**REGIONAL INSTITUTE FOR POPULATION STUDIES (RIPS)**

**COLLEGE OF HUMANITIES**

**UNIVERSITY OF GHANA**

# DETERMINANTS OF UNDER-FIVE MORTALITY IN UPPER EAST REGION OF GHANA: EVIDENCE FROM GHANA ESSENTIAL HEALTH INTERVENTION PROGRAM

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**A DISSERTATION SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES IN PARTIAL FULFILMENT OF THE AWARD OF MASTER OF ARTS DEGREE IN POPULATION STUDIES**

**DECEMBER 2021**

# DECLARATION

I, AGULA MICHAEL, certify that this work is my research. All other materials and works used have been duly referenced. However, this work was done under the supervision of Dr. Adriana Biney and Dr. Patrick Asuming.

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# ABSTRACT

Generally, the world has experienced a reduction in deaths below the age five in the past three decades. However, under-five mortality in low-income countries, including Ghana, is still very high. In Ghana, several programs, interventions and policies have been implemented which have led to a reduction in under-five mortality rates in the country. However, the rate of reduction will not meet Sustainable Development Goal 3.2, come 2030. The goal of this study is to examine the consistent drivers of children dying before age five over a period in the Upper East region of Ghana, using longitudinal data from the Ghana Essential Health Intervention Program (GEHIP).

This longitudinal study compared baseline and end-line datasets collected in 2011 and 2015, respectively. Only data of children below five years were analysed for both the baseline and end-line surveys. Analytic data came from 3,422 and 2215 children below age five in the baseline and end-line surveys, respectively, all from mothers aged 15-49 years. Univariate, bivariate and multivariate analyses were conducted at different levels. At the univariate stage, descriptive statistics were generated to analyse the background characteristics of the sample. At the bivariate level, cross-tabulations were carried to determine the correlation between the independent variables and dying below the age five. Lastly, a multiple binary logistic regression model was fitted to determine the factors that consistently affect under-five child survival over time.

Overall, results from the multivariate regression analysis suggest that breastfeeding and the number of vaccinations received by children were stable and significant determinants of under-five mortality over a period in the Upper East region, regardless of health system interventions. Baseline results show that breastfeeding, the number of vaccinations received at a particular stage of life of the child and the educational level of the mother were significantly associated with under-five mortality. For the end-line, the sex of the child, breastfeeding, sleeping under a treated bed net and the number of vaccinations received at a particular stage of life were significant determinants of under-five mortality. Findings suggest that parents of children should be educated on the benefits of adequate breastfeeding and urged to practice exclusive breastfeeding for improved health outcomes, including reducing under-five mortality. Also, postpartum care models

by Ghana Health Service should pay particular attention to improving child immunization against childhood killer diseases.

## DEDICATION

This work is dedicated to God almighty for seeing me through this program successfully. Without Him, this work would not have been a reality.

# ACKNOWLEDGMENTS

This work would have been a mirage without my dynamic, hardworking and above all, tolerant supervisors Dr. Adriana Biney and Dr. Patrick Asuming who sacrificed their limited time and gave me all the needed support, and precious time to guide and make sure this work becomes a reality. I have nothing to say, but all that I can say is may the good Lord richly bless you.

My sincere thanks go to Prof. Ayaga Bawah for his financial support during the period of my study; may you be blessed immensely dear brother.

I would be very ungrateful without mentioning these key people who have played key roles in assisting me during the journey of this thesis: Caesar Agula, Charles Asabere, and my course mates who have been of great assistance and encouragement during this journey. May you be blessed greatly by almighty God.

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| | |
|---|---|
| CHPS | COMMUNITY-BASED HEALTH PLANNING AND SERVICES |
| GEHIP | GHANA ESSENTIAL HEALTH INTERVENTION PROGRAM |
| GDHS | GHANA DEMOGRAPHIC AND HEALTH SURVEY |
| GHS | GHANA HEALTH SERVICE |
| NHIS | NATIONAL HEALTH INSURANCE SCHEME |
| NMCP | NATIONAL MALARIA CONTROL PROGRAME |
| UNICEF | UNITED NATIONS CHILDREN'S FUND |
| WHO | WORLD HEALTH ORGANIZATION |

# CHAPTER ONE

# INTRODUCTION

## 1.0 Background of the Study

Several scholars have studied under-five mortality in different ways. According to the World Health Organization (WHO), under-five mortality is the number of children dying before the age of five per 1000 live births (Nyaaba et al., 2020). The under-five mortality rate refers to the probability of children dying before the age of five, following the current age-specific mortality rates, expressed as the number of deaths per 1000 live births (Otupiri et al., 2010; UNICEF,2019).

Over the past three decades, considerable progress has been made towards the reduction of the rate of children dying before age five in the world (Kanmiki et al., 2014; Choa et al., 2018; Nyaaba et al., 2020; UN Inter-agency Group for Child Mortality, 2020). The United Nations Children's Fund (UNICEF) reports that the rate of children dying before the age five has reduced by 60% between the 1990 and 2019 period. Specifically, global under-five mortality rates declined from 93 deaths per 1000 live births in 1990 to 76 deaths per 1000 live births in 2000, then to 38 deaths per 1000 live births in 2019 (Bay et al., 2012; UN Inter-agency Group for Child Mortality, 2020; UNICEF, 2020). Although progress has been made, the phenomenon has remained a global concern in many parts of the world especially in developing regions such as sub-Saharan Africa (SSA) where the under-five mortality rates are persistently higher as relative to other parts of the globe (Bay et al., 2012; Blunch, 2013; Nyaaba et al., 2020; Twumwaa et al., 2020 ). Most of

these preventable deaths occurred in the most impoverished regions and countries of the globe (Iram & Butt., 2008; Twumwaa et al., 2020).

Sub-Saharan Africa (SSA) has the highest rate of children dying before age five in every 1000 live births in the world (WHO, 2020; Yaya et al., 2020). Findings from the WHO suggest that in every thirteen births in SSA, one child dies before their fifth birthday, even though all countries are required to reduce under-five mortality by the year 2030 as a benchmark by the Sustainable Development Goal (SDG) 3.2. For instance, under-five mortality in Sub-Saharan Africa was 79 deaths per 1000 live births as relative to the global rate of 41 deaths per 1000 live births in 2015.

In Ghana, like the sub-Saharan African region, under-five mortality is relatively high. Although Ghana observed a downward trend with regards to children dying before age five in the past few decades, the rates are disproportionately high in many parts of the country (Kanmiki et al., 2014). In every 1000 live births 52 die before the age five (GSS, GHS, ICF, 2018). On the flip side, and except for the Ashanti Region, the rest of the regions in the southern part of Ghana had a lower rate of children dying below age five. Having a number of offspring dying before age five lower than 70 deaths in every 1000 live births (GSS GHS ICF, 2018). However, under-five mortality rates are relatively higher in the northern part of Ghana as relative to the southern zone of the country (Kanmiki et al., 2014). For instance, the 2014 Ghana Demographic and Health Survey report shows that there were 111, 92, 72 deaths in every 1000 live births for the Northern, Upper West, and the Upper East region respectively.

According to Chen, (1984), several reasons may account for a child dying before his or her fifth birthday. Some of these reasons could be connected to environmental, socio-economic, and demographic attributes of the woman and child. Factors such as place of birth, sex of a child, number of children ever born, educational level of the mother, health-seeking behavior of mother before and after birth, and the household wealth are some of the determinants associated with children dying before age five in SSA (Van Malderen et al., 2019;Tagoe et al., 2020.)

Similarly, in northern Ghana, the factors include the presence of co-wives, age of mother, maternal education household size, and marital status wealth, and gender of the child, (Aheto, 2019). Considering the disparities in the rates of children dying below the age five in the various parts of Ghana, identifying the drivers that are associated with children dying before they turn five in high mortality zones in the country over time is key. Therefore, this study sought to examine the stable drivers of children dying before age five over a period in the Upper East region of Ghana.

### 1.1 Statement of the Problem

Reducing under-five mortality is a key target (3.2) of the Sustainable Development Goals, to bring down under-five and neonatal deaths to at least 25 and 12 deaths in every 1000 live birth, respectively, by the year 2030 (WHO, 2015; Dwomoh et al., 2019). Whereas remarkable successes have been achieved by most developed countries towards meeting this goal, the rate of children dying before age five in most developing countries such as Ghana is relatively high (Nyaaba et al., 2020). As already indicated, out of 1000 live

births, an average of 52 children die before their fifth birthday in Ghana. Despite the decline, 52 deaths per 1000 live births fall short of the Sustainable Goal 3 target 2. Particularly, the Upper East region experiences a disproportionally high rate of under-five deaths in the country (Awoonor-Williams et al., 2013; Babayara & Addo, 2018).

Though the region has achieved some success in reducing under-five mortality, the improvement is largely due to government's commitment towards enhancing access to quality health care and other implemented health programs through international donor funding (Nyaaba et al., 2020). One notable health program implemented in the region is the Community-based Health Planning and Services (CHPS) program launched in 2000, which sought to provide quality and equitable health care at the doorsteps of those with challenges accessing care (Awoonor-Williams et al., 2013) Another program is the Ghana Essential Health Intervention Program (GEHIP), established in the year 2009 to address the challenges of Ghana's CHPS scale-up (Kanmiki et al., 2014) In addition, the National Health Insurance Scheme (NHIS) was established in 2003 to provide equitable access to health care in Ghana.

Despite these effective interventions over the past 20 years, there has not been any significant reduction in under-five mortality in the region to accelerate the rate of reduction to meet the SDG 3 target 2 (Nyaaba et al., 2020). The persistent high under-five mortality in the region warrants the investigation and the understanding of the factors associated with under-five mortality in the region to achieve the set development goals, and formulation of appropriate interventions to help achieve the SDG 3 target 2 and to interrogate the effect of the GEHIP intervention in the region.

In Ghana, little has been done on assessing the factors affecting under-five mortality over a period. For instance, Babayara and Addo (2018), Kanmiki et al. (2014), and Osei-Kwakye (2010) have examined the socio-economic and demographic factors associated with under-five mortality, especially in the Upper East region, using data from selected districts in the region. Babayara and Addo (2018) also analysed the risk factors of under-five mortality in the Kassena-Nankana Municipal in the Upper East region**.** All these studies were cross-sectional and did not investigate factors that affected under-five deaths over a period.

To meet the SDG 3 target 2, there is the need for appreciation of the determinants of under-five deaths (Nyaaba et al., 2020). A longitudinal analysis of the factors that affect under-five mortality over time provides insights into understanding critical areas that require programmatic strategies for reducing mortality among under-five children in their early ages of life. Thus, there is little information and few studies on the factors of under-five mortality over time, there is, therefore, the need for such a study in the Upper East region to help in policy formulation to curtail the high under-five mortality rates in the region.

### 1.2 Research Questions

The aim of the study is to obtain answers to these research questions.

**1**. What are the determinants of under-five mortality in the Upper East region?

**2.** Which of these factors are associated with under-five mortality over a period (2011 to 2016) in the region?

### 1.3 Objective of the Study

This study aimed at examining the determinants that are associated with under-five mortality. Specifically, the study seeks to:

1. Identify the drivers associated with children dying before age five in the Upper East region.
2. Examine the factors that affect under-five deaths over a five-year period.

### 1.4 Rationale of the Study

There is a need for this study because it adds more knowledge to the determinants of under-five mortality discourse (Godson, 2012). There is limited knowledge on the current drivers associated with children dying before the age five in the region under study. Also, the factors that affect under-five mortality vary from region to region (Godson, 2012). It is therefore prudent to predict the determinants related to children dying before the age of five in key regions of Ghana with high under-five mortality, to help formulate the needed policy recommendations to address under-five mortality in the country.

