urban districts compared to the areas with low under 5 mortality rates were compared. About 90% of U5 deaths occurred in the urban area which was contrary to what exist in literature. However, 52% of health facilities were in these urban districts. All urban districts had at least a hospital, with the rural district (13) comprising of only 4 district hospitals. This is indicative of the fact that most facilities in the rural districts referred all serious cases to the urban district.

U5MR in low populated areas such as Banda, Techiman North, Sene East, Jaman North among others were generally low. This is indicated on the map by the small circles. Such areas have under U5MR been as low as 0-20 per every 10,000 as opposed to 40-140 in the areas with relatively higher populations. Also district such as Tain, Tano North, Dormaa Municipal and Atebubu Amantin had medium U5MRs. The under 5 mortality rates in such districts ranged from 20-40 as indicated in the figure below.

It is obvious that U5MR in the Brong Ahafo Region is spatially dynamic, the under 5 mortalities varies from district to district. This variation may be attributed to factors such population, distribution of health facilities and education levels, socio-economic factors, community factors, referral systems, uneven distribution of health staff and logistics and other health system factors.

Though there was drastic reduction in under-five mortality in all regions, results from this study was consistent with literature except for the year 2013 which recorded fewer cases than 2014.
U5 mortality decline has improved from 1.2% per year between 1990 and 1995, to 3.9% per year between 2005 and 2012 (UNICEF and WHO, 2013). In spite of this substantial drop in global U5MR, about 6.6 million children still die every year before their fifth birthday worldwide which implies 18,000 under-five children die each day (UNICEF and WHO, 2013). Child mortality has been a global menace for decades. This is particularly eminent in developing countries such as Ghana.

In 2013, 57 cases were reported which was much lower compared to subsequent years reviewed. This according to data managers was because it was in that year that the DHIMS 2 platform underwent a massive upgrade to capture most events and therefore could be the possibility of under reporting. The decrease U5MR from 2016 and 2017 may be attributed to better health services provision and health education for care giver.

The reduction in cases from 2015 to 2017 supports finding from a study in Northern Ghana which attributed the success to the effectiveness of child survival interventions such as immunizations, vitamin A supplementation among other (Bay et al., 2014).

686 cases of under-five mortality were reported in 2014 which was the highest in the period under review. In 2015, a slight reduction in cases was observed with a further drop in total cases in 2016 and 2017. This results buttresses the claim according to GDHS 2014 that, there has been a decreasing trend of U5 mortalities for the past 15 years from 1988 to 2014.

The term clustering refers to the aggregation of cases within a specific geographical location. There were varying trends of under-five mortality by district which confirms the spatial differences in geographical difference in the causes of mortality risk which indicated variation between districts. (Sartorius, Kahn, Vounatsou, Collinson, & Tollman, 2010).
High incidence was observed among six (6) districts that recorded more than 150 deaths from the year 2013 to 2017 which represented 63.1% of all facility based under-five mortality in the Brong Ahafo Region. These districts are Techiman Municipal, Pru district, Wenchi Municipal, Kintampo North Municipal and Sunyani Municipal. Finding are consistent with Geographic Information System (GIS) and Demographic and Health Surveys Data that asserts that U5MR is high in areas with high population density.

Whilst in terms of rates 7 districts namely Kintampo North, Wenchi, Techiman Municipal, Nkoranza South, Pru, Sunyani Municipal and Asutifi North District within the entire period recorded U5MR between 40 and 140 per 10,000.

Eight (8) districts Nkoranza North District, Attebubu Amanteng District, Brekum Municipal, Tain District, Dormaa Municipal, Asutifi South District, Asunafo North District and Sene West Districts also reported between 50 and 150 cases of facility based under-five mortalities.

Whilst 7 districts namely Kintampo North, Wenchi, Techiman Municipal, Nkoranza South, Pru, Sunyani Municipal and Asutifi North District within the entire period recorded U5MR of Between 1 to 50 cases 11 districts were within this range. Districts that were within this acceptable range were Tano North, Kintampo South, Tano South, Jaman North, Jaman South, Dormaa East, Asunafo North.

Seven (7) districts recorded zero for the entire 5 years’ period reviewed. It is desirable for all districts to have fallen within this category. However, 6 of these districts in question do not have hospitals and may have referred all cases which were likely to die to other districts with referral facilities. They are Asutifi North, Dormaa West, Banda, Nkoranza North, Sene West, Sunyani West and Techiman North districts. These districts are having a much spread out population since they within the rural districts.
Findings of this study is consistent with earlier studies in West Africa which depicted that U5MR was higher in locations with very high population with more than 1000 persons per square kilometre but were very low in extremely dispersed populations with fewer than 25 person per square kilometre (Alam et al., 2010).

Significant clusters of under-five mortality were observed from 2013 to 2017 in Techiman Municipal, Pru, Wenchi, Sunyani Municipal and Kintampo North. These district are the densely populated areas in the Region.

It was observed that, districts with clusters mostly share boundaries whereas those without also shared boundaries and some did not. This phenomenon confirms the assertion that, communities may not be very cohesive communities, but due to their shared experiences as a result of closeness due geographical location and exposure to the similar social factors (Alam et al., 2010).

