

**REGIONAL INSTITUTE FOR POPULATION STUDIES
UNIVERSITY OF GHANA**

TRENDS AND DIFFERENTIALS IN INFANT DEATHS IN GHANA, 1988-2014

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ACCEPTANCE

Accepted by the Regional Institute for Population Studies (RIPS), College of Humanities,
University of Ghana, Legon, in partial fulfilment of the requirement for a degree of Master of
Arts (MA) in population Studies.

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Date

DECLARATION

I **MICHAEL AMPONSAH**, hereby declare that this submission is my own work towards the award of the M.A degree and that, to the best of my knowledge, it contains no material previously published by another person nor material which had been accepted for the award of any other degree of the university, except where due acknowledgement had been made in the text.

.....

Michael Amponsah (Student)

DEDICATION

I dedicate this work to my siblings; Hannah Larbi and Samuel Appiah, for their prayers and support during my academic programme. You really made my work and academic achievements a success, may God Almighty bless you.

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LIST OF ABBREVIATIONS AND ACRONYMS

ASYMP SIG : Asymptotic Significance

CHPS : Community-based Health Planning and Service

DHS : Demographic and Health Survey

GSS : Ghana Statistical Service

GDP : Gross Domestic Product

IMR : Infant Mortality Rate

MDGs : Millennium Development Goals

OR : Odd Ratios

RIPS : Regional Institute for Population Studies

SPSS : Statistical Package for Social Sciences

SDGs : Sustainable Development Goals

UNICEF : The United Nation 's Children Fund

UN : The United Nations

UN IGME : The United Nations Inter Agency Group for Mortality Estimation

WHO : World Health Organization

DEFINITION OF KEY TERMS

- An Infant** : A baby under one year of age (0-11 months).
- Mortality** : A state of being mortal, death especially on large scale.
- Infant Mortality** : The death of the child under one year (death between 0 and 12 months).
- Determinants** ; A factor which determines the nature or outcome of something.
- Birth Interval**: Duration between the preceding the succeeding birth
- Birth Order** : The nth birth of the child to the woman; n=1, 2, 3.....
- Breastfeeding** : Feeding the baby with milk from the mother's breast
- Singleton Child** : A child who is born singly, rather than multiple births

ABSTRACT

Infant mortality has declined globally, however, sub-Saharan Africa still experiences high rate of infant deaths. Despite efforts made to reduce infant mortality in Ghana, the rate is still high. This study examines the trends and differentials in infant deaths in Ghana using the six successive Ghana Demographic and Health Surveys (GDHS). The general objective is to examine the trends and differentials in infant deaths in Ghana from 1988-2014 using 1988, 1993, 1998, 2003, 2008 and 2014 GDHS data set to establish the relationships between mothers' background characteristics and infant mortality in Ghana over time. The study hypothesised that children born to mothers whose source of water is improved are less likely to die before age one compared to those with unimproved source. The chi square test was used to examine the statistical association between socio-economic, demographic and environmental factors of mothers and infant deaths. To test the robustness of the statistical associations, a binary logistic regression was employed to examine predictors of infant deaths using the 2014 GDHS. The results showed a continuous decline in infant deaths over the period between 1988 and 2014 and variations in the significant factors affecting infant deaths over the period. Four variables; region of residence, ethnicity, type of toilet facility and birth order showed statistically significant association with infant deaths in 2014. After running the regression model, ethnicity and birth order emerged as the significant factors of infant mortality making the study not an exceptional one, as other studies have come out with similar findings. The study recommends ethnic centered education on factors affecting infant deaths and intensification of family planning campaigns especially in the rural areas so as to reduce infant deaths in Ghana.

CHAPTER ONE

INTRODUCTION

1.0 Background

Infant mortality, defined as the risk of a live born child dying before its first birthday is known to be one of the most sensitive and commonly used indicators of the social and economic development of a population (Masuy-Stroobant & Gourbin, 1995). Infant deaths are usually represented as a rate per 1000 live births. Infant mortality rates are expressed by age categories such as neonatal mortality, that is the probability of dying within the first month of life and post neonatal mortality, that is the probability of dying between the first month and a year (GSS/GHS/ICF, 2015).

It is a key indicator of a country's socio-economic development and quality of life and health status (UNDP, 2007). It has often been used as an indicator of human development (Gerring, Thacker and Alfaro, 2012) or population health (UNDP, 2007, United Nations, 2013). Thus, it is a development indicator for health and socioeconomic status, quality of life and life expectancy of a population (Mustafa & Odimegwu, 2008, Mekonnen, 2011). The measures of infant mortality also help in making significant contributions to the appreciation of the advancement in population and health related programs and policies and also to make population projections as well as identifying promising directions (GSS/GHS/ICF, 2014).

Globally infant mortality rate has declined from an estimated rate of 63 deaths per 1000 live births in 1990 to 32 deaths per 1000 live births in 2015 (World Population Data Sheet, 2015). This translates into an annual decline from 8.9 million in 1990 to 4.5 million deaths in 2015 (Global Health Observatory Data, 2015). The rate in Africa is however still high at 59 deaths per 1000 live births. Sub-Saharan Africa has the highest in the region with a rate of 64 deaths per 1000 live births (World Population Data Sheet, 2015).

Even though there has been unprecedented decline in mortality and the corresponding increase in expectation of life of the twentieth century sub-Saharan Africa, the decline in infant deaths has slowed considerably over time, from an annual reduction of 2.2 percent between 1970 and 1985 to around 1.3 percent since then (Laakso et al., 2007 in Handa et al, 2008).

Reports on available data on demographic and health survey points to the fact that between 1988 and 2014, Ghana recorded an uneven decline in infant mortality (GSS/GHS/ICF, 2014). Also, the UNDP report has recorded a continuous decline over a decade, from 64 in 2003 to 41 in 2014 against a target figure of 22 by 2015. The rate, which stood at 66 deaths per 1,000 live births in 1993, dropped to 57 deaths per 1,000 live births in 1998. It rose by 7 points to 64 deaths per 1,000 live births in 2003 before declining continuously to 53 deaths per 1000 live births in 2013. Yet, Ghana did not achieve the millennium development goal target of 21 infant deaths per 1,000 live births by the year 2015 in spite of some key policy interventions. Key challenges were identified such as inadequate national data to provide complete and reliable information on child health, lack of well-motivated personnel with adequate skills in the health system to improve the poor quality of care, lack of adequate resources to support activities under EPI (Expanded Programme of Immunization) as well as socio-economic and socio-cultural factors including low female literacy rates and low levels of women's empowerment (UNDP, 2015).

Ghana as a signatory of the Sustainable Development Goal (SDG) is expected by Goal 3.2 to reduce under-5 mortalities to as low as 25 per 1000 live births and neonatal mortality to at least as low as 12 per 1000 live births, which when achieved, would reduce infant mortality rate.

Research has shown that lower IMR is related with higher Gross Domestic Product (GDP) per capita and education (Pamuk, Fuchs and Lutz, 2011; Wang et al, 2014), better water and sanitation (Cheng, Schuster-Wallace, Watt, Newbold and Mente, 2012), better access to health care (Gruber, Hendren and Townsend, 2014), more foreign aid (Arndt, Jones, Tarp, 2013)

having a history of democracy (Gerring, Thacker and Alfaro, 2012), and in Sub Saharan Africa, with democratization (Kudamatsu, 2012). Wang et al (2014) also attribute lower infant mortality to higher income, more education and improved infrastructure.

The death of infants is a matter of great concern to all stakeholders such as the governments, civil society groups, parents, families and international organizations. Even though death is a biological event, mainly caused by a specific disease, studies have shown that, cultural, environmental, social and behavioural factors influence the likelihood of ill health, disease and death in early infancy. It is therefore very essential to study trends and differentials in infant deaths to identify these factors and their likelihood of influencing deaths in infants in Ghana.

This work will focus on the trends and differentials in infant deaths in Ghana using Ghana Demographic and Health Survey (GDHS) data sets from its inception in 1988 to the current GDHS 2014. It will assess the effects of the mothers' socio economic, demographic and environmental factors on infant deaths so that more effective measures would be taken to help curb this problem.

1.1 Statement of the Problem

Infants suffer the highest consequences of negative health outcomes from socio-economic issues and social disadvantages. This is because infants, more than any other age group, are particularly vulnerable to their immediate living conditions, thus it is important that infant mortality be a focal point of any society to ensure that their levels are kept low (Dube, 2012). Although there have been dramatic advances in reducing childhood mortality in general, the burden of mortality in the first year of life has remained virtually unchanged. In 2015 it was

recorded that, 4.5 million (75% of all under five mortality deaths) occurred within the first year of life (WHO, 2015).

Trends in Infant mortality globally have seen a substantial reduction in infant mortality across regions, from an estimated rate of 63 deaths per 1000 live births in 1990 to 32 deaths per 1000 live births in 2015, seeing an annual decline from 8.9 million in 1990 to 4.5 million in 2015 (Global Health Observatory Data, 2015). In spite of the decline, the risk of a child dying before age 1 was highest in Africa indicating 55 per 1000 live births (WHO, 2015). Sub-Saharan Africa has the highest infant mortality rate in the region and across the globe. The infant mortality rate in sub-Saharan Africa was 94 deaths per 1000 live births in the early 2000's (Frisbie, 2004) and 56 deaths per 1000 live births in 2015 (World Bank, 2015).

In Ghana, 68% of all deaths among children under-5 takes place before the child's first birthday thus one in every 24 children dies before reaching age 1 (GSS, 2014). Although evidence shows that there has been a significant reduction in infant mortality rates in Ghana over the years (GSS/ICF, 2010); infant mortality has remained high at 41 per 1000 live births in 2014 (GSS, 2014) and 43 in 2015 (IGME, 2015) against the Millennium Development Goal target of 22 in 2015. Thus, the country did not achieve the MDG regardless of the health intervention programs such as implementation of the Child Health Policy and Child Health Strategy, establishment of child welfare clinics, sustaining the Expanded Programme on Immunization (EPI), increased use of insecticide-treated nets (ITNs) and improved malaria case management. Others include the expansion of community-based health service delivery, National Health Insurance Scheme (NHIS) and children from their parents for NHIS coverage, scaling up the Integrated Management of Childhood Illnesses (IMCI) programme and increasing the number

of Community Health Planning Services (CHPS) compound (UNDP, 2015). This is due to certain key factors comprising socio-economic and socio-cultural factors (UNDP, 2015).

It is therefore clear that more research needs to be conducted on the socio-economic, and socio-cultural factors as well as other factors such as demographic and environmental and their association with infant deaths so that, well informed policies can be made to minimize infant deaths in Ghana and improve children's health in general. Hence, there should be a concerted effort from all stakeholders to help reduce infant deaths drastically and also achieve the SDG target of 25 infant deaths per 1000 live births.

1.2 Research Questions

1. What are the trends in infant deaths from 1988 – 2014 in Ghana?
2. What socio economic, demographic and environmental factors of the mother affect the mortality of infants?

1.3 Objectives of the Study

1.3.1 General Objective

1. To examine the trends and differentials in infant deaths in Ghana from 1988-2014 using 1988, 1993, 1998, 2003, 2008 and 2014 GDHS data sets, so as to establish the relationships between mothers' background characteristics and infant mortality in Ghana over time.

1.3.2 Specific Objective

1. To describe the demographic, socio economic and environmental characteristics of mothers of children under one year from 1988 - 2014
2. To establish relationships between mother's background characteristics and infant deaths from 1988 – 2014.

3. To establish relationship between the sex of the child and infant deaths from 1988 - 2014
4. To examine how changes in the background characteristics of the mother have affected infant deaths from 1988 – 2014.

1.4 Rationale of the Study

Trends in infant deaths helps to give reasons for why mortality has fallen and why it has not. It also informs us of the extent to which a particular health intervention programme had reduced mortality. Children are vital national assets to every country and therefore require investment in them to ensure a just society, a strong economy and a world free from poverty, disease and hunger in the future. The rates of infant deaths are indicators of assessing standards of living and health status of the people of a country. Hence high rate of infant deaths in Ghana indicates a poor standard of living and poor health status of the country.

Research indicates that socio-economic, demographic, biological, cultural, as well as environmental factors influences infant deaths. Therefore, governments need an in-depth understanding of the trends and differentials in infant deaths as well as these factors that influence them in the various sectors of a country in order to aid in prolonging the live of its people. Studies of socio-economic, demographic and environmental and their influence on infant deaths are used to identify factors that promote child survival as well as those that are detrimental to it. Accordingly, mortality analysis is useful to identify promising directions for health programme and advancing child survival efforts (GSS/GHS/IGF, 2004).

More infant deaths may impede the development of a country as it reduces probable human resource for the future. Therefore, if it is not well addressed there will be a future surge in the

aged population and a shrink in the youthful population leading to low productivity attributable to inadequate labour force in the working-class population.

The motivation for this study is that, infant loss cannot be under-estimated in any society irrespective of its development. The study is very significant because, it uses reliable data from the Ghana DHS 1988, 1993, 1998, 2003, 2008, and 2014 to draw conclusions about the general population of infants in Ghana which was based on the information obtained from a sample of Ghanaian women. Research findings of the study will enable stakeholders to have much insight into the trends and differentials of infant deaths and the significant factors associated with it from 1988 to 2014 in order to serve as a guide in the formulation and implementation of child survival policies in the country. In addition to these, the outcome of this study would provide an additional source of information to the literature on infant mortality in Ghana. In this regard, the research findings will be a contribution to knowledge and a basis for further research into infant mortality in Ghana and the world at large. In turn, this will call for appropriate health and social policies which can lead to sound health interventions and ultimately make positive contributions towards infant mortality decline in Ghana.