In addition, the level of under-five mortality rates in a country is not only used as a measure to determine the level of development and effectiveness of policies and interventions in the country towards meeting international development goals but serves as an indicator of the standards of living and socio-economic development of a country (Chowdhury et al., 2010; Godson, 2012). The high under-five mortality in the region has

positioned the area in a more challenging condition not to compromise the effects of interventions carried out in this area.

As stated earlier several interventions have been carried out in the Upper East region, such as GEHIP, the national health insurance scheme, and CHPS. This renders this study necessary to be conducted in this area to test if there is a change in the determinants associated with under-five mortality before and after the interventions in the area.

Finally, previous studies have only looked at various determinants of child mortality in Ghana, with little done on drivers associated with children dying before age five, and the impact of interventions on health systems to affect under-five mortality in Ghana, and the Upper East region is no exception (Kanmiki et al., 2014). This study gives the opportunity not only to delve into the factors that affect under-five mortality but help to investigate the determinants of under-five mortality for a period of time in the region after interventions have been carried out.

### 1.5 Organization of the Study

This thesis is presented in seven chapters. Chapter one, representing the introduction, includes the study's background, statement of the problem, and the rationale of the study along with the research questions and study objectives. Chapter two includes a review of related literature, the theoretical and conceptual frameworks, and hypotheses of the study. Chapter three highlights the study setting, data source, methods used, measurement of variables, and statistical techniques and models used for the analysis in the study. Chapter four presents the descriptive information on respondents' characteristics which was

displayed through charts and tables. Chapter five provides the bivariate associations between the independent determinants and under-five mortality. Chapter six presents the multivariate analysis used to determine the extent to which the selected factors influence child mortality in the Upper East region over time. The last chapter summarises the research findings, concludes the study, and provides recommendations from the study findings.

# CHAPTER TWO

# LITERATURE REVIEW

## 2.0 Introduction

Children dying before age five is considered one of the proxy indicators of the level of development of a country (Nyaaba et al., 2020). This is because the under-five mortality rates in a country do not only reveal the type of environmental, health, social, and economic conditions in which a child is born into but depicts the level of improvement of the health system and development, and how effective health interventions are proven to be in a country (Kanmiki et al., 2014). Globally, there have been several studies to investigate the bottlenecks that affect children dying before age five, especially in developing countries (Darkwah et al., 2014). These studies discuss demographic, socio-economic, biological, and environmental risk factors that affect under-five mortality, normally using data from surveys and the population census.

This chapter is a review of the literature on the determinants of under-five mortality. This is done by providing the background of under-five mortality, globally, regionally, and nationally. A conceptual framework from Mosley and Chen's analytical framework was adapted to link the different factors influencing under-five mortality in the developing world. For this study, these factors are however further divided into maternal, household, and child factors. Finally, this chapter deliberated the theoretical framework underpinning this dissertation and the hypothesis for the thesis obtained from other works of literature.

### 2.1. Children dying before age five

The goal of every nation is to reduce the level of under-five mortality. This is because the level of under-five mortality is not only seen as a key indicator of health but determines the level of development in a country (Nyaaba et al., 2020). The population is an essential priority for every society. This is because high under-five mortality would not only reduce the level of the population but the labor force in the country. Since the population and labor force are only replaced through the survival of children. However, many countries including Ghana are challenged with high levels of under-five mortality especially in rural parts of Ghana (UN Inter-agency Group for Child Mortality, 2020). This is unacceptable, and thus the need to investigate the factors affecting under-five deaths in less developed areas of Ghana.

### 2.2 Children dying before age five in Sub-Saharan Africa

Most countries, in Sub-Saharan African have high under-five mortality (Nyaaba et al., 2020). Nevertheless, there have been great disparities in the levels of under-five mortality between these countries, and among urban and rural areas. Due to research studies and interventions by different governmental and non-governmental institutions, there has been a reduction of under-five deaths in the past years in the sub-Saharan African region (Awoonor-Williams et al., 2013). However, the pace of reduction in the under-five mortality would not meet the SDG 3, target 2 before 2030 (Kanmiki et al., 2014). To address this menace, there is the need to explore the drivers that associate with children dying before they turn age five in this region (Kanmiki et al., 2014). Doing this will find

strategies and a lasting solution to this problem. Some studies have observed an association between under-five deaths and demographic factors ( Nyaaba et al., 2020. ).

### 2.3 Children dying before age five in Ghana

In the recent past three decades, Ghana has had a reduction in the rates of children dying below the age five (Kanmiki et al., 2014). This reduction in under-five mortality is a result of interventions and policies carried out nationally, regionally, and at the community level geared specifically to curtail the level of under-five mortality in Ghana by various governments, organizations, and non-governmental organizations over the years (Awoonor-Williams et al., 2013). Some of these interventions and policies include the National Health Insurance Scheme (Free Maternal Health Care) which was put in place in the year 2003 to reduce out of pocket expenditure on health care delivery and access to health care services, the Community-Based Health Planning and Services (CHPS) initiatives established in 2000 with the responsibility to provide equitable access to health care services in Ghana, improvement in health care and sanitation, Ghana's Under-five Health Strategies in the year 2007-2015, National Malaria Control Program (NMCP), and the Ghana Essential Health Intervention Program (GEHIP) in 2011, just to mention a few.

### 2.4 Policies

As a result of high mortality in the rural and deprived areas, the Community-based Health Planning and Services (CHPS) was implemented by the government of Ghana to provide doorstep to doorstep services in the year 2000 (Awoonor-Williams et al., 2013). In this

program, community health officers who were made to undergo a training of two years in health care delivery, were equipped and posted to work in the rural communities through their District Health Directorate, to provide preventive and curative care services such as providing health education, family planning services, treatment of minor sicknesses and ailments, immunizations and vaccinations, and provision of antenatal and postnatal care services to people in these deprived areas of Ghana (Kanmiki et al., 2014). However, CHPS was confronted with challenges, such as a gradual decline in neonatal mortality than post-neonatal mortality most especially in areas outside the region, where the "Navrongo Experiment" was first carried out (Kanmiki et al., 2014). As a result of these challenges, the Ghana Essential Health Interventions Program was launched to improve the CHPS Program. The intervention provided training and promoted facility-based delivery, providing training to mothers of premature neonates as well as providing of emergency referral system to prevent delays in case of emergencies do arise, and providing postnatal health care (Awoonor-Williams et al., 2013). At the end of the intervention, it was realised GEHIP has helped improve the CHPS by training community health nurses on how to refer cases without delay, improving the quality of health care services to newborns, training community health volunteers in integrated management of childhood illness (IMCI), training of community health nurses on how to manage emergencies, most especially obstetric complications, and finally improved the CHPS leadership at all levels of the program (Awoonor-Williams et al., 2013).

Access to health care for all, was confronted with accessibility barriers as a result of a lack of affordability of health services (Lambon-quayefio & Owoo, 2017). To provide a solution to this problem, the National Health Insurance Scheme was introduced in the

year 2003 to increase the accessibility of health care delivery, especially for people in rural and deprived areas of Ghana, to reduce maternal mortality (Lambon-quayefio & Owoo, 2017). This was aimed at replacing the cash and carry system to increase accessibility (Singh et al., 2015). In 2008, national health insurance was made to include free maternal health care services for pregnant women who were members of the scheme. These pregnant women were excluded from the out-of-pocket expenditure of the cost of antenatal care, postnatal care, and all other expenses related to delivery (Singh et al., 2015).

Yet another intervention is the National Malaria Control Program: The fight against malaria morbidity and mortality started in the 1990s, such as the provision of malaria drugs, spraying, and drain construction in Ghana. Despite these efforts, the country remains a malaria-endemic country (Cruz et al., 2006). Due to the high level of malaria in the country, a Roll Back Malaria initiative (RBM) was launched in the year 1999, to strengthen health services, widen treatment and strategies to all in Ghana, to reduce malaria mortality and morbidity (Cruz et al., 2006). In the year 2000, a national malaria plan was launched with the main aim of eradicating malaria morbidity and mortality by 50% by the year 2010. Finally, in the year 2008, another strategic plan was established to help reduce malaria mortality and morbidity by 75% by the year 2020. As part of these interventions, treated bed nets were supplied across the nation, especially to pregnant women and children. These initiatives by the National Malaria Control were aimed at reducing malaria and children dying before age five in Ghana. It was also revealed that malaria was less reported among children in less than one year due to this intervention( Ghana Statistical Service & Ghana Demographic Health Survey, 2008).

Also, the Interventions to Reduce Under-Five Deaths policy (2007-2015) was a revision and improvement to the Health Sector Intervention of 2007 to 2011 and the earlier document in 1999. The policy sought to promote survival and proper development of every child in Ghana, by reducing the rate of under-five mortality to 40 deaths per 1000 live births. The policy also sought to improve and expand population coverage of health delivery including antenatal care, health care delivery, immunization, nutritional needs, providing treatment to childhood illness and diseases, and prevention and eradication of malaria.

Lambon-Quayefio & Owoo, (2017) who investigated the drivers and the role of health insurance on children dying before one month in Ghana reveal that mothers who are active members of health insurance are less likely to experience neonatal mortality relative to mothers who are not active members of health insurance. They also reveal that health insurance is significantly related to a reduction in out-of-pocket expenditure for women with valid health insurance. Besides that, Singh et al. (2015) reveal that mothers with valid health insurance at the time of delivery were more likely to deliver in a health facility. Also, they revealed that women with valid health insurance have the higher significance of visiting health facilities multiple times (Singh et al., 2015).

### 2.5 Maternal and child-related factors

Maternal and child-related factors are critical when studying under-five mortality in any part of the globe. Some of the maternal, household and child factors this study has considered include the mother's educational level, occupation of the mother, marital status of the mother, mother's age, her health insurance membership status, religion of

the respondent, sex of the child, breastfeeding, vaccination, and the use of treated bed nets.

### 2.5.1 Maternal education

The level of maternal education has been considered one of the most significant correlates with under-five mortality when investigating under-five mortality, especially in developing countries. Associations have been found between maternal education level and under-five deaths by several studies conducted in Ghana and other parts of the globe. For instance, Balaj et al. ( 2021) conducted a study globally using global systematic review and meta-analysis of existing data from 92 countries in the world found that women with some level of education had a lower risk of under-five mortality than mothers without education (Wegbom et al., 2019). Similarly, a study conducted on the effect of birth interval and wealth on under-5 mortality in Nigeria by Biradar et al. (2019) found a significant relationship between a mother's education and under-five deaths. They found that mothers without education had a higher chance of experiencing under-five deaths as relative to mothers with education. In addition, Wegbom et al. (2019) conducted a study to investigate the determinants of under-five mortality in Nigeria, and found a significant relationship between maternal education and under-five mortality. They found that children of educated mothers have lower odds of dying before age five as relative to children of uneducated mothers who were not educated. In their study, they observed that the higher the level of education of the mother the less the chance of experiencing under-five mortality. Also, Nattey et al. (2013) conducted a study in Tanzania and found that children of mothers without education are more likely to die before the age of five as

relative to mothers with secondary education. In addition to the above articles, several studies conducted in Ghana and other parts of the world have observed an association between maternal level of education and under-five deaths (Kanmiki et al., 2014; Yaya et al., 2019; Van Malderen et al., 2019; Afagbedzi, 2020; Nyaaba et al., 2020) Contrary to these studies, Otupiri et al. (2010) discovered no statistically significant association between mother's level of education and under-five deaths in the Builsa district, Ghana.