Case specific cause of death were 36 different condition for all the 229 facility based U5 deaths that were recorded in 2017. For the purpose of this study the top ten was prioritized. Intrauterine hypoxia and birth asphyxia, malaria, perinatal conditions, prematurity, pneumonia, Septicemia, Anemia, Protein Energy malnutrition and unspecified disease of the respiratory system were responsible for most U-5 mortalities.

The top causes of U5 mortality was intrauterine hypoxia and birth asphyxia which accounted for 18% with malaria 10% of the total cause of death. This is consistent with findings in Nigeria which prove that, the major causes of child death in the study area include birth complications, malaria, diarrhoea, measles, HIV/AIDS (Abu et al., 2015).
Also a study conducted in the Builsa District Hospital enumerated malaria, diarrhoea, acute respiratory infections (ARI), pneumonia, and anaemia as the major cause of mortality among children (Bay et al., 2014). Sunyani and Techiman Municipalities alone recorded 52% of intrauterine hypoxia and birth asphyxia. Therefore, if efforts and policies are put in place to address this intrauterine hypoxia and birth asphyxia alone in these two districts much improvement in U5MR will be observed in the Region.

**Strengths of the study**

- The quality of data that was analysed was high because of verification done by district officers and constraints put on entry by the DHIMS software.

- Most of the findings were consistent with similar studies done in Ghana and other parts of the world.

**Some of the Limitations of this study include**

- There was no credible data available at the birth and death registry to verify data that was available on DHIMS 2.

- Due to a maintenance work by the developers of the DHIMS 2 platform, records on admissions was not available for analysis and therefore the researcher could not study risk factors.

- Absence of data on deaths that occurred outside health facilities in the Region.

- Data that was available on DHIMS 2 did not capture age of mother, residence, cost of treatment, time spent in health facility, cost of treatment and insurance status.
During the period of data collection, data changed at various times when researcher went to upload and this prevented the analysis of several variables.

Data on cause of death was not available from 2013 to 2016.
CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

Most findings in the study were consistent with what has been reported in literature. However, a few of the results were contrary to what has been commonly reported in previous studies.

Results of the study revealed with cases of facility based under five mortalities was low initially but increased drastically which was not consistent with what was reported in literature. However, a continuous reduction was observed from 2015 to 2017. Five districts were responsible for 63.1% of all U5 mortalities from 2013 to 2017.

The child mortality rates in the region is observed to be spatially dynamic. Several contributed to the high U5 and not the absolute contribution of a single district. Only few districts experienced an increase in U5 mortality in the Brong Ahafo Region even though some still had high mortality rates but there had been a general decrease in U5MR.

Five conditions; intrauterine hypoxia and birth asphyxia, malaria, perinatal conditions, prematurity, pneumonia were responsible for 51.2% of cases.

6.2 Recommendations

6.2.1: Implications for Public Health and Clinical practice;

- There is the need for the Ministry of Health and Ghana Health Services to prioritize interventions amidst limited resources during planning and implementation (training, projects) to focus on the five major causes of under-five mortalities.

- During resource distribution in the Ministry of Health and Regional Health Directorate, five districts (Pru, Techiman North, Sunyani Municipal, Kintampo North and Wenchi)
should be considered and be provided with enough to cater the gab required to reduce U5 mortality.

- Public education must be intensified on the prevention of under-five mortality. This education should be based on the major risk that exist in the respective districts
- Proper Monitoring and evaluation of outcomes must be done in reference to available data.

### 6.2.2 Implications for policy

- The Ministry of health through its agencies such as CHAG and the Ghana Health Services must organize frequent in-service training to all health workers, especially midwives and Medical officers on the appropriate management of disease among children
- The Government of Ghana through the Ministry of health must put in strategies to ensure that all mortalities that occur in health facilities are thoroughly investigated and all contributing factors are documented
- There is the need to restructure the Birth and Death Registry to be able to register all mortalities that occurs outside the health facility by the Local Government Ministry

### 6.2.3 Implications for research

- Further research should be done to assess reasons that accounted for 7 districts who recorded zero deaths in the entire period under review by Ministry of Health/ Ghana Health Services.
- Ministry of Health/ Ghana Health Services should conduct an enquiry is required to assess factors that contributed to the drastic reduction of cases in 2016 and 2017.
More studies need to be conducted to establish factors associated with under-five mortalities by the Ministry of Health/ Ghana Health Services.
REFERENCES


APPENDICES

Appendix I

Data extracting tool on cause of death for U5 mortality

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<th>Cause of Death</th>
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### Appendix II

**Data extracting tool for collecting data on Facilities in the Region**

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Appendix III

Template used to collect district coordinates

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Appendix IV

Template used to collect data on deaths and age of U5 who died

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<th>2017 Deaths - (aggregate d) 1-4</th>
<th>2017 Deaths - (aggregate d) &lt;28days</th>
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Appendix V


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| TOTAL                     |                  | 2,660,648   |

Source: Population and Housing Census 2010 (GSS).
Appendix VI

Table 2: Health Facilities by Type and Ownership, BAR. 2015.

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Source: DHIMS, 2016