1.5 Organization of the Study

The study is organized into seven chapters. Chapter one is on the background of the study, statement of the problem, objectives of the study and rationale of the study. Literature review, conceptual framework and hypothesis of the study comprise the second chapter while methodology (data sources, methods of analysis, measurement of variables, sampling procedures, limitations and organization of the study) constitute chapter three. Chapter four focuses on descriptive statistics of background characteristics of the study population using GDHS 1988, 1993, 1998, 2003, 2008 and 2014. Chapter five establishes associations between background

characteristics of the study population and infant deaths and identifying the important factors that are significant with the dependent variable. Chapter six used the 2014 data for the multivariate analysis and chapter seven summarizes the results of the study as well as giving conclusion and recommendations based on the major findings.

CHAPTER TWO

LITERATURE REVIEW

2.1 Maternal Age and Infant deaths

Several studies have revealed that, age of the mother is statistically significant to infant deaths. For example; mothers between 15 to 19 are about 2.4 times more likely to experience child death compared to those who had theirs at ages 20-34 (Ntimba and Mbago, 2005). Generally, it is expected that children born by young mothers aged less than 20 years and older mothers aged 40-49 years should experience higher mortality than those born to mothers aged 20-39 years (Mustafa and Odimegwu, 2008, Kembo and Ginneken, 2009). Tawiah (1979) studied some demographic and social differentials in infant and early childhood mortality in Ghana and observed higher infant deaths occurring to youngest and oldest mothers recorded as 14% and 95% respectively, compared to mothers of 20-24 years age group. According to the study, the rate rose after age group 20 to 24 till 145 infant deaths per 1000 live births was observed among women of age group 45 to 49. This means that, youngest and oldest mothers have higher tendency to experience infant deaths compared to mothers of 20 to 24 years age group.

2.2 Level of Education of the Mother and Infant Deaths

The single biggest factor, proven to reducing death rate among children younger than five years is greater education for women (Fischetti, 2011). In all countries worldwide, whether females increase schooling from 10 years to 11 years or two years to three, infant mortality declines (Fischetti, 2011). Women with more education tend to have smaller families, in part because of increased employment opportunities and better knowledge about contraception; fewer children in a family improves the chances that an infant will survive (Fischetti, 2011). More education also enables women to make better decisions about many health and disease factors such as prenatal care, basic hygiene, nutrition and immunization-which are vital to reducing

the leading cause of death in children (Fischetti, 2011). However, in a study on the “impacts of household and community level environmental factors on infant and child mortality in rural Kenya”, K’oyugi (1992) observed that maternal education of under nine years had insignificant protective effects on infant mortality. Caldwell (1979), reported the effect of maternal education and age of mother at first birth in reduction of infant mortality. His theory that mother ‘s education works through changing feeding and care practices, leading to better health seeking behavior and by changing the traditional familial relationships that adversely affect childcare practices. Infant mortality is attributed to a complex interplay of socio-economic, demographic, environmental, biomedical and cultural factors (Mustafa and Odimegwu, 2008). They also highlight some evidences from studies that used data of censuses (Tulasidhar, 1993) and demographic surveillance systems (Bhuiyat, 1991), which show the same mortality differential by maternal education.

Zerai, (1996 in Kembo and Ginneken, 2009) also studied socio-economic and demographic variables in a multi-level framework to determine conditions influencing infant survival in Zimbabwe. Using the cox regression analysis to the 1988 Zimbabwe DHS data to study socioeconomic determinants of infant mortality, the finding was that women ‘s average educational levels in their community exert a greater influence on infant survival than the mother ‘s educational level. This result is in support of the assertions that child survival is strongly influenced by mass education.

Ntimba and Mbago, (2005) conducted a study in Karagwe District in Kagera region of Tanzania on —some socio-economic and demographic determinants of infant and child mortality. The results of their study revealed that, years of schooling are closely related with child death experience. That is, the lower the years of schooling of mother, the higher the

childhood mortality she experiences and vice versa. However, Adetunji, (1995) indicated in the study conducted in the Ondo state of Nigeria by examining the 1986-1987 DHS, that, infant mortality was higher among children who were born to mothers with secondary education compared to uneducated mothers.

2.3 Employment Status of the Mother and Infant deaths

Employment status refers to the type of employment a person is engaged in, in return for regular payment. A study conducted by Ntimba and Mbago, (2005), in Tanzania, found that employed mothers were about 2.3 times less likely to experience child deaths as compared to mothers who were unemployed. Lin (2006) in "The effects of economic instability on infant, neonatal and post neonatal mortality rates: Evidence from Taiwan" used a data set comprising 23 cities in Taiwan for the years 1979-2002 and a fixed-effects model to find evidence of the effect of economic instability on infant, neonatal and post neonatal mortality rates. In addition, the effects of income, demographic factors and the availability of medical resources were also examined in relation to childhood mortality. The most important finding in the work was that, infant, neonatal and post neonatal mortality rates move counter-cyclically with the city unemployment rate in Taiwan. Also, it was found that, the impact of economic instability on the infant, neonatal and post neonatal mortality rates was found to be the strongest in the eastern part of Taiwan where there are few health care resources.

2.4 Place of Residence of the Mother and Infant Mortality

Studies have shown that, mothers who live in rural areas are more likely to experience higher infant deaths than to those residing in urban areas. A study by Adewuyi (2017) on the risk factors for infant's mortality in rural and urban Nigeria, concluded that infants in rural areas had higher rates of mortality than their urban counterparts and inequalities in risk factors

between them. This can be attributed to the poor living standards and or lack of education to most women living in rural areas. Nevertheless, results by Ntimba and Mbago (2005) showed insignificant association when the variable (place of residence) was combined with other socio-demographic factors such as maternal education, wealth index of the household, age at first birth, birth interval and birth order. Gaisie (1979), in his study of some selected African cities by mortality differentials among rural and urban residence found that, urban dwellers have a higher life expectancy at birth than their rural dwellers. The study further revealed a relatively lower rate in most African urban areas compared to rural areas.

Gyamfi (2002) found type of place of residence of the mother as a significant independent determinant of infant mortality in his multivariate analysis. The study indicated that children born to mothers living in rural areas are more at risk of dying compared to those in urban areas. Children born to mothers at the urban areas are 42 percent less likely to experience infant deaths than rural dwellers. Twum-Baah et al. (1994) analyzed nationwide survey for infant, child and maternal mortality in Ghana. The study found lower infant mortality rates for women in urban areas compared to those in rural areas. Urban areas in Ghana in 1992 recorded 70 infant deaths per 1000 live birth whilst rural areas recorded 86 deaths per 1000 live births. This can be a result of the disparities in the distribution of facilities necessary for maintaining adequate health in favour of urban areas. Gyimah (2004) also studied maternal education and infant mortality in Zambia and found that, the mortality risk of infants in the rural areas is different in the urban areas. The results showed that mothers who live in urban areas are less likely to record infant deaths by a factor of 0.11 compared to their rural counterparts. Tettey's (2003) studies in Ghana and Nigeria showed a significant relationship between place of residence and infant mortality in Ghana. The study showed that mothers of infants in rural areas experienced high infant and child mortality rates of 67 deaths per 1000 live births whilst their counterparts in the urban

areas had 43 deaths per 1000 live births. It was observed that norms, beliefs and culture also influence infant and child survival aside lack of medical facilities for infants and in rural areas.

2.5 Ethnicity and Infant Mortality

Suwal (2001) investigated the factors that contribute to either low or high rate of infant mortality in Nepal. The study used data from the 1991 Demographic and Health Survey of Nepal. It was concluded after fitting a logistic regression model that, among the entire variables used for the analysis in the study, ethnicity was among the most influential risk factors of infant mortality with others like place of residence, parity, and immunization. Also, a study conducted by Mustafa and Odimegwu, (2008) in Kenya indicated Ethnicity as one of the most important determinants of mortality in both urban and rural settings.

2.6 Environmental factors and Infant Deaths

Appropriate medical attendance during pregnancy and clean environmental condition during delivery can reduce the risk of infections and possibly deaths for both the mother and the baby (Gyimah, 2004). Gyimah (2004) contented that, mothers who delivered at health facilities were less likely to experience infant mortality than those who delivered at home. Thus, for sound reduction of health risks of the mother and the child, the health-facility-based deliveries should be increased. Various studies have also established the effects of type of toilet facility on infant mortality. Incidence of infectious diseases such as diarrhoea is seen to be influenced by the state of the environment. The type of toilet facility may facilitate pollution and contamination of the environment and consequently affect infant mortality. According to unpublished study conducted by Wak, (2002) in the Kassena-Nankana District in Ghana, infant mortality is experienced by children whose compounds have no toilet facilities while those who use water closet or pan toilet latrine experience the lowest infant deaths.

This study further indicated that children born to mothers whose drinking water is from unprotected sources, experience high infancy deaths than children born by mothers whose drinking water is from protected sources. Folasade (2000) also did an investigation to determine the relative significance of environmental and maternal factors on childhood mortality in two contrasting towns in southwestern Nigeria. While most studies have focused only on the effect of maternal factors on childhood mortality on one hand, others have suggested the effects of only environmental factors. Folasade (2000) therefore integrated the separate influence of environmental and maternal factors on childhood mortality. The conclusion was that; domestic environmental conditions were stronger predictors of child mortality in the more developed study town of Ota than in the more traditional town of Iseyin.

Agha (2000) also investigated the determinants of infant mortality in Pakistan. The study examined the factors which are associated with the survival of infants in Pakistan using data from the Pakistan Integrated Household Survey, 1991. The study stated that, the infant mortality rate was still very high in Pakistan until the early 1990s at 100 deaths per 1000 live births. It showed that, there is no evidence of a secular decline in infant mortality during the 1980s. It was therefore concluded that, the underlying cause of the stagnation of infant mortality in Pakistan is due to the large differentials in infant survival by socio-economic factors, access to water and sanitation.

2.7 Breastfeeding and Infant Mortality

Infant feeding guidelines by World Health Organization (WHO, 2003) recommends that all infants should be breastfed within one hour after birth and exclusively breastfed from birth until 6 months of life. Thereafter, infants should be introduced to nutritionally adequate and safe complementary foods with continued breastfeeding for up to 2 years or beyond. A study conducted by Mustafa and Odimegwu, (2008) in Kenya found breastfeeding as the most

important determinant of infant mortality followed by ethnicity, and then fertility factors (birth order and intervals) and the least is the sex of the child. Once the child has survived the first month, ethnicity becomes the most important determinant of mortality in both urban and rural settings, then, followed in sequence by breastfeeding status, sex of the child, fertility factors, and the least significant ones are the mother 's occupation and her highest level of education attained.

A study by Handa et al, (2008) also found that, the rate of breastfeeding has declined in Tanzania, Zambia and Malawi. For example, in Malawi a 16-percentage-point decline between 1992 and 2004 led to an increase in the mortality risk by 8%. Breastfeeding status as the most important determinant of infant deaths is subject to many reasons; the first four months of infancy period is usually a period of exclusive breastfeeding, the stopping of breastfeeding for any reason (such as gastro-intestinal illnesses) could affect the survival of the infant. Furthermore, those neonates with congenital anomalies or premature usually have problems with breastfeeding hence they are prone to higher risk of dying (Mustafa and Odimegwu, 2008).

2.8 Fertility Factors and Infant Mortality

The length of birth interval is one of the important bio-demographic factors that influence infant and child mortality; and it is a common problem in most developing countries. Mortality theories indicated that short birth interval is associated with high risk of infant and child mortality due to physiological and nutrition depletion of the mothers which relate to premature child births and the mothers exposed to pregnancy complication (Boerma and Bicego, 1993 in Dube, 2012). According to Mustafa and Odimegwu, (2011) births order number of six or higher with short preceding birth intervals have the highest risk of mortality, that is multiple births

have a relationship with a higher mortality risk. In general, short birth interval raises the vulnerability of infectious and parasitic diseases and exposing children to malnutrition.

2.9 Sex of the Child and infant Mortality

A child 's sex has been shown to affect the probability of infant death. Owing to biological factors, male infants have a higher risk of mortality during the first year of life, as highlighted in the report by WHO (2003). In addition, differential treatment of boys and girls, owing to cultural and socioeconomic factors, may also be expected to affect the chances of survival during childhood (Kaldewei, 2010). According to research, male children experience relatively higher mortality during infancy and childhood than the females. This has been attributed to male children being biologically exposed to risks during the first year of life. For example, the study conducted by Goro (2007) in the three regions of Ghana; namely Northern, Upper West and Upper East regions found that, infant mortality for males was 84 per 1000 live births in the Upper East Region and females were 74 per 1,000 live births.

2.10 Methods applied in the study of infant deaths

Most of the investigations into the causes of infant mortality make use of the logistic regression as the method for determining the risk factors that affect the probability of a child dying before one-year-old due to the binary nature of the response variable.