### 2.5.2 Marital status of mother

The marital status of the mother has been considered one of the most significant correlates with the level of under-five mortality, when investigating under-five mortality, especially in developing countries. Several authors have observed a significant correlation between a mother's marital status and under-five mortality. For instance, Kanmiki et al. (2014) investigated the determinants related to under-five mortality in rural Northern Ghana and found that mothers who are married were less likely to experience under-five mortality as relative to single mothers, widows, and divorcees. Also, Wegbom et al.'s (2019) study in Nigeria found a significant relationship between marital status and under-five mortality. They found that mothers who are married were less likely to experience under-five mortality as relative to single mothers. In addition to that they also found out that mothers in polygamous marriages have higher odds of experiencing under-five deaths as relative to mothers in monogamous marriages. Similarly Kaberuka et al. (2017) conducted their study in Uganda, and found a significant association with marital status and childhood mortality. Pedersen (2000) also conducted a study in the West Bank and Gaza Strip and found a significant relationship between marital status and under-five

mortality. In addition, Shifa et al. (2018) conducted a study to determine the socio-economic and environmental factors associated with under-five mortality in Southern Ethiopia and found a significant relationship between the marital status of mothers and children dying before age five. They observed that under-five mortality was high among mothers who are single, separated, divorced as relative to mothers who were married.

### 2.5.3 Age of mother

The age of the mother is a key factor in determining under-five mortality by several studies. For instance, it was observed that mothers of age 20 and less have higher chances of experiencing under-five deaths as relative to mothers aged between 35 and 49 years (Kanmiki et al., 2014). Similarly, Budu et al. (2021) conducted a study to investigate the association between under-five mortality and preceding birth interval and observed a statistically significant relationship between under-five deaths and the age of mothers using data from eight different countries in West Africa. They found that children of mothers with ages less than 20 years having higher odds of dying before age five as relative to children of mothers aged 20 and 29 years of age. Also, Nyaaba et al. (2020) observed a statistically significant association with the age of the mother at birth and under-five mortality. They found that mothers within the ages 20-29 were less likely to experience under-five mortality as relative to mothers of ages between 15-19 years. In addition, Biradar et al. (2019) observed a statistically significant association between the age of the mother and children dying before the age of five. They found that younger mothers of age 20 years and below had a higher chance of experiencing under-five mortality as relative to mothers of higher ages 20 and above. Similar to the above studies,

Yaya et al. (2019) discovered a link between the mother's age at birth and the mortality of children while Babayara & Addo (2018) also observed a significant relationship between maternal age at and childhood deaths. Similarly, Gebretsadik & Gabreyohannes (2016) conducted a study in Ethiopia, using data from the 2011 Ethiopian Demographic and Health Survey to determine the factors associated with under-five mortality in Ethiopia, and found a significant relationship between children dying before age five and the age of mother at birth. In their study they found that mothers at age 16 years and below were associated with higher under-five mortalities as relative to those aged 17 years and above. Similarly a study conducted by Ettarh & Kimani, (2012) to investigate the correlates of under-five mortality in rural and urban Kenya found a significant relationship between age of mother at birth and under-five mortality. They found that children of mothers aged 32 years and above were less likely to experience under-five deaths, as relative to mothers with ages less than 32 years.

### 2.5.4 Religion

The religion of the mother is also a key factor in determining under-five mortality. For instance, Kanmiki et al. (2014) observed a significant relationship between the religion of mothers and children dying before the age of five in the Upper East region of Ghana. In their study, it was revealed that mothers who practice the Traditional religion were more likely to experience under-five deaths as relative to mothers who practice Christianity. Similarly, (Diddy et al., 2009) observed a significant association between under-five deaths and religious affiliation. It was found that children of traditional mothers were more likely to die before the age of five as relative to children of Christian

mothers. Another study conducted in Ghana by Gyimah (2021) observed a statistically significant relationship between child mortality and religious affiliation. At the bivariate stage, it was observed that children of mothers of traditional religion and Muslim religion have higher odds of dying before the age of five as relative to the children of Christian mothers. However, there was no significant difference at the multivariate stage after socioeconomic factors were controlled for.

### 2.5.5 Occupation of mother

The key profession of the mother has also been found to be one of the most significant correlates with under-five mortality when investigating under-five mortality, especially in developing countries. For instance, Kanmiki et al. (2014) observed a statistically significant relationship between the main occupation of mother and under-five deaths. In their study, they found that mothers who were self-employed have lower probability of experiencing deaths before age five as relative to mothers who are engaged in farming. Also, they realised that mothers who were formally employed in the Government sector were less likely to experience under-five mortality as relative to mothers who were farmers. Similarly, Nattey et al. (2013) observed no significant correlation between under-five deaths and the occupation of the mother. In their study, it was revealed mothers who were farmers and casual workers were less likely to experience under-five mortality as relative to mothers who were not gainfully employed.

### 2.5.6 Sex of child

Studies have shown that the sex of a child has a statistically significant relationship with under-five mortality especially in the developing countries where most of the countries do not have efficient functioning health systems in place. For instance, a study conducted by Wegbom et al. (2019) in Nigeria, found a significant relationship between the sex of the child and under-five deaths. They found that females have a higher chance of reaching age five as relative to male children. In addition, Yaya et al.'s (2019) study in sub-Saharan Africa suggests a significant relationship between under-five deaths and the sex of the child. They found that female children were less likely to experience under-five mortality as relative to male children. Also, Budu et al. (2021) conducted a study to investigate the association between under-five mortality and preceding birth interval and found a significant association between under-five deaths and sex of the child using data from eight different countries in West Africa. They found that male children have higher odds of dying before age five as relative to female children. In addition, Van Malderen et al. (2019) found a significant relationship between under-five mortality and the sex of children in sub-Saharan Africa. They found that female children are associated with less odds of under-five mortality as relative to male children. However, a study conducted by Ettarh & Kimani (2012) to investigate the factors associated with under-five mortality in rural and urban Kenya, using data from 2008-2009 Demographic Health Survey, found no significant relationship sex of child and under-five mortality.

### 2.5.7 Vaccinations

Another important factor associated with under-five mortality is the vaccination of children. Vaccination of children has helped in the reduction of under-five mortality. For instance, a study conducted by Darkwah et al. (2014) to determine the factors of under-five mortality using the logit model in the Tona South district in Ghana, found a significant relationship between under-five deaths and vaccination. In their studies, they found that children who were vaccinated had less chance of experiencing under-five mortality as relative to children who were not vaccinated. This is because vaccination help prevents the spread of sickness. Yet to add, Otupiri et al. (2010) found that vitamin A supplementation was significantly associated with under-five deaths. It was observed that children who received vitamin A supplements had lower possibility of dying before age five as relative to counterparts who did not receive vitamin A supplements. Also, Bawah et al. (2010) observed that children who have received full doses of immunization had a lower probability of experiencing under-five deaths as relative to children who have never received vaccinations. A study conducted by Nyarko et al. (2001) in rural northern Ghana investigated the relationship between immunization status and child survival and found that children who received the full dose of vaccinations had a lower probability of dying below the age five relative to children who had not received no vaccination, and partial vaccination.

### 2.5.8 Use of treated bed nets

Malaria has been long identified to be one of the top killers of children, thus, use of treated bed-nets has helped in the reduction of malarial infection within children. For instance, a

study conducted by Darkwah et al. (2014) found a significant relationship between under-five deaths and the use of treated bed nets. They found that children with mothers in households who sleep under treated bed nets have lower odds of children dying before the age of five as relative to those in households who do not sleep under treated bed nets. Similarly, a study conducted by Deribew et al. (2012) in Ethiopia found that long-lasting insecticide-treated bed nets (LLITN) are significantly associated with under-five mortality. They found that children of mothers who use long-lasting bed nets have a lower likelihood of dying before the age five. Long-lasting bed nets help reduce morbidity and mortality of malaria. In addition Otupiri et al. (2010) found that sleeping under insecticide-treated bed nets (ITNs) was statistically significantly related to under-five deaths. They found that mothers who slept under treated bed nets are less likely to experience under-five deaths as relative to mothers who do not sleep under treated bed nets.

### 2.5.9 Breastfeeding

Breastfeeding has also been found to be a significant predictor of under-five mortality. Ettarh & Kimani, (2012) observed significant correlation between breastfeeding and under-five mortality. In their study, they found that mothers who practiced breastfeeding are less likely to experience under-five mortality. Similarly, a study conducted by Darkwah et al. (2014) in the Tona South district in Ghana observed that children of mothers who practice breastfeeding have lower odds of dying before they turn the age of five as relative to mothers who do not practice breastfeeding. In addition to the above authors, Kaberuka et al. (2017) in their study to investigate the factors of under-five

mortality in Uganda, found a significant relationship between the duration of breastfeeding and under-five mortality. They found that children of mothers who practice breastfeeding have a lower probability of dying before they turn age five as relative to mothers who do not practice breastfeeding. Also Otupiri et al. (2010) found that breastfeeding was significantly related to under-five mortality. They found that children of mothers who practice breastfeeding have a lower likelihood of dying before the age five as relative to children of mothers who do not practice breastfeeding. Also Gebretsadik & Gabreyohannes's (2016) study in Ethiopia investigated the determinants of under-five mortality in high mortality zones of Ethiopia and found that mothers that practice breastfeeding have lesser odds of their children dying before the age of five as relative to mothers who do not practice breastfeeding. Similarly to the above studies, others found a significant relationship between breastfeeding and under-five mortality (Karmaker et al., 2014; Kwarteng Acheampong & Eyram Avorgbedor, 2017).

## 2.6 Household factors

Household factors are critical when studying under-five mortality in any part of the globe. The household factors this study has considered include the drinking water source and the size of the household.

### 2.6.1 Main drinking water source

Another sanitation and environmental factor that is significantly correlated with children dying below the age five is the type of water source. For instance, Nyaaba et al. (2020)

observed a significant association between children dying before the age of five and the main source of water supply. They found that mothers who use well and borehole water have a higher chance of experiencing under-five mortality as relative to mothers who use pipe born and tap water. Similarly, a study conducted by Karmaker et al. (2014) study in Bangladesh found a significant relationship with the source of water of household and under-five mortality. They found that mothers of households with pipe-born water were less likely to experience under-five mortality as relative to households that use wells. In addition, Gebretsadik and Gabreyohannes (2016) found that mothers that have pipe-borne water and taps as their source of drinking water are less likely to experience under-five mortality as relative to mothers who do not have access to taps and pipes as their source of drinking water. Ezeh et al.'s (2015) study in Nigeria to investigate the impact of sanitation and water on childhood mortality found that mothers of households that use less improved drinking water have a higher chance of experiencing under-five mortality as relative to mothers of households that obtained drinking water from improved sources. Contrary to the above, a study conducted by Shifa et al. (2018) in Ethiopia found no significant relationship between under-five mortality and the source of drinking water.

### 2.6.2 Size of household

Another important factor that has been found to be significantly correlated with children dying below the age five is the size of the household. For instance, a study conducted in Ethiopia (Zewudie et al., 2020) found a significant relationship between under-five mortality and household size. The study found that an increase in family size leads to an increase in risk of experiencing under-five mortality. In addition a study conducted in

Nigeria (Kayode et al., 2015) found a significant relationship between under-five mortality and household size. The results showed that households with smaller sizes have a lower probability of experiencing under five mortality as compared with children from larger households. Also a study conducted in a number of countries in West Africa, including Ghana, Burkina Faso, Mali, Benin, Cote d'Ivoire, Niger and Nigeria (Bado & Appunni, 2015) found a significant relationship between under five mortality and household size. Similarly, a study conducted by Price et al., (2019) in rural South Africa found a significant relationship with household size and under-five mortality.

## 2.7 Theoretical underpinning

This study is underpinned by W. Henry Mosley and Lincoln C. Chen's analytical framework for the Study of Child Survival in Developing Countries. This is shown in Figure 2.1. According to Mosely and Chen (1984), previous studies in social science and medical science have both contributed significantly to the understanding of child mortality and survival. However, both social science and medical science did not incorporate all factors in their studies regarding issues of child survival and mortality in developing countries. Social science studies only consider socioeconomic factors and neglect biological factors, and medical researchers consider only biological factors of diseases and neglect socioeconomic factors in their studies (Mosely and Chen, 1984). This has led to challenges in the generation of useful strategies to the understanding of child survival in developing countries and policy recommendation biases as a result of disciplinary lines (Mosely and Chen, 1984).

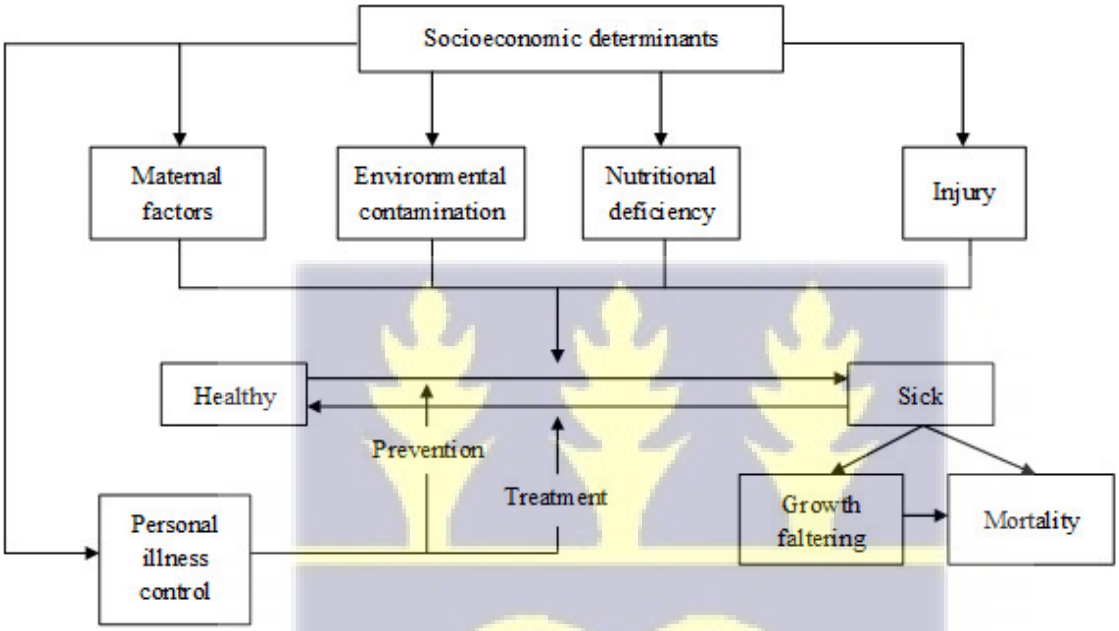
To address these challenges, a new analytical outline that integrates social and medical methods in the study of disease was developed to enable the understanding of morbidity and mortality among children in developing countries (Mosely and Chen, 1984). They argue that social and economic factors interact with these proximate determinants that result in the likelihood of mortality and morbidity. In their essay, they came out with five proximate determinants that socioeconomic determinants interact with (Mosely and Chen, 1984): environmental contamination (air, food/water/fingers, skin/soil/ inanimate objects, and insect vectors.), maternal factors (age, parity, and birth interval), injury (accidental and intentional), personal illness control (personal preventive measures, and medical treatment), and nutrient deficiency (calories, protein, and micronutrients such as vitamins and minerals).

All the proximate determinants such as the environmental contamination, maternal factors, injury, and nutrient deficiency except personal illness control determine the rate of development of healthy persons to sickness whilst the personal illness control factors determine both the rate of illness employing prevention and the rate of recovery through treatment (Mosely and Chen, 1984) as shown in Figure 2.1.

The Figure also indicates that the interaction of the socioeconomic determinants with these five proximate determinants, maternal, environmental contamination, nutrient deficiency, injury, and personal illness control either results in a child being sick or healthy. A sick child could either become healthy through personal illness control and a healthy child could also fall sick because of the interaction of the socio-economic interaction and proximate determinants. A sick child may either recover from sickness or

the situation may worsen finally resulting in a child dying immediately or later dying because of the emaciation.

**Figure 2.1: Theoretical framework displaying an interaction of socioeconomic and proximate determinants on the outcome of child mortality and morbidity in developing countries**



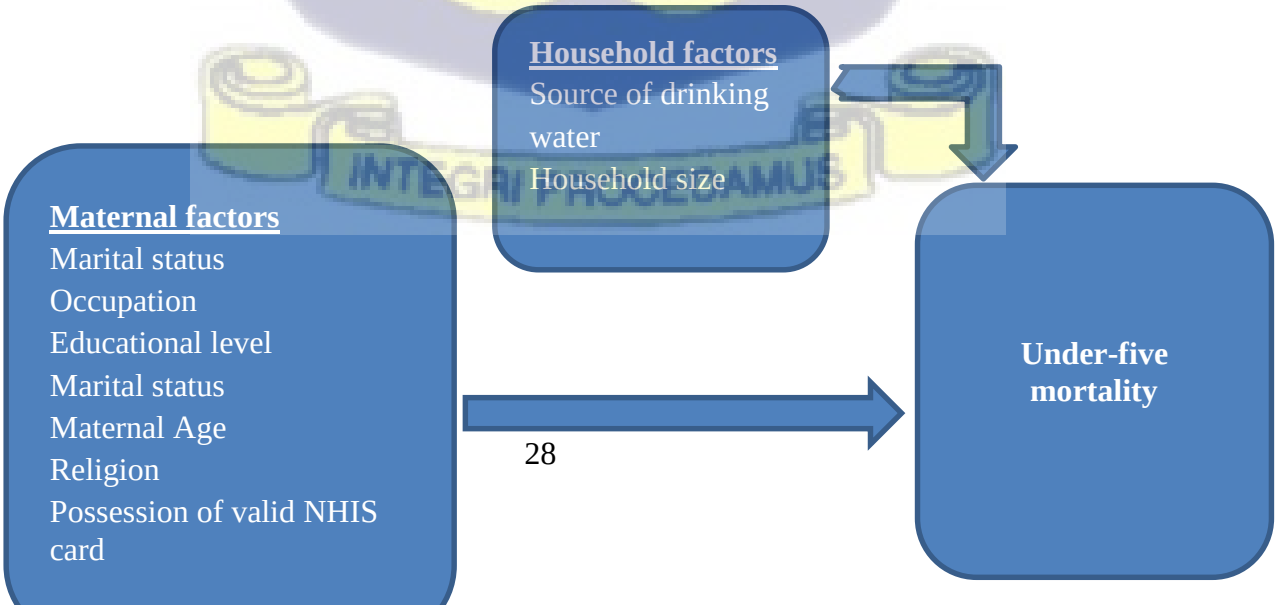

**Source: Mosley and Chen (1984)**

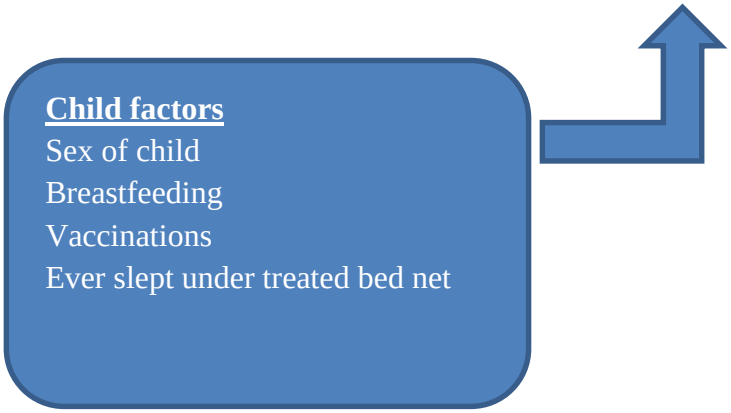
## 2.8 Conceptual Framework

The review of literature in this study based on other studies was organised into three headings: maternal, household and child factors. This was done bearing in mind these factors as discussed by Mosley and Chen's (1984) analytical framework. This study seeks to use these factors to determine the factors that are associated with under-five mortality in rural northern Ghana over a five-year period.

The conceptual framework (Figure 2.2) shows the association between the under-five deaths and each independent variable. The independent variables include the maternal, household and child factors. From Figure 2.2, factors such as vaccination, bed net use, are factors known to be correlated with the health of the mother and the child and consequently affect pregnancy outcomes and under-five survival (Mosely & Chen, 1984). In addition, determinants of under-five deaths such as the main water source, and place of residence of the household, if not properly managed may lead to the spread of diseases causing bacteria and pathogens to the mother and the child resulting in the death of children before age five. Also, maternal education, breastfeeding, maternal age, and marital status could result in morbidity and mortality of children. Finally, child factors such as the sex of a child and vaccination status of child are known to influence the health outcome of children and under-five mortality as observed in the conceptual framework below.

**2.2: A conceptual framework showing determinants associated with children dying before age five in the Upper East region of Ghana**






**Source: Authors construct (2021), as adopted from Mosely & Chen (1984)**

## 2.9 Hypotheses

- Children of educated mothers stand a higher probability of surviving to age five as relative to children of uneducated mothers.
- Children of mothers who practiced breastfeeding are less likely to die before age five as relative to children of mothers who did not practice breastfeeding.
- Children of mothers who are sleeping under a treated bed net regularly are less likely to die before age five as relative to children of mothers who are not sleeping under a treated bed net.
- The greater the required number of the different childhood vaccinations received by children, the less the risk of children dying before age five.

- Children of mothers who have their source of drinking water from protected source are less likely to die before age five as compared to children of mothers who have their source of water from unprotected source.

# CHAPTER THREE

# METHODOLOGY

## 3.0. Introduction

The source of data, area of study, sample size, data collection procedures, and methods used in analysing the data are presented in this chapter. It also discusses variable categorizations and the limitations and strengths of the study.

### 3.1 Study Area

This study made use of data collected from the Ghana Essential Health Intervention Program (GEHIP), which was conducted in the Upper East region of Ghana from 2011 to 2016, comprising seven different ethnic groups (Kanmiki et al., 2014). The treatment areas included Builsa, Garu Tempane and Bongo districts while the comparison area included Talensi Nabdam, Bolgatanga, Bawku West and Bawku districts (Awoonor-Williams et al., 2013). At the time of the study, the region had a total population size of 1,046,545 and a 1.2 annual rate of growth (Ghana Statistical Service, 2013) The region is not only one of the poorest in Ghana but has a higher proportion of its people located in the rural areas and engaged in peasant farming (Kanmiki et al., 2014). The region had an under-five mortality rate of 128 deaths per 1000 births with a 3.43 total fertility rate in 2010 (Ghana Statistical Service, 2013). The region has two seasons, with about five months of rains starting from May and ending in September followed by about seven months of the long dry season from October to April. As a result of the nature of the seasons for the region, most of the people engage in subsistence farming, leading to a high level of poverty in the region (Kanmiki et al., 2014). The region is also characterised by a high level of illiteracy and a low-income level as relative to the other regions of Ghana (Ghana Statistical Service, 2013). The region also has an average household size of 5.2, with a higher proportion of its males having ever attended school as relative to females in the region and an unemployment rate of 7.7 percent (Ghana Statistical Service, 2019). Currently, the region has a population size of 1,301,221 representing 4.2% of the total population of Ghana (Ghana Statistical Service, 2021).