Reed and Wu (2013) in " Logistic regression for risk factor modelling in stuttering research" investigated the uses of the logistic regression in stuttering. The work outlined the steps, assumptions, limitations and the principles of the logistic regression model as applied in the stuttering field. They concluded that, the logistic regression provides an employed and a recognized approach to allow for the prediction of dichotomous outcomes.

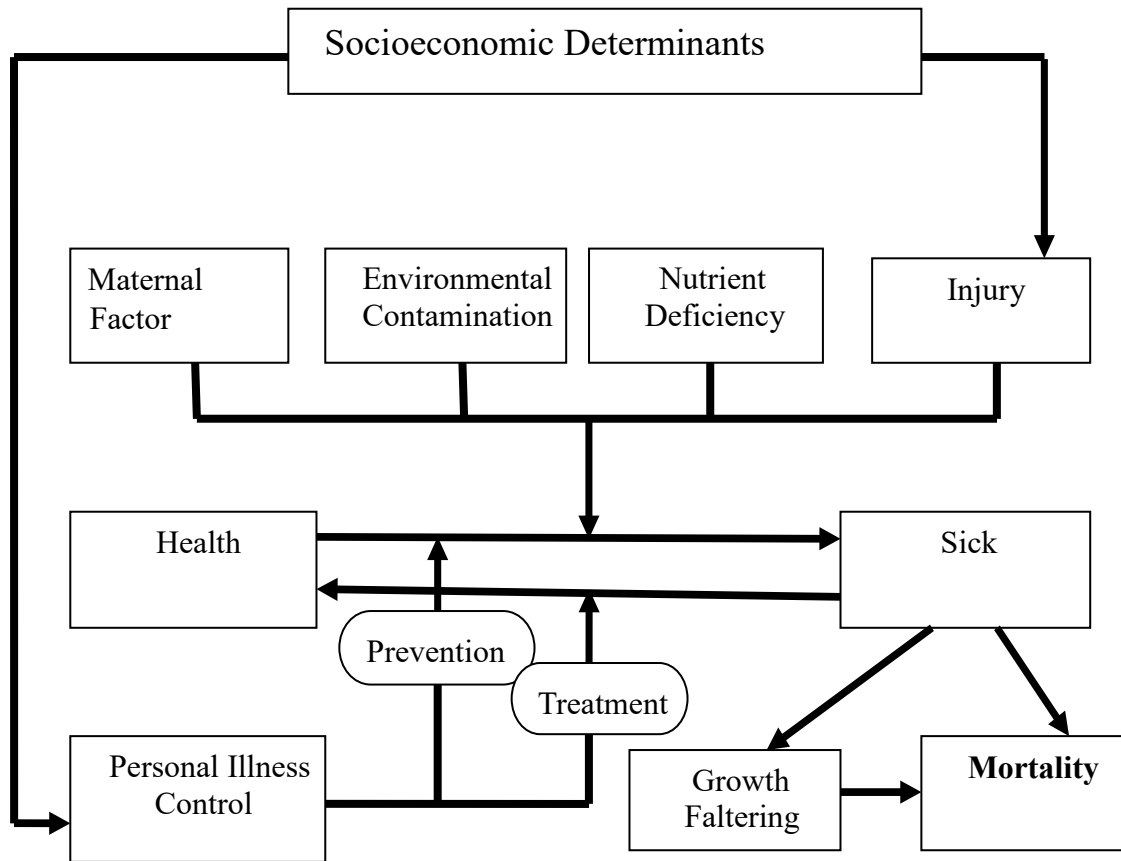
In a similar work, Peng et al. (2002) on " An Introduction to Logistic Regression Analysis and Reporting" outlined the guidelines in using the logistic regression. The article demonstrated

the application of the logistic regression method with an illustration to a hypothetical data set. It was established that, traditional ordinary least squares regression or linear discriminant function analysis were found to be less ideal for handling binary responses due to their strict statistical assumptions. It was concluded that, the logistic regression could be a powerful analytical technique when the response variable is dichotomous and that, the method has gained popularity because it is easy to access sophisticated statistical software that perform detailed analyses using the method.

2.11 Conceptual Framework

There are several conceptual frameworks developed to understand the complex web of factors affecting childhood mortality. Some of the frameworks were developed by Meegama, (1980), Mosley and Chen, (1984), Venkatacharya, (1985) and Millard et al, (1990). Out of these frameworks; the one proposed by Mosley and Chen (1984) shown in Figure 2.1, appears to be the most comprehensive. It considers demographic, environmental, behavioural and socio-economic factors, all of which are known to influence child survival in developing countries. Thus, it is essentially suitable for the study of the trends and differentials of infant mortality (as part of childhood mortality) in Ghana. However, its major limitations lie in the rarity of surveys, especially in developing countries, that can provide information on all variables specified in the framework.

Figure 2. 1: Operational Conceptual Model of the Five Groups of Proximate Determinants of the Health Dynamics of the Population

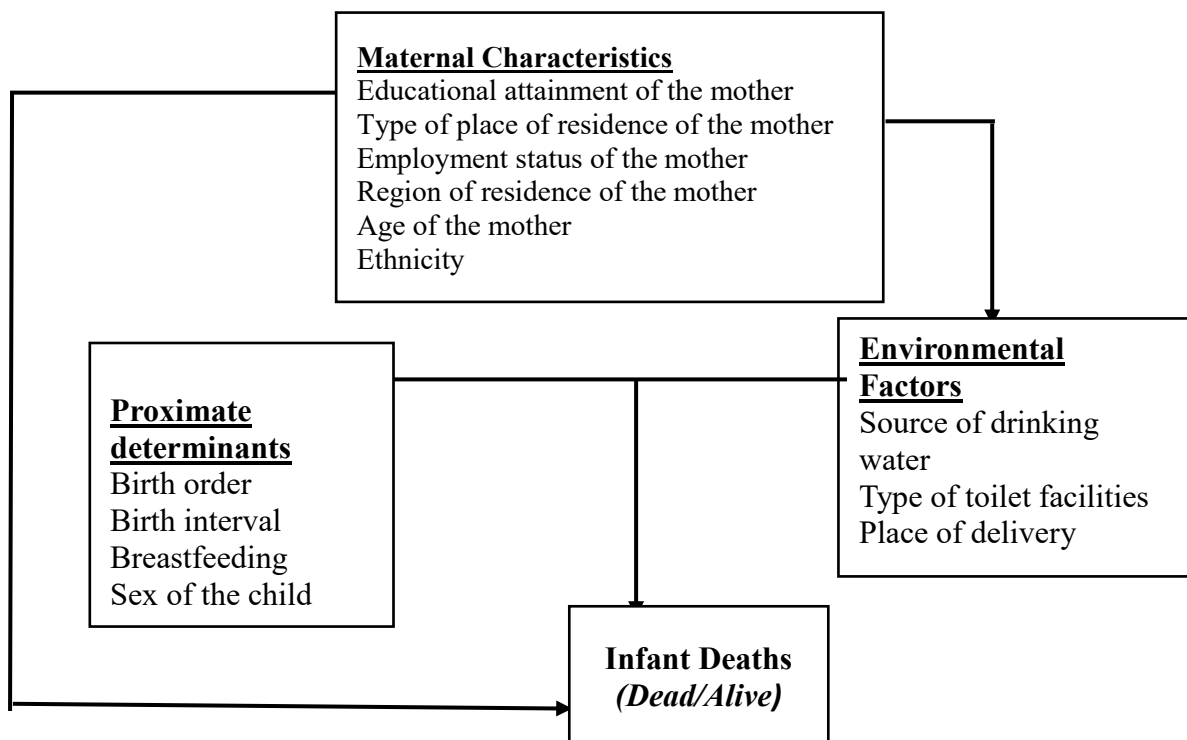


Source: Mosley and Chen, 1984

The modified framework in Figure 2.2 explicitly defines two sets of intermediate variables. The first set made up of environmental factors (place of delivery, source of drinking water and type of toilet facilities) and the second set combines biological (sex of the child), nutritional (breastfeeding), and fertility factors (birth interval and birth order), together as proximate factors through which maternal variables (such as, mother's educational level, employment status of the mother, place of residence of the mother, region of residence of the mother and mother's ethnicity) operate to influence the survival chances of an infant. Maternal educational level, maternal employment status, type of place of residence of the mother, region of residence

of the mother, age of the mother and ethnicity both directly and indirectly affect infant mortality. For example, an educated woman is more likely to use modern antenatal care and child delivery services, and to have her child immunized than uneducated mothers (Mosley & Chen, 1984; Kalu, 1997). She would also ensure adequate nutrition for her child (even when she breastfeeds for a shorter duration), and can teach and promote hygienic practice in the household compared to uneducated woman. Maternal Education heightens the mother’s ability to make use of government and private health care resources and it may increase the autonomy necessary to advocate for her child ‘s survival in the household and the outside world (Caldwell, 1979). An employed woman is also likely to breastfeed her child for a short duration and thus introducing the child to food supplements earlier than an unemployed woman. This may affect the health of the child by exposure to disease infections as the building of body immunity is denied through short duration breastfeeding.

Figure 2. 2: Conceptual Framework



Source: Mosley and Chen, 1984 modified

2.10 Hypotheses

1. Children born to mothers with higher level of education are less likely to die before age one compared to those born to mothers with no education.
2. Children born to mothers who used flush toilets are less likely to die before age one compared to those who use pit latrines.
3. Children born to mothers living in rural areas are more likely to die before age one compared to their urban counterparts.
4. Children born to mothers whose source of water is improved are less likely to die before age one compared to those born to mothers with unimproved source.

CHAPTER THREE

METHODOLOGY

3.1 Data Sources

The study used data from the women's questionnaire of the six successive GDHS of 1988, 1993, 1998, 2003, 2008 and 2014, covering all the 10 regions of Ghana. The primary objective of the data sets was to give information on the childbearing experience of women aged 15-49 years. These include information on children ever born and children dead. For each live birth, information on date of birth, sex and survival status was collected. For children who died, respondents were asked to provide information on their age at death. The surveys also provide information on socio-economic background of the respondents including; highest level of education of the mother, employment status, type of place of residence, region of residence and place of delivery among others. Also; the maternal information such as age of the mother, birth order, birth interval and children factors such as sex of the child were also gathered. This information was used in analyzing the underlying causes of infant mortality in Ghana.

3.2 Methods of Data Analysis

The Statistical Package for Social Science (SPSS), was used for the univariate, bivariate and multivariate analysis. The Univariate analysis was conducted for the purpose of describing the background characteristics of the mothers. Tabulation of each independent variable resulted in an output of frequencies and percentages of the characteristics of the mothers in the study area. This method summarizes the variables used in the study. The variable place of delivery was not captured in the 1988 GDHS data set. However attendant at delivery variable was used as a proxy. Here, doctor, trained nurse and trained midwife variables were classified as government sector, birth attendant as private, no one and relatives as home and others as others.

The bivariate analysis is the second level of analysis which was undertaken in this study. This was done on each independent (socio economic and demographic) variables as well as environmental and proximate variables against the dependent variable (infant deaths). This then showed the extent to which each of the variables was associated with the infant deaths. Pearson chi-square test was run at 95% confidence level. This test, reports chi-square value, indicating the nature of the relationship between each independent and dependent variable. At this level of the analysis, only the proportion of infant deaths were shown in the work. The proportionate distribution of infants who died and survived in each data set is shown in Appendix A.

The third stage of the analysis was the multivariate binary logistic regression test. At this point models were used to test the relationship between all the independent variables and dependent variable. This was done to determine the extent to which all the background variables have an impact on infant deaths. The binary logistic regression test reports odd ratios, which explain the nature of the relationship between each independent variable and the dependent variable in the presence of the other independent variables. Also, the binary logistic regression analysis was run at 95% significance level, and the p-values and the odd ratios (OR) were analysed for statistical significance for each background variable of the mother. Four models were generated using the 2014 GDHS data sets so as to examine the significant factors of infant deaths that are still relevant in Ghana. The first model (Model I) examined the statistical relationship between socio-economic and demographic variables and infant deaths. Model II investigated the statistical relationship between the intermediate variables and the dependent variable. Model III was generated to examine the impact of both independent and intermediate variables on the dependent variable. For the adherence to the principle of parsimony, a fourth model (Model IV) was developed. This model comprised of two socio-economic variables (region of residence and ethnicity) and two intermediate variables (birth order and source of drinking

water). The selection of variables for Model IV is based on observed statistically significant association or relationship to the dependent variable at either bivariate analysis or multivariate analysis or at both bivariate analysis and multivariate analysis. The detailed descriptions are indicated under each model.

3.3 Sampling Techniques

The study used six successive Ghana Demographic and Health Surveys from 1988 to 2014. The GDHS sample was designed to provide estimates for the whole country, urban and rural areas within the ten (10) regions of Ghana. The sampling frame was adopted from Ghana 2010 Population and Housing Census' frame. The frame contains information about the enumeration area's location, estimated number of residential households and type of residence (urban or rural).

In total, there were 37,641 enumeration areas in the sampling frame Urban areas represented 16,503 whilst 21,138 represented rural areas with an average enumeration area size of 145 households. Urban enumeration areas have a larger average size than rural enumeration areas, representing 185 households per enumeration area and 114 households per enumeration area respectively (GSS, 2014).

The stratification and selection of the 2014 GDHS sample were in two stages with each region being stratified into urban and rural areas, making 20 sampling strata. The samples of enumeration areas were selected independently in each stratum in two stages (GSS, 2015).