### 3.2 Data source, sampling design and selection procedure

The Ghana Essential Health Interventions Program (GEHIP) was designed to improve the Community-based Health Planning and Services (CHPS) initiative (Awoonor-Williams et al., 2013). The intervention was a five-year program beginning in 2011 and was devised to streamline and develop strategies to help CHPS overcome its service gaps and operational challenges in the Upper East region. This research component of the study was carried out in two phases suggesting a repeated cross-sectional design. Phase one (baseline) was conducted in 2011 to "provide the needed information and indicators such as mortality rates, fertility rates, and health coverage for onward evaluation of the project" (Kanmiki et al., 2014). During the end-line study, data were collected in 2015 from the same areas and respondents, before the end of the study in 2016. The end-line activities sought to investigate the effect of the program on health care systems and delivery in the region. During baseline and the end-line surveys of the study, data were collected from mothers between the ages 15 and 49 using structured questionnaires and after applying a two-stage probability sampling procedure to recruit the women. The study made use of a sampling frame from the Ghana Statistical Service (GSS) of 66 enumeration areas (EAs) representative of the population size of the area.

This study uses the baseline and end-line child file data sets, comprising children under-five years born to women from 2007 to 2011 and from 2012 to 2015, respectively, representing live births to women five years before both the baseline and end-line surveys. For the baseline, total observations were 3,422 and for the end-line the total number of observations was 2,215.

The focus of this thesis is drivers of children dying below the age five in the Upper East region of Ghana, using GEHIP data set. It made use of baseline and end-line data sets, with the child file being used for the study. Children beyond age five before 2007 were excluded from the study. The study seeks to identify the persistent determinants associated with children dying before age five, before and after interventions have been carried out. It also examines whether there is a difference in factors resulting in under-five mortality in the region before interventions were carried out in 2011 and during the end-line in 2015 using the GEHIP data sets.

### 3.4 Methods of Data Analysis

The data were analysed using Stata version 17.0. This was done in three levels: univariate, bivariate, and multivariate analyses. At the univariate level, descriptive statistics were generated to describe the independent variables and presented in charts and tables. Cross-tabulations using the Pearson chi-square test (for categorical variables) and mean comparison t-test (for continuous variables) were conducted at the bivariate level to determine the correlation between the response variable (children dying before age five) and the independent variables in the study. Finally, at the multivariate level, binary logistic regressions were fitted to identify the factors associated with under-five mortality at the baseline and end-line. A binary logistic regression was employed because the outcomes for both the baseline and end line models had two categories: 1. children dying before age five and 2. otherwise/those surviving at and beyond age five. The covariates of the multivariable regressions were mother's level of education, marital status of mother, mother's occupation, mother's age, mother's religion, health insurance status of

mother, child's sex, breastfeeding status of child, vaccination score of child, source of drinking water for the household and the size of the household. The proceeding sub-sections and Table 3.1 provide further information the variables and their measurements. For the regression models, only covariates with a probability value less than 5 percent were considered significant in this study and discussed.

## 3.5 Variables used in the study

The under-five mortality which was measured as a dichotomous variable was the dependent variable and independent variables comprising maternal, child and household factors

### 3.5.1 Children dying before age five in the study

As indicated earlier the outcome variable, under-five deaths, refer to all deaths among children under age five or deaths among children less than 60 months. The child file was used from the GEHIP data set, which includes children under age five from 2007 to 2011 and 2012 to 2015. In the GEHIP questionnaire respondents were asked their birth history to help obtain information on the number of children who died before age five. In this study, all births five years retrospective from the survey period were obtained and all children who died before the age of five were considered under-five deaths.

### 3.5.2 The independent variables used in the study

Determinants used in this study were informed by the literature and specifically from Mosley and Chen's analytical framework, were grouped under maternal, household and child factors. Table 3.1 highlights the different variables and their numeric codes.

**Maternal education**

The maternal education is one of the crucial variables in this study. The level of education of mothers is a correlate of under-five deaths (Biradar et al., 2019). In the GEHIP questionnaire mothers' level of education was grouped into none, primary, junior secondary school (JSS), middle school, senior secondary school (SSS), tertiary, and others. However, in this study maternal degree of education is re-categorised under none, primary school, junior secondary school/middle school, and secondary and higher.

**Marital status of mother**

The marital status of the mother has been considered one of the most significant correlates with the level of under-five mortality, when investigating under-five mortality, especially in developing countries (Wegbom et al., 2019). In the GEHIP questionnaire marital status of a mother was grouped into Single, Married, Widowed, Divorced, Separated Cohabiting/living together. With this study, marital status is measured by regrouping the variables into three categories, Married/Living together, Widow/Divorced/Separated, and Never married

**Respondent's main occupation**

The occupation of the mother is a key determinant of under-five deaths (Kanmiki et al., 2014). In the GEHIP questionnaire, occupation was measured by grouping it into Farming, Trading/Selling, Hairdressing/Dressmaking, Housewife, Craftmanship, Construction work, Civil/Public servant, Student, and Others. In this study occupation is categorised into Farming, Trading, Hairdressing/Dressmaking, Housewife, Student, and other occupations.

**Maternal age**

Mothers' age has been found to have a significant relationship with under-five mortality (Nyaaba et al., 2020). In this study maternal age has been re-categorised into 15-24, 25-34, and 35-49 for mothers whose ages were between the age groups 15 and 24 years, those between the ages 25 and 34, and for mothers whose ages were between 35 and 49, preceding the survey.

**Religion**

The religion of the mother is also a key factor in determining under-five mortality (Diddy et al., 2009). In the GEHIP study, religion of the mother has been classified into Christianity, Traditional religion, Islamic religion, no religion, and others. In this study, religion is measured by classifying religion into Christianity, Islamic religion, Traditional religion, and no religion and others

**National Health Insurance**

National health insurance is also a key determinant of under-five deaths. This study measured possession of a valid national health insurance card as 'having valid national health insurance' and 'otherwise' for those without valid national health insurance or a card altogether, as used in the GEHIP questionnaire.

**Sleeping under treated bed net**

Sleeping under a treated bed net has also been observed to have a significant relationship with under-five mortality (Deribew et al., 2012). In the GEHIP study, the use of a treated bed net is measured as sleeping under a treated bed net every night, most nights, some nights, rarely, and never. However, this study measures the use of treated bed net as either 'yes' to sleeping under a bed not or 'no'.

**Vaccinations**

Vaccinations have also been found to be statistically significantly related to under-five mortality (Darkwah et al., 2014). In this study, vaccinations are measured as the sum of the number of different required vaccinations received at the stage of the life of a child.

**Breastfeeding**

Breastfeeding is also identified as one of the key variables in measuring under-five mortality (Ettarh & Kimani, 2012). In this study breastfeeding is measured as ever been

breastfed or not. ‘Yes’ for those who have ever been breastfed and ‘no’ for those that have never been breastfed.

**Sex of a child**

The sex of a child has also been identified as a significant determinant of under-five mortality (Budu et al., 2021). In this study child’s gender was determined as female or male as assessed in the GEHIP questionnaire.

**Drinking water source**

The main source of water for a household has also been observed to be associated with under-five mortality. This study measures the source of drinking water as a protected (piped water) and unprotected source ( well, rivers, and others ).

**Household size**

Household size has also been found to be statistically significantly related to under-five mortality. In this study, household size is measured as a numeric variable comprising the average number of people in a household.

**Table 3.1: Measurement of variables**

| VARIABLE | MEASURE | CODE |
|---|---|---|
| | None | 0 |
| | Primary, | 1 |
| | JSS/Middle school | 2 |
| | Secondary or Higher | 3 |
| **Occupation of Mother** | Farming | 0 |
| | Trading | 1 |
| | Hairdressing/Dressmaking | 2 |
| | Housewife | 3 |
| | Student | 4 |
| | Other occupations | 5 |
| | No occupation | 6 |
| **Maternal Age** | 15- 24 | 0 |
| | 25-34 | 1 |
| | 35- 49 | 2 |
| **Religion** | Christianity | 0 |
| | Islamic Religion | 1 |
| | Traditional Religion | 2 |
| | No religion | 3 |
| **Marital Status of Mother** | Married/Living together | 0 |
| | Widow/Divorced/Separated | 1 |
| | Never married | 2 |
| **Sex of Child** | Male | 0 |
| | Female | 1 |
| **Breastfeeding** | Yes | 0 |
| | No | 1 |
| **National Health Insurance** | Valid | 0 |
| | Otherwise | 1 |

| | | |
|---|---|---|
| **Household size** | Count variable | 0-9 |
| **Used of Treated Bed Nets** | Yes | 0 |
| | No | 1 |
| **Source of drinking water** | Protected | 0 |
| | Unprotected | 1 |

# CHAPTER FOUR

# MATERNAL, HOUSEHOLD AND CHILD FACTORS, AND UNDER-FIVE MORTALITY

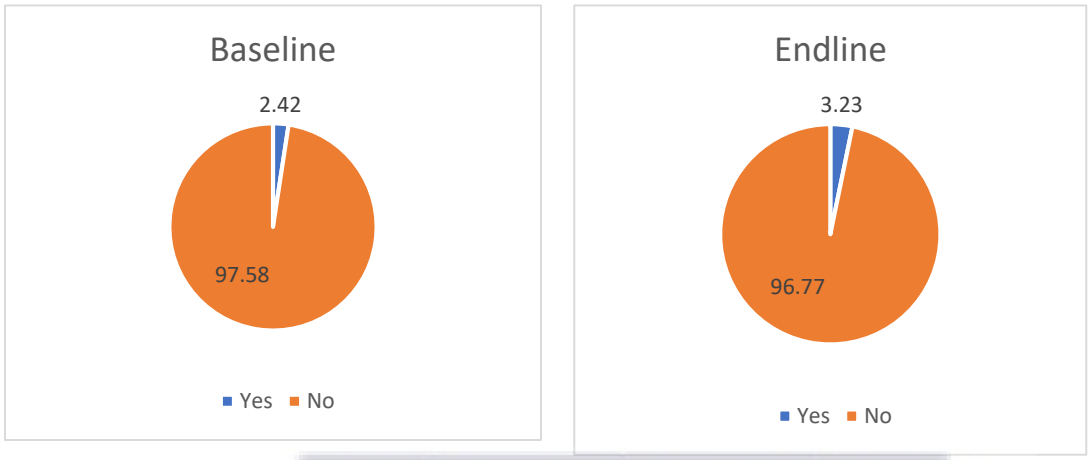
## 4.0 Introduction

Several factors are associated with under-five mortality. In this study, the attributes of the child, the household and the mother are key in analysing the determinants that are correlated with under-five mortality. This chapter provides information on the frequencies and percentages of the features of the mother, child and household characteristics of the respondent, and under-five attributes. This was done based on a literature review conducted.

## 4.1 Under-five deaths

Generally, from the analytic sample of 4,487 for the baseline of this study, 233 children died before their fifth birthday. However, at the endline, 89 children died before reaching age five from a sample of 2,663 children. This means that under-five deaths was lower in the baseline (2.42%) compared to the end line (3.23%) (see Figure 4.1). Intuitively, in every 40 live births, one child dies before the age of five for the baseline period whereas in the end line, one out of every 30 live births die.

**Figure 4.1: Pie chart displaying proportional distribution of under-five mortality at baseline and in the end-line.**




**Source: Generated from Baseline (2007-2011) and End-line (2012-2015) data of GEHIP.**

### 4.2 Household, maternal and child characteristics

From Table 4.1, both baseline and end-line mothers have their main source of drinking water from a protected source, more than eighty percent in both periods. In the baseline, 85.7 percent and in the end-line 83.7 percent have their main source of drinking water from a protected source. Also, in the baseline, the household size was slightly higher (7.46) compared to the end-line household size of 6.91.

Further, the table shows that a higher percentage of the respondents both in the baseline (44.69%) and end-line (45.41%) were in the 25-34 age group and the lowest number among the respondents were in the age group of 35-49, both in the baseline (31.91%) and end line (24.82%). It was observed that a higher percentage of the respondents both in

the baseline (72.61%) and end line (65.86%) have not received any form of formal education and the least percentage of the respondents had received at least secondary education in both the baseline (3.83%) and end line (6.73%).

In addition, under the category of religion, a higher proportion of the respondents were Christians both in the baseline and end-line with fewer respondents having no religion. It was observed that mothers who are Christians in the baseline were a little above 50 percent (50.98%) in the baseline and about 55 percent in the end-line (55.39%) with the lowest percentage among the respondents having no religion, representing 3.83% in the baseline and 2.09% in the end-line. A higher proportion of the respondents were either married or living together both in the baseline (92.2%) and end-line (92.87%), with the lowest proportion of the respondents being never married in both the baseline (3.01%) and the end line (3.12%).

In terms of the occupation of the respondents, it was observed that in both the baseline (47.88%) and end-line (41.35%), a higher proportion of the respondents are engaged in farming activities with the least among the respondents in the baseline (8.66%) being in other occupations and the least proportion in the end-line being housewives. It is observed that respondents who have valid health insurance in both the baseline (41.56%) and end line (45.59%) were less than mothers who are active members of health insurance in the baseline (58.44%) and end-line (54.41%).

**Table 4. 1: Distribution of household characteristics at baseline and end-line**

| | Baseline (2011) | End-line (2015) |
|---|---|---|
| | | |
| **Variable** | **Percentage** | **Percentage** |
| *A. **Household characteristics*** | | |
| **The main source of water** | | |
| Protected | 85.72 | 83.69 |
| Unprotected | 14.28 | 16.31 |
| **Household size+** | 7.46[0.22] | 6.91 [0.15] |
| *B. **Mother's characteristics*** | | |
| **Age category** | | |
| 15-24 | 23.40 | 29.77 |
| 25-34 | 44.69 | 45.41 |
| 35-49 | 31.91 | 24.82 |
| **Educational level** | | |
| None | 72.61 | 65.86 |
| Primary | 15.33 | 14.48 |
| JSS/Middle School | 8.22 | 12.92 |
| Secondary and higher | 3.83 | 6.73 |
| **Religion** | | |
| Christianity | 50.98 | 55.39 |
| Traditional | 16.26 | 10.56 |
| Islam | 28.97 | 31.95 |
| No religion | 3.76 | 2.09 |
| **Marital status** | | |
| Married/Living together | 92.20 | 92.87 |
| Widow/Divorced/Separated | 4.79 | 4.01 |
| Never married | 3.01 | 3.12 |
| **Main occupation** | | |

| | | |
|---|---|---|
| Farming | 47.88 | 41.35 |
| Trading | 21.38 | 16.71 |
| Hairdressing/Dressmaking | 11.17 | 14.53 |
| Housewife | 10.91 | 5.93 |
| Other occupations | 8.66 | 21.48 |
| **Valid national health insurance** | | |
| Yes, seen and valid | 41.56 | 45.59 |
| Otherwise | 58.44 | 54.41 |
| *C. **Child's characteristics*** | | |
| **Breastfed** | | |
| Yes | 98.89 | 98.98 |
| No | 1.11 | 1.02 |
| **Sleeping under treated bed net** | | |
| Yes | 42.74 | 75.49 |
| No | 57.26 | 24.51 |
| **Sex of child** | | |
| **Boy** | *52.34* | 51.5 |
| **Girl** | 47.66 | 48.5 |
| **Total vaccination+** | 6.29 [0.17] | 8.81 [0.14] |

*+ Means are presented for continuous variable and values in brackets represent standard errors.*

**Source: Generated from Baseline (2007-2011) and End-line (2012-2015) data of GEHIP**

With regards to the child's characteristics, at birth a higher proportion of live children born were males juxtaposed with females in both wave one (baseline) and wave two (end-line). Males were about 52 percent and females were 48% percent in the baseline and

male children were about 52 percent compared to 49 percent female children in the end-line. A higher proportion of children under-five were breastfed in both the baseline and the end line. In the baseline, about 98.89 percent of the children were breastfed and in the end line, about 98.98 percent of children under-five were breastfed. A lower proportion of children under-five (42.74%) sleep under a treated mosquito net in the baseline as relative to almost 75 percent of children under-five sleeping under a bed net in the end-line. Finally, Table 4.1 shows that averagely the total number of vaccinations received by children during the baseline was six (6.29) different vaccinations and this was a little below the average number of different vaccinations received in the end-line, almost nine different vaccinations (8.81) were given to children in the specific ages of their life before they turned age five.

# CHAPTER FIVE

# ANALYSIS OF HOUSEHOLD, MOTHER AND CHILD FACTORS AND UNDER-FIVE DEATHS AT THE BIVARIATE LEVEL

## 5.0 Introduction

The chapter tests for the association between maternal, household and child factors and under-five deaths. These factors stated above have a probability of an association with under-five mortality as discussed in the literature. For instance, factors such as sex of the child, breastfeeding, vaccination, the use of treated bed nets, source of drinking water, age of the mother, level of education of mother, religion preferred of mother, marital status of the mother, occupation of mother, possession of national health insurance, and average number of people in a household have been identified to correlate with children dying below age five (Nyaaba et al., 2020). This chapter shows bivariate analysis results conducted for each independent variable and the dependent variable which involves cross-tabulations between categorical variables and under-five deaths to explore the determinants that are correlated with children dying before the age five. The p-values and chi-square tests were generated to ascertain statistical significance between the independent variables and under-five mortality. T-tests were also carried out between household size and number of vaccinations and under-five mortality.

### 5.1 Maternal Factors

This section discusses the association between child, household and maternal determinants, and under-five deaths born five years before the baseline and end-line surveys as observed below.

**Table 5.1: Percentage distribution of maternal characteristics and under-five deaths**

| | Baseline (2011) | | End-line (2015) | |
|---|---|---|---|---|
| **Variable** | **Yes** | **P-value** | **Yes** | **P-value** |
| | % | | % | |
| **Age category** | | | | |
| 15-24 | 2.2 | 0.875 | 3.44 | 0.509 |
| 25-34 | 1.98 | | 2.85 | |
| 35-49 | 2.31 | | 2.33 | |
| **Educational level** | | | | |
| None | 1.88 | 0.342 | 2.3 | 0.112 |
| Primary | 2.64 | | 4.92 | |
| JSS/middle school | 3.59 | | 3.45 | |
| Secondary and higher | 1.92 | | 3.31 | |
| **Religion** | | | | |
| Christianity | 2.24 | 0.0480 | 3.22 | 0.644 |
| Traditional | 3.17 | | 2.53 | |
| Islam | 1.02 | | 2.37 | |
| No religion | 4.9 | | 4.26 | |
| **Marital status** | | | | |
| Married/Living together | 2.05 | 0.580 | 2.88 | 0.709 |
| Widow/Divorced/Separated | 3.10 | | 2.22 | |
| Never married | 1.23 | | 4.29 | |
| **Main occupation** | | | | |
| Farming | 2.39 | 0.416 | 2.48 | 0.232 |
| Trading | 2.59 | | 3.2 | |
| Hairdressing/Dressmaking | 0.99 | | 1.84 | |
| Housewife | 2.03 | | 5.26 | |
| Other occupations | 1.28 | | 3.53 | |
| **Valid national health insurance** | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Yes seen and valid | 1.95 | 0.566 | 2.74 | 0.687 |
| | Otherwise | 2.27 | | 3.03 | |
| | | | | | |

**Source: Created from Baseline (2007-2011) and End-line (2012-2015) data of GEHIP**

### 5.1.1 Age of Mother

From Table 5.1 above, mother's age was grouped into 15-24, 25-34, and 35-49 years. There was no significant association, at a 95 percent confidence level, between the age of the mother and under-five deaths in both the baseline (wave one) and end-line (wave two). As observed from Table 5.1, the P-value in wave one was 0.875 and in wave two the P-value was 0.509. From Table 5.1 under the age category in the baseline, a higher percentage of under-five deaths (2.31%) occur to mothers in the age group of 35-49 and the least percentage of under-five deaths (1.98) occur to mothers in the age group of 25-34. However, in the end-line, the higher percentage of under-five deaths (3.44%) occur to mothers in the age group of 15-24 and the least percentage of under-five deaths (2.33%) percent occur to mothers within the age group of 35-49 years.

### 5.1.2 Maternal education and under-five mortality

From Table 5.1 above, maternal education has been grouped into none, primary, junior secondary school/middle school, and secondary and higher. However, the level of education of mothers and under-five deaths had no significant association at the bivariate level in both the baseline and the end-line, at a 95 percent confidence level. In the baseline, the P-value is 0.342, and in the end line, the P-value is 0.112. From Table 5.1,

we find a higher percentage of under-five deaths (3.59) occurring to mothers with junior or middle school education and about 1.88 percent of under-five deaths occur to mothers with no formal education in the baseline. In the end-line, a higher proportion of under-five deaths (4.92%) occur to mothers with primary education, and the lowest percentage of under-five deaths (2.3%) occur to mothers with no education Also, the lack of significance in the association between mother's level of education and under-five deaths could be attributed to the several interventions and studies conducted in the Upper East region unlike other rural areas of Ghana that have not received such interventions.

### 5.1.3 Religion and under-five mortality

From Table 5.1 above, there was a P-value of 0.048 in the baseline and a P-value of 0.644 in the end-line. This indicates a correlation between the religion of respondent and under-five deaths in the baseline and no significant association between mother's religion and under-five deaths in the end-line at the bivariate stage. A higher percentage of children who died before age five were reported to have been belonging to mothers without a religion in both baseline (4.9%) and 4.26 percent in the end-line. However, it was observed that the least percentage of under-five mortality was associated with children of mothers who practice the Islamic religion in both the baseline (1.02%) and end-line (2.37%) as relative to the other religions.



### 5.1.4 Marital status and under-five mortality

From Table 5.1 there is no significant association between marital status of mother and under-five mortality in both the baseline and end-line at the bivariate level. From Table

5.1, the P-value in the baseline is 0.580 and the P-value in the end-line is 0.709, indicating no significant association between marital status and under-five mortality. In the baseline, a higher proportion of children (3.10%) who died before age five occurred to mothers who belong to the category of widowed, divorced and separated, and the least percent of under-five deaths (1.23%) occurring to mothers who were never married. However, in the end-line, a higher percentage of under-five deaths (4.29%) was associated with mothers who were never married, and the least percentage of under-five deaths (2.22%) were associated with mothers who were in the category of widowed, divorced and separated.

### 5.1.5 Main occupation and under-five mortality

From Table 5.1 above the P-value in the baseline is 0.416 and the P-value in the end-line is 0.232 at a 95 percent confidence level. This indicates no association between the mother's main occupation and under-five deaths both in the baseline and the end-line. From Table 5.1, under the category of the main occupation, a higher number of under-five deaths (2.59%) were associated with mothers who are engaged in trading in the baseline, and the higher proportion of under-five deaths (5.26%) was associated with mothers who are housewives in the end-line. Contrarily, the lowest proportion of under-five deaths is associated with mothers who are either engaged in hairdressing or dressmaking, both in the baseline (0.99%) and end-line (1.84%).