In the first stage led to the selection of 427 enumeration areas with probability proportional to its size and with independent selection in each sampling stratum. A household listing operation was carried out in all the selected enumeration areas, and the resulting lists of households served as a sampling frame for the selection of households in the second stage. To minimize the task of household listing for EAs with more than 200 households, each large

enumeration area was segmented. Only one segment was selected for the survey with probability proportional to the segment size. Household listing was conducted only in the selected segment. Therefore, a 2014 GDHS cluster is either an enumeration area or a segment of it (GSS, 2015).

In the second stage, a fixed number of 30 households per cluster were selected with an equal probability systematic selection from the newly created household listing. The survey interviewers visited and interviewed only the selected households. No replacements or changes of the selected households were allowed during data collection, in order to prevent bias. All women age 15-49 who were usual members of the selected households or who spent the night before the survey in the selected households were eligible for the female survey (GSS,2015).

To ensure precision in the 2014 data set across all regions, the sample fixes an allocation of power between regions and between different types of residence within each region. This was based on a fixed sample take of 30 households per cluster, and 427 EAs were selected. This translates into 216 enumeration areas for urban areas and 211 enumeration areas for rural areas. The survey was then conducted in 12,810 residential households made up of 6,480 residential households in urban areas and 6,330 residential households in rural areas. The sample was expected to result in about 10,214 completed interviews with women age 15-49 with 5,098 from urban areas and 5,116 from rural areas.

Using the six successive GDHS's, the study recorded infant mortalities at the time 0-11 months in the past year prior to the survey for each data set. This was computed by subtracting the date of births of children born to mothers interviewed from the date of interview to get a number of children from 0 to 59 months old. The data was then sorted by infants (those less than 12 months) to obtain the total number of observations for the respective years; 1988,

1993, 1998, 2003, 2008 and 2014. The observations were 4136, 2203, 3194, 3639, 2909 and 5695 respectively, representing the number of live births (singleton births) to the interviewed mothers and 446, 148, 246, 299, 178 and 271 infant deaths respectively.

3.4 Measurement of Variables

Independent Variable	Measurement
Highest level of Education	0=No education, 1= Primary, 2= Secondary 3 =Higher
Employment status of the mother	0=Not Working, 1=Working
Mother 's Place of Residence	0=Urban, 1=Rural
Region of Residence	1= Western, 2= Central, 3=Greater Accra, 4= Volta, 5 = Eastern, 6= Ashanti, 7= Brong Ahafo 8= Northern Upper East, & Upper West
Place of Delivery	0=Home, 1=Government Hospital, 2=Private Hospital, 3=Others
Source of Drinking Water	0=Improved (piped water and bottled water), 1=Improved (wells, boreholes, surface water, spring, dug, out, tanker truck rainwater, river, dam, lake, ponds stream water),
Type of Toilet Facilities	1=Flush Toilet, 2=Pit Latrine, 3=Other (No facility, bush, field, composite toilet, bucket toilet and hanging toilet)
Age of the mother	1= 15-19 years, 2=20-24 years, 3=25-29years, 4=30-3 years, 5=35- 39 years, 6=40-44 years and 7=45-49 years
Birth order	0=1-3 births, 1=4-6births, 2=7 or 7+ births
Birth Interval	1=<18 months, 2=18-24 months, 3=25-35 months, 4=36 or 36+ months, 5=first birth
Breastfeeding	0=never, 1=ever, 2=Other
Sex of the child	0=male, 1=female
Dependent Variable Infant Deaths	0=No, 1= Yes

3.5 Limitation of the Study

The dependent variable in this study is infant deaths and there is the possibility that, the infant mortality calculated may be lower than the infant mortality in reality; because some mothers may tend not to report deaths of the infants.

Another potential limitation is on data quality problem as a result of age heaping at death. These errors in the age at death may result in the transference of deaths from one age bracket to another. For example, heaping on age 1 can result in underestimation of the infant deaths.

CHAPTER FOUR

DESCRIPTION OF DEMOGRAPHIC, ENVIRONMENTAL AND SOCIO-ECONOMIC CHARACTERISTICS OF THE MOTHER

4.0 Mother's Background Characteristics

The background characteristics included in this study are, region of residence of the mother, ethnicity of the mother, religion of the mother, educational level of the mother, type of place of residence of the mother, sources of drinking water, types of toilet facilities, employment status of the mother, household wealth index and place of delivery. Others are, age at first birth of the mother, duration of breastfeeding, birth order, birth interval and sex of the child. These characteristics are described from 1988 to 2014 to know variations across time.

4.1 Age of the Mother

It can be seen from Table 4.1 that from 1988 to 2014, mothers aged 20-34 years account for 70.3% (1988), 72.1% (1993), 68.5% (1998), 67.2% (2003), 67.8% (2008) and 66.8% in 2014. Less than a tenth are teenagers (15-19) across the years and the rest, 25.4% (1988), 20.9% (1993), 27.9% (1998), 29.4% (2003), 28.2% (2008) and 29.1% (2014) are 35 years and over. The median age of mothers of infant interviewed was between ages 25 to 29. And this was the same across the years. This depicts that a greater percentage of mothers of infants are between the ages 25-29 across the years.

Table 4. 1: Percentage distribution of Mothers by Age.

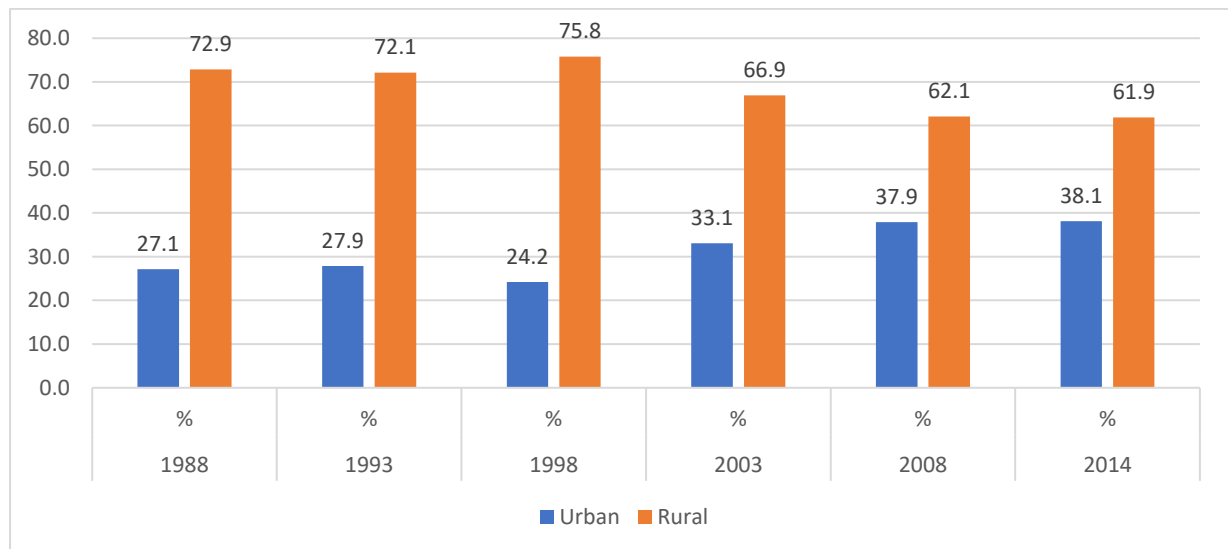
Age	1988	1993	1998	2003	2008	2014
	%	%	%	%	%	%
15-19	4.4	7.0	3.6	3.4	4.0	3.4
20-24	21.0	22.9	22.2	18.7	19.5	17.0
25-29	28.7	26.5	27.1	26.2	27.9	25.4
30-34	20.6	22.7	19.2	22.3	20.4	24.4
35-39	14.9	12.4	15.8	17.2	17.2	17.8
40-44	6.8	6.5	9.1	8.3	7.7	8.9
45-49	3.7	2.0	3.0	3.9	3.3	3.2
Total N	(4136)	(2204)	(3914)	(3639)	(2910)	(5695)

Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data sets

4.2 Type of Place of Residence of Mothers

The percentage distribution of the mothers by the type of place of residence of the mother is shown in Figure 4.1. The results show that mothers who live in rural areas across the six successive GDHS's, 1988, 1993, 1998, 2003, 2008 and 2014 represents 72.9%, 72.1%, 75.8%, 66.9%, 62.1% and 61.9% respectively. Those who live in urban areas are also represented respectively as follows 27.1%, 27.9%, 24.2%, 33.1%, 37.9% and 38.1%. The table shows a decreasing trend in the percentage of mothers in urban and a relatively increasing trend in rural areas across the respective years.

Figure 4. 1: Percentage distribution of Mothers by Type of Place of Residence



Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data sets

4.3 Mother's Educational Level

From the 1988 and 1993 data sets, the percentages of mothers who had primary school education are 50.3% and 54.7%, mothers with no education were 44.8% and 39.7%, and those with secondary and higher combined represented 4.9% and 5.6% respectively. However, from 1998 through to 2014 with the exception of 2003, the percentages of mothers who had secondary education are 40.3%, 40% and 48.1%, those with no education were 38.5%, 32.7%

and 20.4% and those with higher education represented 9%, 2.4% and 4.5% respectively. The 2003 data saw a different trend representing mothers with no education by 40.3%, secondary by 35.4% and mothers with higher education were 1.1% of the total sample size. The results are shown in Table 4.2 and it shows a decreasing trend of mother with no education and primary whilst there is an increasing trend of mothers with secondary and higher education.

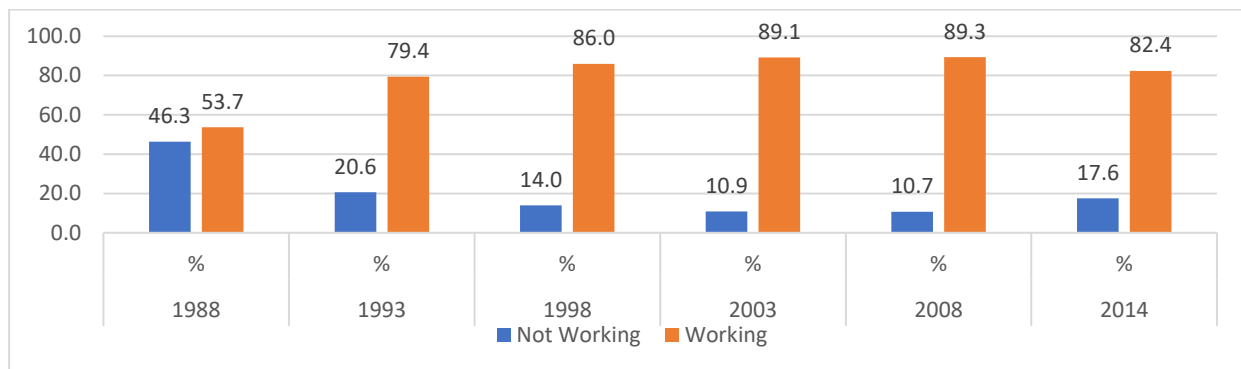
Table 4. 2: Percentage distribution of Mothers by Level of Education

Level of Education	1988 %	1993 %	1998 %	2003 %	2008 %	2014 %
No education	44.8	39.7	38.5	40.3	32.7	27.4
Primary	50.3	54.7	20.3	23.2	24.9	20.0
Secondary	4.3	4.9	40.3	35.4	40.0	48.1
Higher	.6	.7	.9	1.1	2.4	4.5
Total N	(4136)	(2204)	(3914)	(3639)	(2910)	(5695)

Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data sets

4.4 Employment Status of Mothers

The results in figure 4.2 indicate that 53.7% (1988) , 79.4 (1993), 86.0% (1998) , 89.1% (2003), (2008), 82.4% (2014)) infants were born by mothers who were working and the remaining non-working mothers had 1988 (46.3%), 1993 (20.6%), 1998 (14.0%), 2003 (10.9%), 2008 (10.7%) and 2014 (17.6%). This shows that a greater percentage of mothers of infants were working as compared to non-working mothers over the years.

Figure 4. 2: Percentage distribution of Mothers by Employment Status


Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data sets

4.5 Ethnicity

From table 4.3, mothers with infants who belong to the Akan ethnic group is represented as follows; 51.9% (1988) ,49.1% (1993),52.5% (1998), 46.9% (2003), 45.6% (2008) , and 36.7% (2014) . Among all the ethnic groups across the successive years, Akan mothers have the greatest percentage of infants. Mothers of the Guan ethnic group had the least percentage of infants across the successive years. This is represented as follows 2.1% (1988) ,2.8% (1993) , 1.4% (1998) , 2.9% (2003),2.4% (2008), and 2.4% (2014)

Table 4 3: Percentage distribution of Mothers by Ethnicity

Ethnicity	1988	1993	1998	2003	2008	2014
	%	%	%	%	%	%
Akan	51.9	49.1	52.5	46.9	45.6	36.7
Ga Adangme	8.1	6.9	7.3	7.2	4.9	5.5
Ewe	15.3	13.7	13.7	12.1	12.4	11.1
Guan	2.1	2.8	1.4	2.4	2.9	2.4
Mole Dagbani	12.6	17.2	8.2	16.5	20.5	27.3
Other	10.1	10.3	16.9	14.9	13.6	16.9
Total N	(4136)	(2204)	(3914)	(3639)	(2910)	(5695)

Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data sets

4.6 Type of Toilet Facility

The results in Table 4.4 indicate that the percentages of mothers of infants who use pit latrine across all the years from 1988 to 2014 had as 55.9% (1988), 61.1% (1993), 65.1%(1998), 61.3% (2003), 61.6% (2008) and 53.5% (2014) compared to those who used flush toilet are represented as 1988 (3.4%), 1993 (4.1%), 1998 (3.8%), 2003 (6.9%), 2008 (8.8%) and 2014 (12.8%). Thus, the proportion using pit latrine is higher than those who use flush toilets over the years.

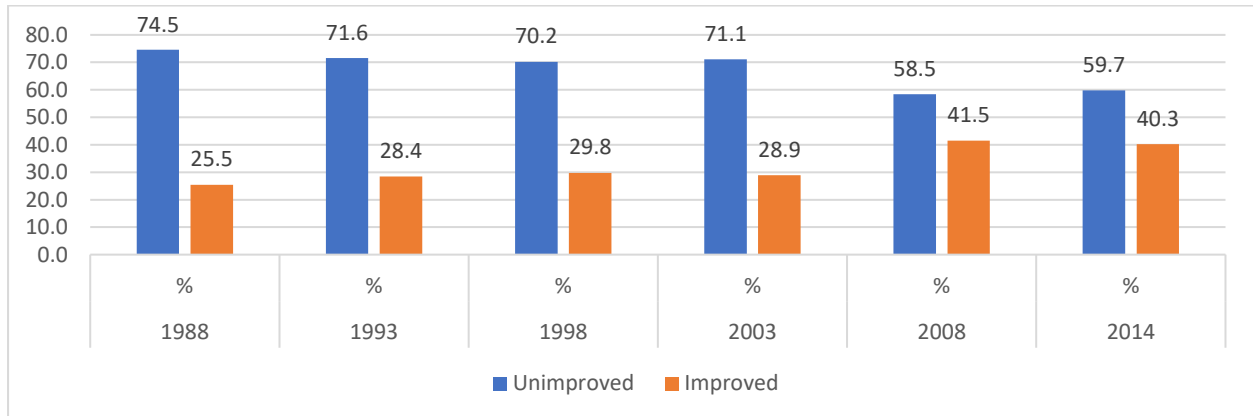
Table 4. 4: Percentage distribution of Mothers by Type of Toilet Facility

Type of toilet facility	1988	1993	1998	2003	2008	2014
	%	%	%	%	%	%
No Facility	40.7	34.7	31.0	31.8	29.4	33.7
Flush Toilet	3.4	4.1	3.8	6.9	8.8	12.8
Pit Latrine	55.9	61.1	65.1	61.3	61.6	53.5
Total N	(4136)	(2204)	(3914)	(3639)	(2910)	(5695)

Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data sets

4.7 Sources of Drinking Water of Mothers

Figure 4.3 shows that, from 1988 through to 2014. Mothers rely mostly on unimproved sources representing 74.5% (1988) ,71.6% (1993) ,70.2% (1998) 71.1% (2003), 58.5% (2008) and 59.7% (2014). This implies that more than half of mothers of infants depend on unimproved sources of water over the years of the surveys.

Figure 4. 3: Percentage distribution of Mothers by Source of Drinking Water

Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data sets

4.8 Percentage distribution of Mothers by Place of Delivery

Table 4.5 showed that in 1993, 1998 and 2003 a greater percentage of children were delivered at home representing 57.0%, 55.7% and 53.4%, compared to the government sector 31.5%, 32.7% and 36.3% respectively and those born at other places are represented as 2.7% (1988), 1.0% (1993), 0.9% (1998), 1.0% (2003), 0.5% (2008) and 0.3% (2014). However, 1988, 2008 and 2014 data showed that those born at the government hospitals were more representing 40.1%, 48.4% and 61.7% respectively than 29.7%, 42.0% and 32.0% respectively who were born at home. The trend shows that in recent times, there is a rise in the number of women who deliver at the Government hospitals as compared to the past. This may be due to the introduction of free maternal care policy under the National Health Insurance Scheme (NHIS) in 2008 by the Government of Ghana.

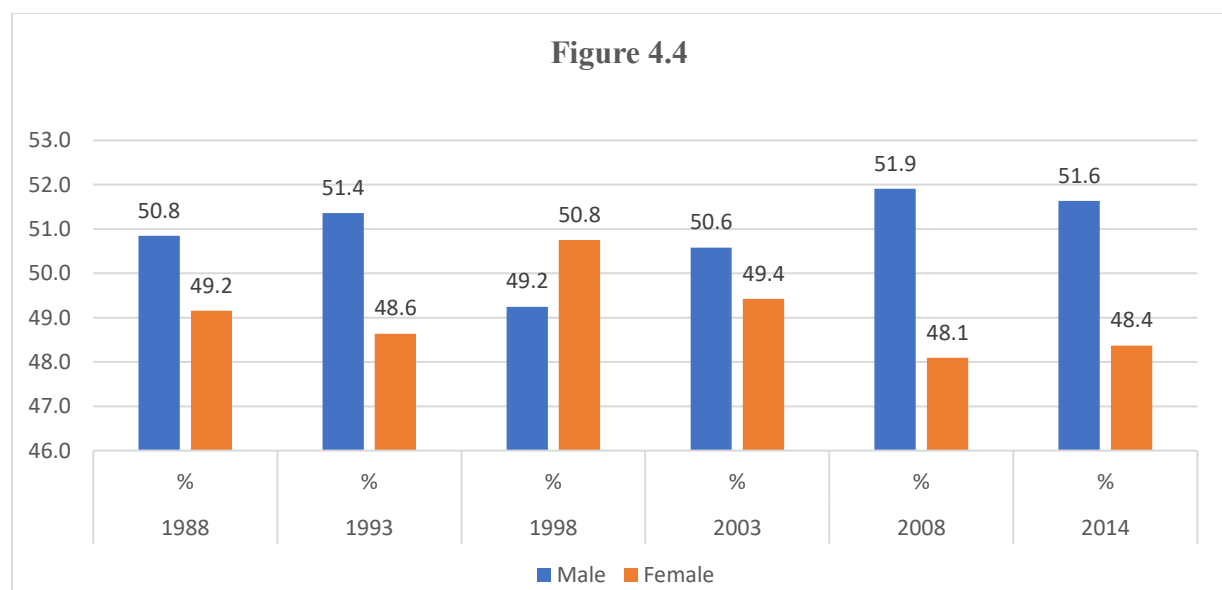
Table 4. 5: Percentage distribution of Mothers by Place of Delivery

Place of Delivery	1988 %	1993 %	1998 %	2003 %	2008 %	2014 %
Home	29.7	57.0	55.7	53.4	42.0	32.0
Government	40.1	31.5	32.7	36.3	48.4	61.7
Private	27.5	10.6	10.7	9.4	8.7	5.9
Other	2.7	1.0	.9	1.0	.5	.3
Total N	(4136)	(2204)	(3914)	3639)	(2910)	(5695)

Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data sets

4.9 Sex of the Child

The sex of a child is an important factor when studying infant deaths. Several literatures have shown that some sex differentials exist in survival chances of infants. These differentials favour the female sex over the male.

Figure 4. 4: Percentage distribution of Infants born to Mothers by Sex

Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data sets

The results in the above Figure 4.4 indicates that more male infants were born by mothers represented the following; 50.8% (1988), 51.4% (1993) ,50.6% (2003) 51.9% (2008), 51.6% (2014) as compared to females who were represented as 49.2%, 48.6%, 49.4% 48.1% and 8.4% respectively. However, 1998 data saw less males, 49.2% as compared to more females, 50.8%. The trend shows more males births and compared to females over the years, therefore exposing more mothers to a higher risk of losing their infants due to sex of the child.

4.10 Distribution of the children by Breastfeeding, Birth Order and Birth Interval.

Table 4.6 summarizes the results of the descriptive statistics of the distribution of the children by breastfeeding, birth order and birth interval. The result shows that 5.3.0% (1988) ,57.0% (1993), 58.6% (1998) ,57.4% (2003),61.7% (2008) and 59.8% (2014) of the women had birth order between 1-3 and 1988 (15.4%), 1993 (12.3%),1998 (12.7%), 2003 (12.3%), 2008 (9.5%), 2014 (8.6%) of women had their birth order of 7 or more. The results depict that a greater proportion of women over the years had a birth order between 1-3 as compared to the other categories the least birth order recorded for 7+

With regards to breastfeeding the analysis shows that a greater percentage, 94.8%(1988) , 96.7% (1993)), 95.8% (1998) ,95.2% (2003) ,94.9% (2008) and 97.1% (2014)) of mothers ever breastfed their infants, as compared to 3.2% (1988) ,2.2% (1993) ,2.6% (1998) 3.0% (2003) , 2.5% (2008),2.9% (2014) of mothers who never breastfed their infants. There were mothers of infants with no information about their breastfeeding habits that represented the other category as 2.0% (1988) ,1.1% (1993) ,1.6% (1998) ,1.8% (2003) ,2.7% (2008) ,0.1% (2014).

The birth interval results showed that, 20.0% (1988) 20.6% (1993) 23.9% (1998) ,22.9% (2003) ,23.8% (2008),24.4% (2014) of the infants were the first born; 5.7% (1998) ,2.9%

(1993) ,3.8% (1998), 3.8% (2003) ,2.9% (2008) ,2.7% (2014) were born less than 18 months preceding the subsequent births whilst 11.3%, 26.4% and 36.6%(1988) ,8.9%, 23.2% and 44.4% (1993) , 8.1%, 21.3%, 42.9% (1998) , 7.8%, 23.4% and 43.1% (2003) (), 7.8%, 23.4% and 43.1% (2008) , and 9.2%, 20.9% and 42.9% (2014) were born at interval of 18-24 months, 25-35 months and 36 or 36+ months respectively preceding the later births. The results depict that a greater percentage of mothers had their infants after 36 months preceding their first birth as compared to the other categories below 36 months over the years. Several studies have revealed that the lesser the interval between births the greater to likelihood of the infant deaths.

Table 4. 6: Percentage Distribution of Mothers by Selected Fertility and Nutrition

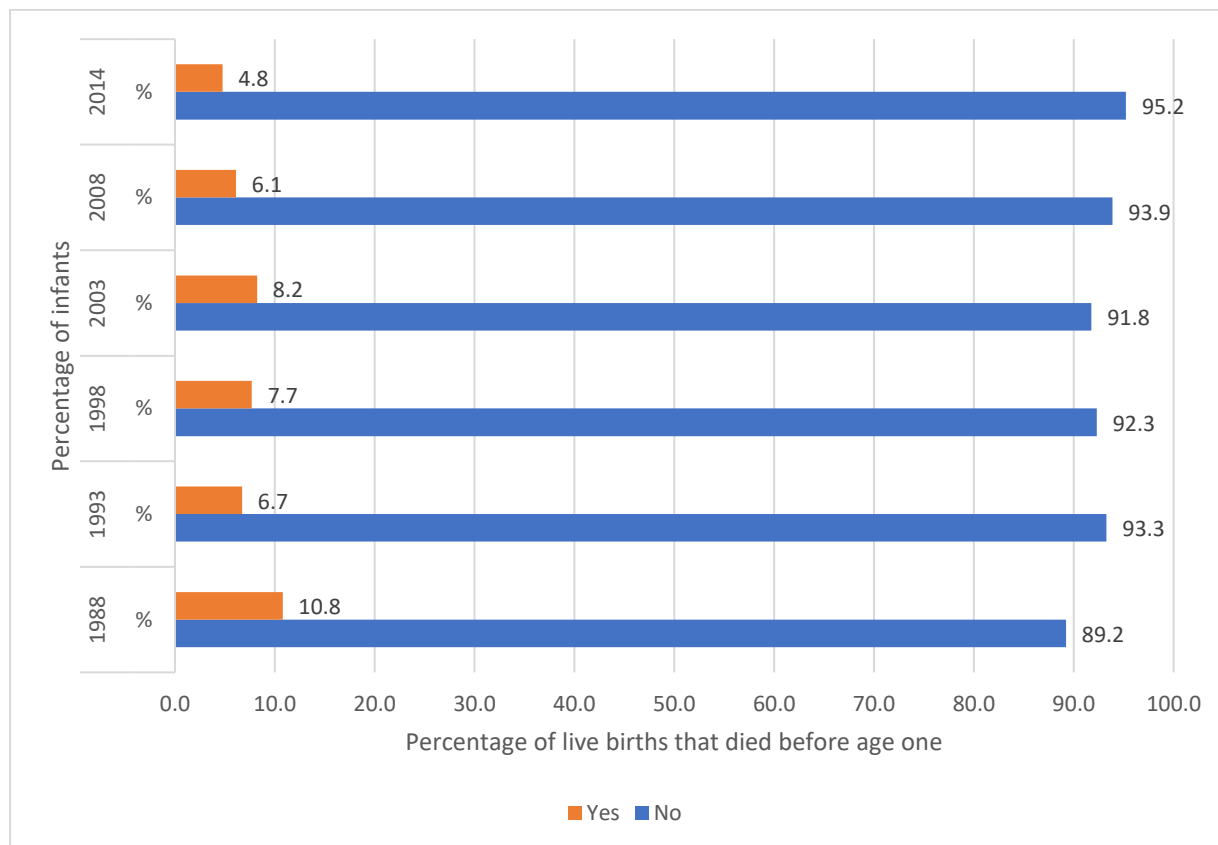
		1988	1993	1998	2003	2008	2014
		%	%	%	%	%	%
Birth Order Number	1 -3	53.0	57.0	58.6	57.4	61.7	59.8
	4-6	31.7	30.7	28.7	30.2	28.8	31.6
	7+	15.4	12.3	12.7	12.3	9.5	8.6
	Total (N)	4136	2204	3194	3639	2909	5695
Breastfeeding	Ever Breastfed	94.8	96.7	95.8	95.2	94.9	97.1
	Never Breastfed	3.2	2.2	2.6	3.0	2.5	2.9
	Other	2.0	1.1	1.6	1.8	2.7	.1
	Total (N)	4136	2204	3194	3639	2909	5695
Birth interval	First births	20.0	20.6	23.8	22.9	23.8	24.4
	< 18 months	5.7	2.9	3.8	3.8	2.9	2.7
	18-24 months	11.3	8.9	8.1	7.8	9.4	9.2
	25-35 months	26.4	23.2	21.3	22.4	19.3	20.9
	36+ months	36.6	44.4	42.9	43.1	44.6	42.9
	Total (N)	4136	2204	3194	3639	2909	5695

Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data sets

4.11 Percentage distribution of Infants by Deaths

Out of 4136 (1988), 2204 (1993), 3195 (1998), 3652 (2003), 2910 (2008) and 5695 (2014) singletons born in the years preceding the surveys, the percentage of live births that died before age one was 10.8%, 6.7%, 7.7%, 8.2%, 6.1% and 4.8% respectively. This is shown in the Figure 4.5 below. The trend shows a general decline in infant deaths. However, the year 1998 and 2003 saw a relative rise in infant deaths compared to the preceding year and it declined again in the succeeding years through to 2014.