### 5.1.6 National health insurance and under-five mortality

From Table 5.1 above, the P-value at the baseline is 0.566 and 0.687 at the end-line. These P-values indicate no statistically significant association between the possession of national health insurance by mothers and under-five deaths. Both at the baseline and end-line, a higher proportion of under-five deaths (2.27% and 3.03%, respectively), occur to mothers who are not members of a health insurance scheme or may not be active members of health insurance at the time of the survey, with the least proportion of under-five deaths occurring to mothers with valid health insurance (1.95%) and (2.74%) in the baseline and end-line, respectively. The least number of under-five deaths associated with mothers with valid health insurance could be attributed to these mothers having access to health care and free maternal health care services.

## 5.2 Child Factors

### 5.2.1 Sex of child and under-five mortality

From Table 5.2 below, at the bivariate level, there was no association between child's sex and under-five deaths at baseline as the P-value was 0.625. However, after the end-line, a statistically significant correlation was observed between the child's sex and dying before age five. From Table 5.2, it is observed that at the baseline a higher percentage of under-five deaths are associated with females (2.55) as relative to males (2.32). However, at the end line, a higher percent of under-five deaths is statistically significantly associated with males (3.65). This is in line with the literature as female children are genetically resistant to many ailments and conditions than the males.

**Table 5.2: Bivariate analysis of children dying below the age five and child's characteristics baseline and end-line**

| | | Baseline (2011) | | End-line (2015) | |
|---|---|---|---|---|---|
| **Variable** | | **Yes** | **P-value** | **Yes** | **P-value** |
| | | % | | % | |
| **Sex of Child** | | | | | |
| | Boy | 2.32 | 0.625 | 3.65 | 0.0005 |
| | **Girl** | 2.55 | | 1.29 | |
| **Breastfed** | | | | | |
| | Yes | 2.33 | 0.001 | 2.66 | 0.000 |
| | No | 10.26 | | 26.09 | |
| **Sleeping under a treated bed net** | | | | | |
| | Yes | 1.86 | 0.117 | 1.59 | 0.000 |
| | No | 2.83 | | 5.93 | |
| | | **Mean** | **Std Err** | **Mean** | **Std Err** |
| **Total vaccination** | | 3.882 | 0.477 | 4.85 | 0.831 |

**Source: Generated from Baseline (2007-2011) and End-line (2012-2015) data of GEHIP**

### 5.2.2 Breastfeeding and under-five mortality

From Table 5.2 above, at the bivariate level, the P-values at baseline and end-line are 0.001 indicating a significant association with dying below the age five and breastfeeding. From Table 5.2 above, the higher percentage of children dying in both the baseline (10.26%) and the end line (26.09%) before age five are correlated with children who are not breastfed as relative to a lower percentage of under-five deaths associated with children who are breastfed both in the baseline (2.33%) and end-line (2.66%). This is also in line with the literature that children who are breastfed are provided with nutritional

requirements to help boost the immune system thereby reducing their likelihood of death before age five as relative to children who are not breastfed.

### 5.2.3 Sleeping under a treated bed net and under-five mortality

As observed from Table 5.2, at the bivariate level there was no significant association between children sleeping under a treated bed net and under-five mortality at the baseline at a P-value of 0.117. At the end line, there was a significant association with children sleeping under a treated bed net and under-five mortality, with a P-value of 0.001 at a 95 percent confidence level. As observed from Table 5.2 above, both in the baseline (2.83%) and end line (5.93%), a higher percentage of children who died before age five was associated with children who do not sleep under a treated bed net as relative to the smaller percentage of under-five deaths that are associated with children who sleep under a treated bed net in both the baseline (1.86%) and (1.59%) in the end-line. The significant association with under-five deaths in the end-line could be attributed to the GEHIP conducted in the region leading to effective and proper utilization of treated bed nets leading to lower deaths associated with the use of treated bed net in the region.

### 5.2.4 Total number of vaccinations and under-five mortality

From Table 5.2 above, the vaccination received by a child was measured as a count variable. This is because at a particular stage of the life of a child, he or she has a different number of vaccinations to be taken to be protected from a particular ailment. However, this method of summing the vaccines may be challenging because children at different levels of ages from age zero to age five have a different number of vaccines they are

qualified to be vaccinated. From Table 5.2 in the baseline, under-five deaths were associated with an average of 4 (3.882) different completed number of vaccinations received, and in the end line, the average number of under-five deaths are associated with an average of 5 (4.85) different number of completed vaccinations.

## 5.3 Household Factors

### 5.3.1 Main source of water and under-five mortality

From Table 3.3 below, there was no association between the household source of water and under-five mortality at both the baseline and end-line. In the baseline, the P-value was 0.174 and for the end-line, the P-value was 0.876. A higher percentage of under-five deaths (3.39%) was associated with households who have their main source of water from unprotected sources and a lower percentage of under-five deaths (2.26%) associated with households who have their main source of water from protected sources in the baseline. This is contrary to results in the end line. From Table 5.3, in the end line, a higher percentage of children who die before age five (2.93%) is associated with households that have their main source of water from protected sources and lower percentages of under-five deaths (2.73%) associated with households with who have their main source of water from an unprotected source.

**Table 5.3: Bivariate analysis of under-five mortality and household characteristics**

| | Baseline (2011) | | End-line (2015) | |
|---|---|---|---|---|
| **Variable** | **Yes** | **P-value** | **Yes** | **P-value** |
| | % | | % | |
| **Main source of drinking water** | | | | |
| Protected | 2.26 | 0.174 | 2.93 | 0.876 |
| Unprotected | 3.39 | | 2.73 | |
| | **Mean** | **Std Err** | **Mean** | **Std Err** |
| **Household size** | 7.188 | 0.429 | 6.84 | 0.560 |

**Source:** Generated from Baseline (2007-2011) and End-line (2012-2015) data of GEHIP

### 5.3.2 Household size and under-five mortality

From Table 5.3 above, at the baseline, children who die before age five belong to households with an average household size of 7.188 persons in the baseline (with a standard error of 0.429), and in the end line, the number of under-five deaths was associated with a household size of 6.84 people (with a standard error of 0.560).

# CHAPTER SIX

# DETERMINANTS OF UNDER-FIVE DEATHS IN THE UPPER EAST REGION OF GHANA

## 6.0 Introduction

In this chapter, multivariate results are discussed to determine the factors that are correlated with under-five mortality in the Upper East region of Ghana from 2007 to 2011 and from 2012 to 2015 after testing for significant associations between variables at the bivariate level. This chapter comprises further tests conducted to obtain more robust and statistically significant results between factors associated with under-five deaths at the baseline and end-line by executing binary logistic regression models at both waves (baseline and end-line). A binary logistic regression was run for both the baseline and end-line after controlling for the intervention districts and all variables in this study to ascertain the variables that were significantly correlated with children dying below the age five. The results for both the baseline and end-line such as the P-values and the odds ratios are presented in Table 6.1 at a 95 percent confidence level. The finding from binary logistic regression analyses will help answer research questions on the factors that are significant determinants of under-five mortality in both periods. It will also help identify factors that are significant at the baseline and those that are significant determinants at the end-line. Finally, the study can allude to how the GEHIP interventions may have influenced under-five mortality.

### 6.1 Findings and Discussion on the Multivariate Analyses Results

The study seeks to investigate the determinants of children dying before age five in the Upper East region of Ghana. However, the findings and discussion in this chapter are backed and supported by similar studies which were representative of their study areas and populations, conducted globally, regionally, nationally, and/or within the Upper East region of Ghana.

From Table 6.1 below, breastfeeding (AOR=5.3; p<0.01; 95% CI: 2.2 – 12.5), vaccinations received (AOR=0.9; p<0.01; 95% CI: 0.8-0.9), mothers who have completed JHS education (AOR=3.1; p<0.01; 95% CI: 1.4-6.7), and control districts (AOR=2.0; p<0.01; 95% CI: 1.2-3.4) were significant determinants of under-five mortality in the baseline. At the end-line, sex of a child (AOR=0.30; p<0.01; 95% CI: 1.80 – 6.06), breastfeeding (AOR=8.22; p<0.01; 95% CI: 4.41 – 28.07), sleeping under a treated bed net (AOR=3.50; p<0.01; 95% CI: 2.02-6.07), and the number of vaccinations received at a specific age of life (AOR=0.86; p<0.01; 95% CI: 0.84-0.91) were variables that are significantly related with children dying before they turn age five. However, breastfeeding and the number of specific different vaccines received by a child were the only two factors that were associated with under-five mortality in both the baseline and end-line results.

**Table 6.1: Binary logistic regression model indicating factors associated with under-five mortality at pre- and post-intervention**

| Variable | Baseline (2011) | | End-line (2015) | |
|---|---|---|---|---|
| | Adjusted odds ratios | CI 95% | Adjusted odds ratios | CI 95% |
| ***Child's characteristics*** | | | | |
| **Sex of Child (Ref: Female)** | | | | |
| **Male** | 0.85 | [0.56-1.29] | 3.30*** | [1.80-6.06] |
| | | | | |
| **Breastfed (Ref: Yes)** | | | | |
| No | 5.30*** | [2.24 – 12.56] | 8.22*** | [2.41-28.07] |
| **Sleeping under a mosquito net (Ref: Yes)** | | | | |
| No | 1.51 | [0.85-2.69] | 3.50*** | [2.02-6.07] |
| **Total vaccination** | 0.91*** | [0.87-0.94] | 0.86*** | [0.84 - 0.91] |
| ***Mother's characteristics*** | | | | |
| **Age category (Ref:15-24)** | | | | |
| 25-34 | 0.67 | [0.35-1.23] | 1.22 | [0.61-2.45] |
| 35-49 | 0.80 | [0.37-1.69] | 1.25 | [0.56-2.82] |
| **Educational level (Ref: None)** | | | | |
| Primary | 1.48 | [0.84-2.61] | 2.08 | [0.98-4.37] |
| JSS/middle school | 3.11*** | [1.45-6.70] | 1.35 | [0.59-3.08] |
| Secondary and higher | 0.91 | [0.61-5.16] | 1.12 | [0.31-3.98] |
| **Religion (Ref: Christianity)** | | | | |
| Traditional | 1.73 | [0.87-3.44] | 1.09 | [0.32 – 3.08] |
| Islam | 0.61 | [0.28-1.35] | 0.84 | [0.43 - 1.65] |
| No religion/ Others | 1.60 | [0.63-4.05] | 2.46 | [0.49-12.31] |
| **Marital status (Ref: Never married)** | | | | |
| Widow/Divorced/Separated | 6.49 | [0.94-45.03] | 0.64 | [0.04-10.92] |
| Married/Living together | 4.37 | [0.57-33.49] | 1.82 | [0.34-9.86] |
| **Main occupation (Ref: Farming)** | | | | |
| Trading | 0.96 | [0.54-1.72] | 1.09 | [0.49-2.39] |
| Hairdressing/Dressmaking | 0.45 | [0.17-1.21] | 0.71 | [0.21-2.34] |
| Housewife | 1.33 | [0.66-2.65] | 1.85 | [0.61-5.64] |
| Others | 091 | [0.22-3.67] | 1.19 | [0.52-2.71] |

| | | | | |
|---|---|---|---|---|
| **Valid national health insurance (Ref: Yes seen & valid)** | | | | |
| Otherwise | 1.13 | [0.67-1.92] | 1.27 | [0.72-2.24] |
| ***Household characteristics*** | | | | |
| **The main source of water (protected)** | | | | |
| unprotected source | 1.47 | [0.85-2.54] | 1.00 | [0.43-2.79] |
| **Household size** | 0.97 | [0.92 - 1.02] | 1.01 | [0.91 – 1.02] |
| **Treatment (Ref: control)** | | | | |
| **Treated** | 2.03*** | [1.20-3.43] | 0.71 | [0.35-1.43] |
| **N** | Observations =3,422 | | Observations=2,215 | |
| ***p<0.1; **p<0.05; ***p<0.01** | | | | |

**Source: Generated from Baseline (2007-2011) and End-line (2012-2015) data of GEHIP**

From Table 6.1 above, it was observed that the sex of the child was not significantly associated with under-five mortality in the baseline but was significant at the end line. In the end line, female children have lower likelihood of dying before the age five relative to children of the opposite sex. This was in line with a study conducted by Ettarh & Kimani (2012) to investigate the determinants associated with under-five deaths in Kenya. The baseline finding is contrary to the trend of studies conducted by various scholars (Wegbom et al., 2019; Budu et al., 2021; Van Malderen et al., 2019) who found statistically significant relationships between the sex of a child and under-five mortality. In their studies, they found that male children have higher odds of dying before age five as relative to female children.