Figure 4. 5: Percentage Distribution of Infants by Deaths



Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data set

CHAPTER FIVE

RELATIONSHIPS BETWEEN BACKGROUND CHARACTERISTICS OF MOTHERS AND INFANT DEATHS

5.0 Introduction

This chapter examines the bivariate relationships between the various background characteristics of respondents and the death of infants. The mothers' characteristics include; type of place of residence, region of residence, ethnicity, highest level of education, place of delivery, employment status, age of the mother, breastfeeding and birth interval. Sex of the child is also included as children's factor. The chi-square test statistic is used to assess the significance of the association between each of the background characteristics and the dependent variable (death of infants), at 95% confidence level.

5.1 Maternal Age and Infant Mortality

There are variations among the significant levels of maternal age and its association with infant mortality across the various GDHS; 1988, 1993, 1998, 2003, 2008 and 2014 as shown in Table 5.1. It was significant in 1988 (Asymp. Sig= 0.001 and $\chi^2 = 21.63$) and 2003 (Asymp. Sig= 0.047 and $\chi^2 = 12.752$). The results also indicate that, among the children who died at the age of 0-11 months in 1988, 21.1% were born by mothers aged between 45-49 years, 12.1% were born to mothers aged between 40-44 years and 6.6% were born by mothers who were aged between 15-19 years. In 2003 also, 12.6% of infant deaths occurred to mothers between the ages 45-49, 11.3% for aged group 40-44 and 6.7% infant deaths to mothers within the age group 25-29. The trend in Figure 5.1 shows a relative decline in the percentage of infant deaths to each age group of mothers from 1988 to 2014.

Table 5. 1: Relationship Between Mothers age and Infant Death

Age in groups	1988		1993		1998		2003		2008		2014	
	% Dead	(N)	% Dead	(N)	% Dead	(N)	% Dead	(N)	% Dead	(N)	% Dead	(N)
15-19	6.6%	181	5.2%	154	8.7%	115	8.9%	124	3.4%	116	3.1%	191
20-24	10.9%	868	6.7%	505	9.3%	709	8.0%	679	6.3%	568	4.1%	966
25-29	10.3%	1185	6.2%	585	6.8%	866	6.7%	953	4.9%	811	3.9%	1449
30-34	10.8%	852	7.6%	501	5.9%	615	9.1%	810	5.9%	593	5.1%	1389
35-39	9.6%	616	5.9%	273	9.1%	506	6.9%	626	7.4%	501	6.1%	1015
40-44	12.1%	282	8.4%	143	9.3%	291	11.3%	302	8.0%	225	4.8%	504
45-49	21.1%	152	9.3%	43	3.2%	94	12.6%	143	8.5%	94	6.6%	181
Total	10.8%	4136	6.7%	2204	7.7%	3196	8.2%	3637	6.1%	2908	4.8%	5695
Chi Square	21.63		2.887		11.694		12.752		7.293		1.017	
P-Value	0.001		0.823		0.069		0.047		0.299		0.313	

Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data sets

5.2 Mother's Region of Residence and Infant Mortality

Region of residence was found significant in 1988 (Asymp. Sig= 0.000 and $\chi^2 = 40.808$), 1998 (Asymp. Sig= 0.000 and $\chi^2 = 37.301$), 2008 (Asymp. Sig= 0.014 and $\chi^2 = 17.547$) and 2014 (Asymp. Sig= 0.000 and $\chi^2 = 34.325$). The results of the 1988 data show that mothers in Central Region had the highest percentage of 17.1% infants' deaths followed by the three northern regions (Upper West, Upper East & Northern) with 4.5% and the least represented by Eastern Region with 7.9% of infant deaths occurring within the year. The results in the 1998 data showed that 11.6% of the proportion of mothers in the Central Region of Ghana had their infants' dead, the three northern regions (Upper West, Upper East & Northern) representing 11.3% and 7.9% infant deaths occurred to mothers in Eastern region of Ghana. The 2008 data depicts that, 8.5% of infants' deaths occurred to mothers in the Central region of Ghana, 8.3% infant deaths to mothers in the three northern regions (Upper West, Upper East & Northern) and Eastern region with 2.9% infants' deaths. The results of the 2014 data also shows that 6.5% of infants' deaths occurred to women in the Ashanti Region of Ghana, then the three northern

regions (Upper West, Upper East & Northern) with 5.7% and 2.9% each represented by Central and Greater Accra regions of Ghana.

The trend depicts a general fall in infant deaths from 1988 to 1993, a rise in 1998 in respect of the three Northern Regions (Upper West, Upper East & Northern), Brong Ahafo and Central regions of Ghana. The year 2003 data saw a general rise in the proportion of infant deaths to all regions with reference to infant deaths in the preceding years, except the three Northern Regions (Upper West, Upper East & Northern) and Central. In 2008, the three Northern (Upper West, Upper East & Northern) and Central regions of Ghana rose in their respective percentages as the other regions were falling in infant deaths. The 2014 data depicts a different trend seeing all the regions falling with Ashanti and Eastern regions rising in their respective proportions compared to the previous year, 2008. This is shown in Table 5.2.

Table 5. 2: Relationship between Mothers Region of Residence and Infant deaths

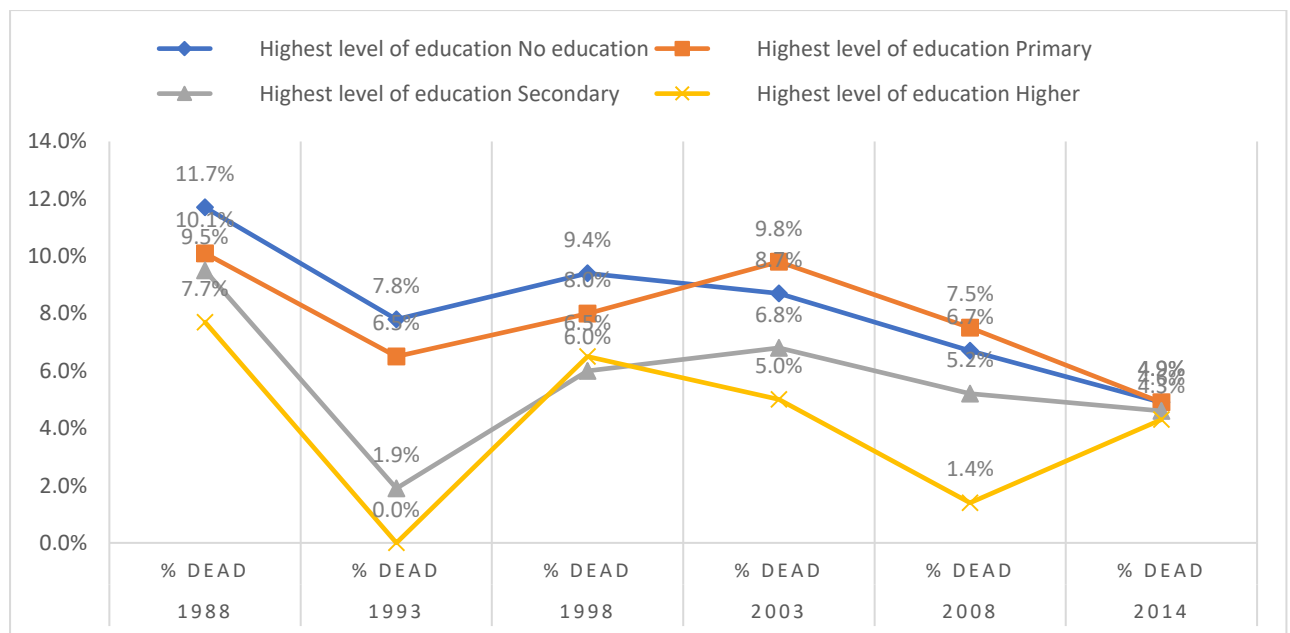
Region	1988		1993		1998		2003		2008		2014	
	% Dead	(N)	% Dead	(N)	%Dead	(N)	% Dead	(N)	% Dead	(N)	% Dead	(N)
Western	9.6%	363	9.2%	206	7.7%	413	9.5%	367	4.1%	271	2.9%	545
Central	17.1%	473	7.8%	231	11.6%	379	7.9%	304	8.5%	293	4.6%	517
Greater Accra	8.0%	402	5.5%	199	4.3%	329	5.9%	389	4.9%	346	2.9%	475
Eastern	7.9%	597	5.4%	239	3.8%	338	9.7%	298	2.9%	244	4.4%	500
Volta	9.7%	504	6.7%	238	6.3%	430	6.9%	362	5.9%	255	4.8%	586
Ashanti	10.9%	709	5.3%	400	5.6%	514	9.2%	685	6.4%	545	6.5%	522
Brong Ahafo	8.4%	538	5.2%	211	10.4%	260	8.5%	400	4.4%	272	4.0%	594
Upper W,E & Northern	14.5%	550	8.1%	480	11.3%	531	7.9%	833	8.3%	684	5.7%	1957
Total	10.8%	4136	6.7%	2204	7.7%	3194	8.2%	3638	6.2%	2910	4.8%	5696
Chi Square	40.808		7.219		37.301		6.369		17.574		34.325	
P-Value	0.000		0.406		0.000		0.497		0.014		0.000	

Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data set

5.3 Mother’s Level of Education and Infant Mortality

Educating a woman is a very profitable investment as far as child survival is concerned. This is because education has a strong negative association with infant and child mortality. However, the variable was only significant in 1998 (Asymp. Sig= 0.014 and $\chi^2 = 10.683$) as shown in Figure 5.3. The results show that mothers with no education had a proportion of 9.4% of infant deaths, 8.0% for mothers who had primary education and 6.0% for mothers with secondary education. The trend shows a general fall from 1988 to 1993 and a general rise in 1998. Mothers of primary and secondary education experienced a continuous rise in the percentage of infant deaths as the other categories fall in 2003. In 2008, the trend depicts a fall of the respective proportions of infant deaths through to 2014, except mothers with higher education experiencing a relative rise in the proportion of infant deaths between 2008 and 2014. This is shown in Figure 5.3

Figure 5. 1: Relationship between Mothers’ Level of Education and Infant Death



Chi Square	3.287	6.743	10.683	7.17	7.424	0.325
P-Value	0.349	0.081	0.014	0.067	0.060	0.950

Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data set

5.4 Mother's Ethnicity and Infant Mortality

In Table 5.4, Ethnicity was significant in 1988 (Asymp. Sig= 0.045 and $\chi^2 = 11.325$), 2008 (Asymp. Sig= 0.009 and $\chi^2 = 15.282$) and 2014 (Asymp. Sig= 0.004 and $\chi^2 = 17.256$). The results show that in 1988, 14.0% of the proportion of infant born to mothers of the Mole Dagbani ethnic group died, 11.1% infant deaths to Akan and 5.9% infant deaths represented by the Guan. In 2008 however, other ethnic groups had 10.1% of infant deaths followed by the Guan 6.0% and 3.6% represented by the Ewes. The 2014 data saw the Guans with a proportion of infants' deaths of 10.9%, 5.6% to mothers of Mole Dagbani and 3.8% to Ga Adangme. Table 5.3 shows a general undulating fall in respective percentages of infant deaths by ethnic group from 1988 to 2014 except the Guan ethnic group showing a rise between 2008 and 2014.

Table 5.3: Relationship between Mothers Ethnicity and Infant Deaths

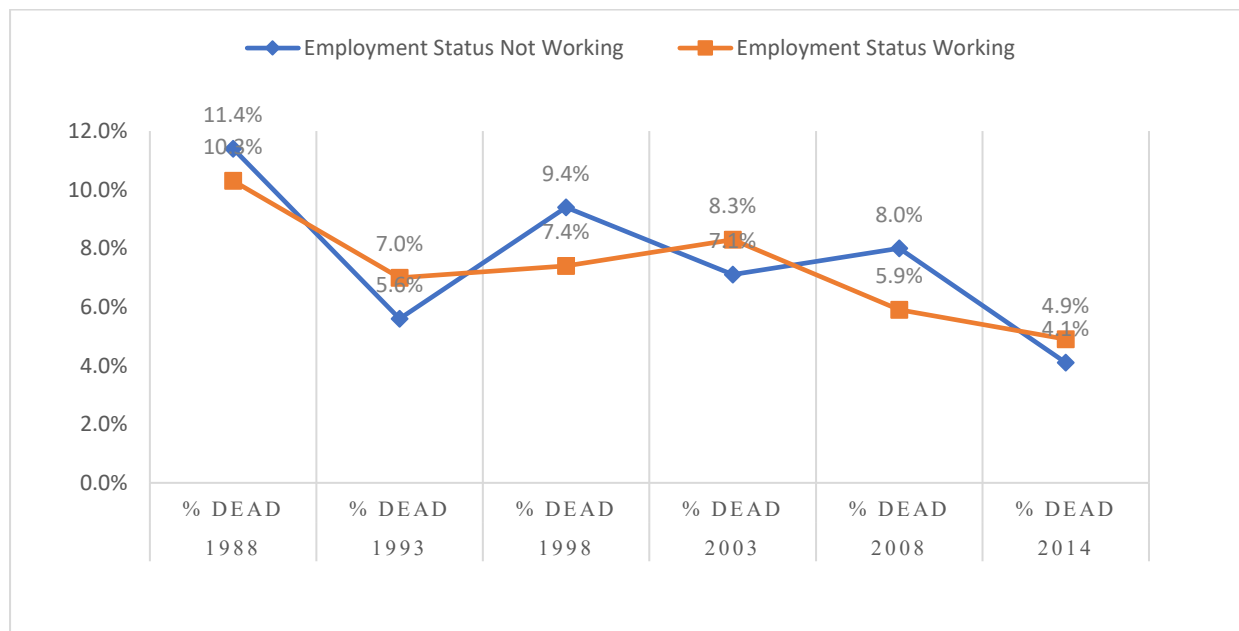
Ethnicity	1988		1993		1998		2003		2008		2014	
	Dead %	(N)	Dead %	(N)	Dead %	(N)	Dead %	(N)	Dead %	(N)	Dead %	(N)
Akan	11.1%	2148	7.5%	1067	7.8%	1067	8.3%	1705	5.8%	1327	4.0%	2090
Ga Adangme	9.3%	334	6.0%	150	5.2%	150	6.9%	262	5.6%	143	3.8%	315
Ewe	8.9%	631	3.7%	297	5.5%	297	7.9%	442	3.6%	361	4.4%	634
Guan	5.9%	85	11.5%	61	8.7%	61	10.5%	86	6.0%	84	10.9%	137
Mole Dagbani	14.0%	520	7.5%	373	10.6%	373	8.0%	601	5.9%	597	5.6%	1556
Other	10.3%	418	4.9%	223	8.7%	223	9.1%	541	10.1%	396	4.7%	962
Total	10.8%	4136	6.7%	2171	7.70%	2171	8.2%	3637	6.1%	2908	4.8%	5694
Chi Square	11.325		9.163		9.268		1.803		15.282		17.26	
P-Value	0.045		0.103		0.099		0.876		0.009		0.004	

Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data set

5.5 Mother’s Employment Status and Infant Mortality

Studies in 19th-century in England show higher infant mortality in households with a working mother, which they attribute to the lack of mother's time for infant care, inadequate care, early introduction of artificial feeding and poor living conditions (Nair et al, 2011). After the Pearson Chi-square test, it was observed across the years 1988 to 2014 that the variable had no significant association with infant mortality. The trend shows fluctuations in the percentages of infant deaths by the employment status of the mother This is shown in Figure 5.5 below.

Figure 5. 2: Relationship between Mothers’ Employment Status and Infant Deaths



Chi Square	1.325	1.189	2.058	0.682	2.136	1.29
P-Value	0.250	0.276	0.152	0.409	0.144	0.256

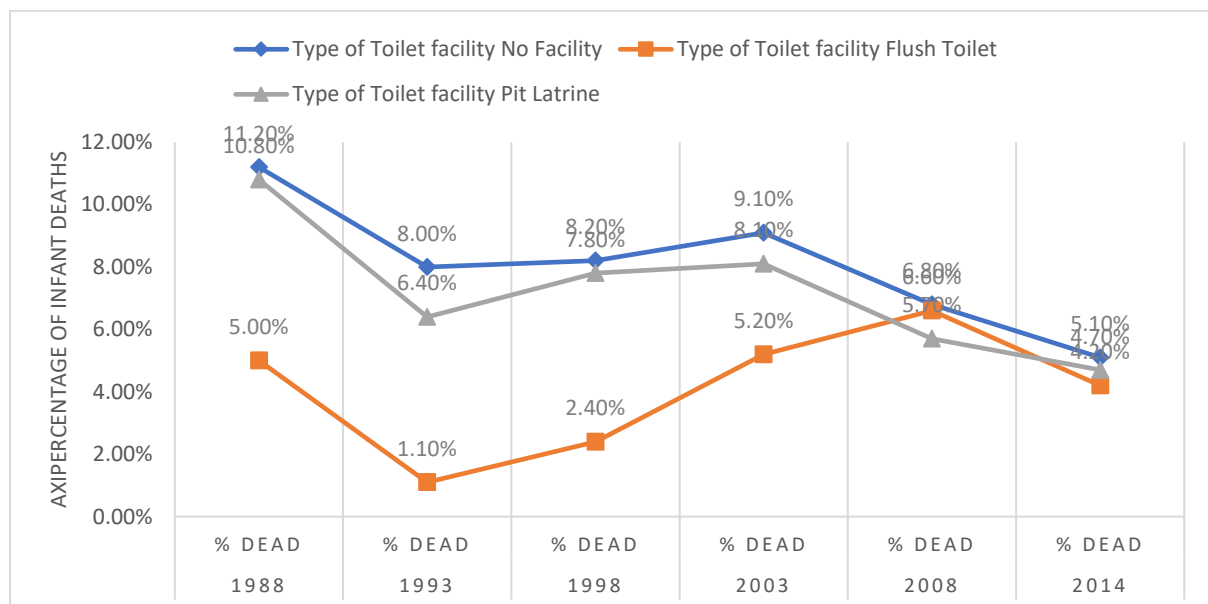
Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data sets

5.6 Mother’s Toilet Facilities and Infant Mortality

The Pearson Chi-square test as shown in Figure 5.6 presented a significant association between types of toilet facility of the mother and infant deaths in 1993 (Asymp. Sig= 0.034 and $\chi^2 = 6.749$) and 2014 (Asymp. Sig= 0.002 and $\chi^2 = 17.382$). With reference to the 1993 data, the results indicated that, among the children born by mothers who had no facility, 8.0% died,

while 6.4% of the children born by mothers who used pit latrines died and 1.1% of the children born by mothers who used flush toilets died. The 2014 data showed that women with no facility had 5.1% of infants' deaths followed by those who used pit latrine 4.7% and those with flush toilet 4.2%. The trend in Figure 5.6 shows a general fall in infants' deaths by type of toilet facility from 1988 to 1993 and a rise from 1993 through to 2003. The gap between the respective percentages narrowed in 2008 seeing a general fall through to 2014.

Figure 5. 3: Relationship between mother's Type of Toilet Facility and Infant Deaths



Chi Square	5.304	6.749	5.116	4.327	1.286	17.382
P-Value	0.071	0.034	0.077	0.115	0.500	0.002

Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data set

5.7 Mother's Place of Delivery and Infant Mortality

Table 5.7 shows that place of delivery is significant in 1993(Asymp. Sig= 0.000 and $\chi^2 = 19.592$) and 1998 (Asymp. Sig= 0.007 and $\chi^2 = 12.083$). The category differentials of infant mortality under this variable were; delivery at other places accounted for 40.0% of infant deaths. Delivery at home, government sector and private sector accounts for, 6.5%, 5.9% and

5.2 % infant deaths respectively. As it has been noted in chapter two, these results also revealed that women who deliver at home experience higher infant mortality. Gyimah 's study conducted in 2004 using 2003 GDHS also showed that, mothers who delivered at health facilities experience lower infant mortality than those who delivered at home. The trend in Table 5.4 shows an undulating decline in infant deaths across all the years.

Table 5.4: Relationship between Mothers' Place of Delivery and Infant Deaths

Place of Delivery	1988		1993		1998		2003		2008		2014	
	% Dead	(N)	% Dead	(N)	% Dead	(N)	% Dead	(N)	% Dead	(N)	% Dead	(N)
Home	9.3%	1229	6.5%	1256	8.60%	1778	7.60%	1942	6.10%	1223	5.20%	1822
Government	9.6%	1658	5.9%	695	6.30%	1045	8.60%	1319	5.80%	1407	4.40%	3513
Private	12.2%	1136	5.2%	233	3.80%	341	5.80%	342	5.50%	255	6.50%	338
Other	11.3%	62	40 %	10	6.30%	16	7.70%	13	7.70%	13	5.00%	20
Total	10.3%	4085	6.3%	2194	7.30%	3180	7.80%	3616	5.90%	2898	4.80%	5693
Chi Square	6.992		19.592		12.083		2.979		0.323		4.02	
P-Value	0.072		0.000		0.007		0.395		0.956		0.259	

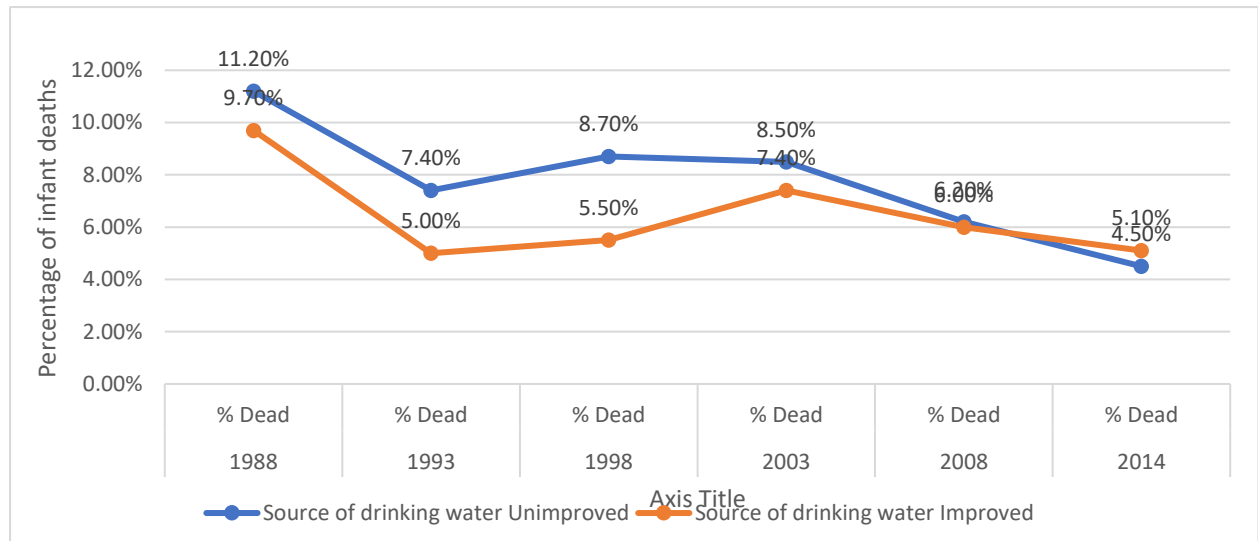
Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data set

5.8 Mother's Source of Drinking Water and Infant Mortality

The Pearson Chi-square test analysis in Figure 5.8 shows that source of drinking water was significantly associated with infant mortality in 1993 (Asymp. Sig= 0.037 and $\chi^2 = 4.312$) and 1998 (Asymp. Sig= 0.002 and $\chi^2 = 9.527$) The results indicate that in 1993, 7.4% of infants' deaths occurred to children born by mothers drinking from unimproved water sources and 5.0% occurring to children born by mothers drinking improved source of drinking water. The 1998 data saw a similar trend, with 8.7% proportion of infants' deaths occurring to mothers of unimproved water sources and 5.5% to mothers of improved sources. This may be a result of using contaminated water from un-improved sources. The trend in Figure 5.8 shows a fall in the percentage of infant deaths by sources of drinking water from 1988 to 1993 and a rise in

1998 for both categories relative to 1993 at widening gaps. Between 1998 and 2003, the gap closed and continued in a falling trend through to 2014.

Figure 5. 4: Relationship between mothers Source of Drinking Water and Infant Deaths



Chi Square	1.766	4.312	9.527	1.231	0.087	1.161
P-Value	0.184	0.037	0.002	0.267	0.768	0.281

Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data set

5.9 Relationship between Sex of Child and Infant deaths

The sex of the child was only significant to infant deaths in the 1988 data. The results show that 12.0 % of male infants died as 9.50% of the female infants died. This means that male children are at a higher risk of infant deaths as compared to females. Table 5.5 depicts that, across the successive data sets, male children dominate in their numbers at birth as compared to females and are at a higher risk of deaths compared to the female counterparts. However, sex of the child happens to be insignificant from 1993 to 2014.