The first hypothesis for this study was children of educated mothers have a higher probability of surviving to age five as relative to children of uneducated mothers. This was however contrary to this study. In this study, the category of educational level that is significantly related to under-five mortality was junior secondary/middle school, with

children of mothers with junior secondary/middle school having higher odds of experiencing under-five mortality as relative to children of mothers without formal education. This finding is contrary to studies conducted by Nattey et al. ( 2013) Nyaaba et al. (2020), and Balaj et al. (2021). In their studies, they found that children of educated mothers have lower odds of dying before age five as relative to children of uneducated mothers. It was also observed that at the end-line the educational level of the mother was not significantly correlated with children dying below the age five. This finding could be attributed to the several interventions in the region such as the CHPS initiative, the NHIS, and most importantly GEHIP conducted in the region. They have made health care and health education accessible and within reach of all manner of persons in the region.

The second hypothesis for this study was children of mothers who practice breastfeeding have lower likelihood of dying before age five as relative to children of mothers who do not practice breastfeeding. This hypothesis was in line with the findings from this study. Both in the baseline and in the end-line, children who were breastfed were less likely to die before the age of five as relative to children who have not been breastfed. In the baseline, children who were not breastfed are 5.3 times as likely of dying before age five as relative to children who are breastfed, and in the end-line, children who are not breastfed are 8.22 times as likely to die before age five. This finding was in line with other studies (Otupiri et al., 2010; Darkwah et al., 2014; Honwana & Melesse, 2017; Aberuka et al., 2017). In their studies, they found that children of mothers who do not practice breastfeeding have higher odds of dying before age five as relative to children of mothers who practice breastfeeding. This find also goes to confirm that breastfeeding is

a persistent factor that is associated with under-five mortality, whether interventions have been conducted or not in the region.

In addition, the third hypothesis was children who sleep under a treated bed net are less likely to die before age five as relative to children who do not sleep under a treated bed net. In the baseline, sleeping under treated bed net was not significantly associated with under-five mortality. However, in the end-line, sleeping under the treated bed net was significantly associated with under-five mortality. It was observed from Table 6.1 that in the end-line, children who slept under a treated bed net had lower odds of dying before age five as relative to children who did not sleep under a treated bed net. This finding is in line with a study conducted by Deribew et al. (2012) in Ethiopia. In their study, they found a significant association between the use of treated bed nets and under-five mortality. They found that children whose mothers use treated bed nets have lower likelihood of dying before age five as relative to children whose mothers do not let them sleep under a treated bed net. In this study, sleeping under a treated bed net was not significantly associated with under-five mortality in the baseline but was associated with under-five mortality in the end-line. This could be because of the GEHIP interventions in the region which included educating people on the need to sleep under a treated bed net and its effective utilization, thus being reflected as improving the under-five mortality situation in the end-line.

The fourth hypothesis of this study was children of mothers who have had a completed number of specified vaccinations in a particular stage of life are less likely to die before age five as relative to children who received a lesser number of vaccinations in a particular stage of life. This hypothesis was found to be in line with the finding of this

study as it was observed that children who received vaccinations have lower odds of dying before age five both in the baseline and in the end-line. From Table 6.1, in the baseline results, children who received vaccinations have a lower odd (0.91) of dying before age five as relative to children who have not received vaccinations at a particular stage of life. Also, in the end-line, children who received vaccinations have lower odds (0.86) of experiencing under-five mortality as relative to children who do not receive the required number of vaccinations. This is in line with studies conducted by Nyarko et al. (2001), Bawah et al. (2010) and Darkwah et al. (2014). In these studies, they found a significant association between vaccination of children and under-five mortality. They found that children who received vaccinations are less likely to experience under-five mortality as relative to children who have not received vaccinations. The recurring nature of the association of vaccination and under-five mortality in both the baseline and end-line suggests that vaccination is a key determinant in reducing children dying before the age five. During the GEHIP study, ensuring children received their required vaccinations was a strategy that was prioritised to reduce child deaths.

Findings indicate that the household's source of water was not statistically significantly related to under-five mortality at both the baseline and end-line. Finally, although not included as a main independent variable, there was the need to control for the type of area of the study – whether treatment or comparison. In Table 6.1, it was observed that the treated areas are associated with under-five mortality in the baseline as relative to the control areas. However, after the GEHIP intervention, a reduction in under-five mortality was realised at the end line, per the odd ratios (0.71) although this was not a significant relationship. This finding is in line with a study conducted by Awoonor-Williams et al.

(2013) which showed that the GEHIP interventions have helped in the reduction of under-five mortality in the region.

### 6.1.1 Limitations of the Study

As expected, this study was confronted with several challenges. Many variables such as, wealth status of mother, birth interval, birth order of child, weight of the child at birth or size of child at birth that have been identified as being statistically significant in predicting under-five mortality by other studies have not been included in this study because the dataset does not include these variables. A number of variables such as children ever born, and birth interval were not included in the study because the variables were extremely skewed. Moreover, they were automatically dropped from the model by the statistical software, STATA, because of collinearity.

Also, the five-year period between the interventions was too short for this study. It would have been more appropriate to use ten or more year intervals for the study to identify significant changes in under-five deaths. Thus, the duration used was a limitation to the study.

In addition, since the GEHIP study was a plausibility study, there were fewer areas for the sample selection for the study. Also, because the study was conducted in a retrospective manner, it could lead to bias in reporting under-five mortality since most of the respondents may have not been able to recollect all deaths properly.

### 6.1.2 Strengths of the Study

The strength of this study is that the sample size was large, and the response rate was also high. The method of sampling indicates a sample that was representative of the population being studied, and this adds validity to the results and findings of the study. Besides that, the data collected by GEHIP obtained ethical clearance from the Ghana Health Ethics committee thereby ensuring this study was ethically accepted.

# CHAPTER SEVEN

# SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

## 7.0 Introduction

This section summarises the study, draw conclusions, and recommendations based on the finding of the study. It provides results and findings on the determinants of under-five mortality in the Upper East region of Ghana using longitudinal or repeated cross-sectional data from GEHIP surveys carried out in 2011 and 2015. In addition, the chapter concludes based on the study's findings, and makes recommendations on improving strategies to moderate under-five mortality in the region.

## 7.1 Summary

The purpose of this study was to determine socio-economic, socio-demographic, socio-cultural and household factors that affect children dying below the age five in the Upper East region of Ghana. Specifically, the purposes of this study were to: (1) identify the determinants that are associated with under-five deaths in the Upper East region; and (2) examine the determinants that affect children dying before age five over a period in the region. Finally, the study seeks to inform policy based on recommendations from this study.

The maternal level of education, the mother's occupation, marital status of the mother, religion of mother, maternal age, the source of drinking water, use of a treated bed net, enrollment on national health insurance, sex of a child, breastfeeding, and vaccinations

of the child were the determinants used in the study. The data used for this study were the GEHIP baseline and end-line data sets carried out in 2011 and 2015, respectively, to investigate determinants of under-five mortality and these determinants over the period of the GEHIP study. The sample used for this study only included mothers aged 15 to 49 years, with children born alive within five years before the GEHIP baseline and end-line surveys.

Three different stages of analysis were used in this study. At the univariate stage, descriptives were conducted on the characteristics of the mother of children and under-five children born five years before the GEHIP surveys. Cross-tabulation and chi-square tests were employed at the bivariate level to investigate the existence of an association between determinants of women and children and under-five mortality in both waves. T-tests were also carried out between numeric variables and under-five mortality for both waves. At the final stage of analysis, binary logistic regression models were employed to test for determinants that were significantly associated with under-five mortality at both waves of the study.

From the univariate results, 3514 under-five children were observed in the baseline and in the end-line, a total population of 2752 under-five children was observed. At the bivariate level, exclusively breastfeeding was significantly associated with under-five mortality at the baseline, and the end-line sex of the child, breastfeeding, and sleeping under a treated bed net were significantly associated with under-five mortality. Results from the multivariate stage of the analysis suggest that three variables were statistically significantly related to under-five deaths in the baseline. They include breastfeeding, the number of vaccinations received at a particular stage of life for the child, and the

educational level of the mother. In the case of the end-line, the sex of the child, breastfeeding, sleeping under a treated bed net, and the number of vaccinations received at a particular stage of life of the child were significant determinants of under-five mortality. It was however observed that breastfeeding and the number of vaccinations received in a particular stage of life of the child were significant determinants of under-five mortality in both the baseline and end-line**.** The second, third and fourth hypotheses were supported by the findings. However, for the final hypothesis, children of mothers who have their main source of water from a protected source are less likely to die before age five as relative to children of mothers who have their main source of water from unprotected source, was rejected because both in the baseline and end-line there was no correlation between drinking water source and the likelihood of children dying before age five.

### 7.2 Conclusions

As stated earlier, under-five mortality is still high in most developing countries. Ghana is one of these several countries experiencing high under-five mortality in the world. Results carried out at both the bivariate and multivariate levels revealed that some of the determinants that were significant at the baseline were different from those determinants that were significant at the end line, except for breastfeeding and the number of different vaccinations received by children that were significant at both baseline and end-line at the multivariate level. Multivariate analysis results suggest factors that were significantly associated with under-five mortality at the end-line were the sex of the child, breastfeeding, the number of different vaccinations received in a particular stage of life

and sleeping under a treated bed net. The change in the determinants of under-five mortality between the baseline and end-line could be the policies and interventions, especially the GEHIP intervention that has led to these changes in the end-line. Considering the importance of reducing the number of children dying below the age five to the world and to meeting the SDG 3 target 2, similar studies must be replicated to investigate the determinants of under-five mortality to meet this important sustainable development goal.

### 7.3 Recommendations

From the multivariate analyses results, it was observed that breastfeeding and the required number of vaccinations received by a child at a particular stage of life were the persistent determinants of children dying before age five in both periods of the study. It is therefore suggested that mothers of children should be encouraged to practice breastfeeding continuously and exclusively since findings showed that having ever been breastfed reduced the number of children dying before the age five. Also, interventions by the Ghana Health Service, such as vaccinations of children against childhood killer diseases, should be intensified since vaccinations provide children with strong immunity against these diseases. Mothers should be encouraged to vaccinate their children against diseases and health workers should intensify their efforts to avoid trace defaulters.

In addition, the Ghana Health Service should continue to promote the use of sleeping under a treated bed net, by providing them to the rural communities and educating the people on the need to use treated bed nets since they are seen to prevent malaria in

children, and thus, reduce under-five deaths. It is believed that prior to GEHIP interventions, the treated bed nets that people may have owned were perhaps not being used effectively by respondents. However, after the GEHIP interventions respondents were educated on its proper use, thereby improving its effective utilization. This may have led to this indicator becoming a significant factor of children dying before they turn age five at the end line.

Finally, further research should focus including determinants such as birth interval, children ever born, vaccination, and exclusive breastfeeding, since this study was unable to.

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