Table 5.5: Relationship between Sex of the Child and Infant Deaths

Sex of child	1988		1993		1998		2003		2008		2014	
	% Dead	(N)	% Dead	(N)	% Dead	(N)	% Dead	(N)	% Dead	(N)	% Dead	(N)
Male	12.0%	2103	7.2%	1132	7.8%	1573	8.4%	1841	6.5%	1510	5.0%	2940
Female	9.5%	2033	6.2%	1072	7.6%	1622	8.0%	1798	5.6%	1399	4.5%	2755
Total	10.80	4136	6.7%	2204	7.7%	3195	8.2%	3639	6.1%	2909	4.8%	5695
Chi Square	6.399		1.039		0.063		0.203		0.903		1.017	
P-Value	0.011		0.31		0.802		0.652		0.342		0.313	

Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data sets

5.10 Relationship between Fertility Factors and Infant Deaths

From table 5.6, birth order was significant in 1993 (Asymp. Sig= 0.025 and $\chi^2 = 7.359$) 1998 (Asymp. Sig= 0.004 and $\chi^2 = 11.028$) and 2014 (Asymp. Sig= 0.000 and $\chi^2 = 15.521$). The 1993 data showed that 10.3% of children born to mothers with birth order of 7 or more experienced infant deaths and 5.8% deaths to those with birth order between 1-3. The 2008 data also showed a similar trend with 10.5% of the proportion of children born to mothers with birth order 7 or more experiencing infant deaths and 5.4% to mothers with birth order of 1-3. In 2014, 8.4% of children born to mothers with birth order of 7 or more experienced infant deaths and 4.3% infant deaths to mothers with birth order 1-3. In general, there is a decline in the percentage of infant deaths by the respective birth order categories from 1988 to 2014. However, it is still a significant factor that causes infant deaths in 2014.

Apart from the 2014 data set result, months of breastfeeding had been a significant factor of infant deaths from 1998 to 2008. The result from Table 5. showed the following significant levels in the respective years 1988 (Asymp. Sig= 0.000 and $\chi^2 = 681.624$), 1993 (Asymp. Sig= 0.000 and $\chi^2 = 684.666$), 1998 (Asymp. Sig= 0.000 and $\chi^2 = 566.688$), 2003 (Asymp. Sig= 0.000 and $\chi^2 = 987.598$) and 2008 (Asymp. Sig= 0.000 and $\chi^2 = 278.535$). The 1988 data showed that mothers who never breastfed their children experienced 74.4% infant deaths and

8.5% of infant deaths were experienced by mothers who ever breastfed their children. The 1993 data depicts that mothers who never breastfed their children experienced 89.6% infant deaths and 4.3% infant deaths to mother who ever breastfed their children. In a similar vein, in the succeeding years, mothers who never breastfed their children experienced 74.4%, 88% and 45.8% infant deaths in 1998, 2003 and 2008 respectively and those who ever breastfed experienced 5.6%, 5.3% and 4.5% infant deaths respectively. Breastfeeding was no longer a significant contributor of infant deaths in 2014.

Birth interval was also significantly associated to infant deaths from 1988 to 2008 with the exception of 2014. Table 5.6 indicates the following 1988 (Asymp. Sig= 0.000 and $\chi^2 = 25.470$), 1993 (Asymp. Sig= 0.000 and $\chi^2 = 39.119$), 1998 (Asymp. Sig= 0.000 and $\chi^2 = 24.189$), 2003 (Asymp. Sig= 0.000 and $\chi^2 = 22.117$), and 2008 (Asymp. Sig= 0.000 and $\chi^2 = 29.639$). The trend showed that women who had birth interval less than 18 had more infant deaths in respect of the number of children born by that interval. The 1988 to 2008 data depicts that women who had children within the interval less than 18 experienced 17.8%, 21.9%, 12.3%, 18.2% and 20.0% infant deaths in 1988, 1993, 1998, 2003 and 2008 data respectively. However, in 2014, the variable was not significant to infant deaths.

Table 5.6: Relationship between Fertility Factors and Infant Deaths

	1988		1993		1998		2003		2008		2014	
Birth order												
number	% Dead	(N)	% Dead	(N)	% Dead	(N)	% Dead	(N)	% Dead	(N)	% Dead	(N)
1 -3	10.2%	2191	5.8%	1256	8.1%	1871	7.5%	2091	5.4%	1795	4.3%	3407
4-6	11.0%	1310	6.9%	677	7.2%	917	9.0%	1100	6.1%	838	4.6%	1797
7+	12.4%	635	10.3%	271	6.9%	405	10.0%	449	10.5%	275	8.4%	490
Total	10.8%	4136	6.7%	2204	7.7%	3193	8.2%	3640	6.1%	2908	4.8%	5694
Chi Square	2.708		7.359		1.040		4.406		11.028		15.521	
P-value	0.258		0.025		0.595		0.110		0.004		0.000	
Breastfeeding												
Ever breastfed	8.0%	3922	4.3%	2132	5.6%	3061	5.3%	3465	4.5%	2760	4.8%	5528
Never breastfed	74.4%	133	89.6%	48	74.4%	82	88.0%	108	45.8%	72	4.3%	163
Other												
Total	43.2%	81	58.3%	24	29.4%	51	29.9%	67	28.6%	77	0.0%	4
Chi Square	10.8%		4136		6.7%		2204		7.7%		3194	
P-value	681.264		648.666		566.688		987.598		278.535		0.281	
	0.000		0.000		0.000		0.000		0.000		0.869	
Birth interval												
< 18 months	17.8%	236	21.9%	64	12.3%	122	18.2%	137	20.0%	85	8.5%	153
18-24 months	14.3%	469	11.7%	196	12.4%	259	10.1%	286	5.1%	272	5.2%	522
25-35 months	8.2%	1093	8.6%	511	7.8%	682	8.0%	816	5.5%	561	5.2%	1189
36+ months	10.5%	1512	4.5%	978	5.2%	1371	7.1%	1568	5.7%	1299	4.7%	2443
Total	10.8%	3310	7.1%	1749	7.0%	2434	8.2%	2807	6.1%	2217	5.0%	4307
Chi Square	25.470		39.119		24.189		22.117		29.639		4.481	
P-value	0.000		0.000		0.000		0.000		0.000		0.214	

Source: Generated from 1988, 1993, 1998, 2003, 2008, 2014 GDHS Data sets

CHAPTER SIX

MULTIVARIATE ANALYSIS

6.0 Introduction

The Binary Logistic regression is an appropriate method for the multivariate analysis due to the dichotomous nature of the dependent variable, that is whether the child is dead or alive at an infancy stage (0-11 months). As a probability, it ranges between 0 and 1. For that matter the logit transformation model is used and its standard form is represented as follows:

$$-\text{Log} \left(\frac{P_i}{1-P_i} \right) = X_i \beta_i$$

Where P_i signifies the logit transformation of survivorship status, X_i represents the independent variables. In principle, the logistic regression estimates the log of the odds of the outcome occurring in terms of a vector of independent variables and an error term (Gyamfi, 2003). The resulting odd ratios (OR) show the nature of the net impact of independent variable on the probability of the outcome occurring. Odd ratios greater than one ($OR > 1$) depict an increased chance of the outcome occurring; while OR less than one ($OR < 1$) signifies a decreased chance of an outcome occurring and odd ratios equal to one ($OR = 1$) suggests no relationship between the independent (predictor) variables and the dependent (predicted) variable; which in this study is the infant deaths. In the logistic regression analysis, the socio-economic and demographic factors (type of place of residence, region of residence, highest level of education, employment status of the mother and ethnicity) were used as independent variables.

Intermediate variables included; breastfeeding, sex of the child, birth order and birth interval. Others are sources of drinking water, type of toilet facilities and place of delivery.

6.1 Effect of Socio Economic and Demographic Factors on Infant Deaths

Logistic regression of infant deaths by socio economic and demographic factors working through environmental and proximate factors was conducted to examine their relationship to

the outcome variable. After the analysis, it was observed that 2.4% ($R^2=0.024$) of the variation in the dependent variable is explained by the independent variables.

Table 6. 1: Variations in Infant Mortality by Selected Maternal Variables (Model I)

	Exp(B)	95%C.I. for EXP(B)		Sig.
		Lower	Upper	
Highest level of Education				
				.972
No education (RC)	1.000			
Primary	1.035	.724	1.479	.849
Secondary	.981	.731	1.316	.897
Higher	.891	.466	1.703	.726
Ethnicity				
				.016
Akan (RC)	1.000			
Ga Adangme	1.049	.534	2.061	.888
Ewe	1.251	.711	2.204	.437
Guan	3.133	1.691	5.806	.000
Mole Dagbani	1.251	.784	1.996	.348
Other	1.144	.710	1.845	.580
Age in 5 years group				
				.143
15-19 (RC)	1.000			
20-24	1.170	.495	2.765	.720
25-29	1.047	.450	2.438	.915
30-34	1.452	.630	3.348	.381
35-39	1.721	.743	3.984	.205
40-44	1.354	.551	3.330	.509
45-49	1.857	.689	5.008	.221
Region of Residence				
				.057
Western (RC)	1.000			
Central	1.716	.888	3.313	.108
Greater Accra	.885	.404	1.938	.759
Volta	1.411	.653	3.049	.381
Eastern	1.771	.913	3.435	.091
Ashanti	2.323	1.241	4.350	.008
Brong Ahafo	1.357	.703	2.619	.363
Northern Upper W & E	1.860	.994	3.480	.052
Employment Status				
				.139
Not Working (RC)	1.000			
Working	1.297	.919	1.829	.139
Type of place of residence				
				.085
Urban (RC)	1.000			
Rural	.791	.606	1.033	.085
Constant	0.018			0.000

-2Loglikelihood= 2136.222 Nagelkerke R Square = .024 Total number of observations = 5695. Source: 2014 GDHS Data

According to the results in Table 6.1, only ethnicity had a significant relationship with the dependent variable. Under ethnicity, Akan was taken as the reference category. Guan was found to have a significant relationship with infant mortality at 95%. That is women of the Guan ethnic group with odd ratios of 3.155 were 2.155 times more likely to experience infant mortality compared to the women of Akan ethnic group (RC).

6.2 Effect of Intermediate Factors on Infant Mortality

Logistic regression of infant mortality based on intermediate variables was conducted to examine how these factors influence the infant mortality. The results showed that, 1.5% ($R^2=0.015$) of the variations in Infant deaths is explained by the intermediate variable.

Table 6. 2: Variations in Infant Deaths by Selected Intermediate Variables (Model II)

	Exp (B)	95% C.I. for EXP(B)		Sig.
		Lower	Upper	
Type of Toilet facility				
No Facility (RC)	1.000			.893
Flush Toilet	.930	.545	1.586	.789
Pit latrine	1.033	.746	1.432	.844
				.172
Place of Delivery				
Home (RC)	1.000			
Government sector	.814	.595	1.113	.198
Private sector	1.372	.783	2.403	.269
Other	.651	.044	9.595	.754
Source of Drinking Water				
Unimproved (RC)	1.000			
Improved	1.307	.947	1.803	.103
Sex of Child				
Male (RC)	1.000			
Female	.787	.596	1.039	.091
				.300
Birth Interval				
<18 months (RC)	1.000			
18-24 months	.617	.308	1.235	.172
25-35 months	.617	.329	1.158	.133
36 +	.558	.305	1.022	.059
				.977
Months of Breastfeeding				
Ever Breastfed (RC)	1.000			
Never Breastfed	.910	.384	2.154	.829
Other	.000	0.000		.999
Birth Order Number				
1-3.(RC)	1.000			.017
4-6.	1.069	.786	1.455	.671
7+	1.878	1.211	2.911	.005
Constant	.089			.000

-2 Log likelihood =1697.104 Nagelkerke R Square .015 Total number of observations = 5695

Source: 2014 GDHS Data

From Table 6.2 (Model II), birth order emerged as the only statistically significant determinant of infant mortality. The results indicate that women with birth order of 7 or more had odd ratios of 1.878 which means that they were 87.8% more likely to experience infant mortality compared to those with birth order of 1 -3 (RC).

6.3 Effect of Socio-economic, Demographic & Intermediate Variables on Infant Deaths

Model III is a logistic regression of both socio-economic, demographic and intermediate variables. In this model birth order had significant relationship with infant mortality. The model indicated an R^2 of 0.041 implying that 4.1% of the variations in infant deaths were explained by the independent variables. This result calls for more research on other variables which have a significant relationship with infant mortality beside the variables examined and discussed in this study.

Table 6.3: Variations in Infant Mortality by Socio-economic, Demographic and Intermediate Variables (Model III)

	Exp(B)	95% C.I. for EXP(B)		Sig.
		Lower	Upper	
Region				.068
Western (RC)	1.000			
Central	1.297	.614	2.738	.495
Greater Accra	.715	.292	1.746	.461
Volta	1.149	.482	2.743	.754
Eastern	1.458	.687	3.091	.326
Ashanti	2.090	1.048	4.171	.036
Brong Ahafo	1.482	.723	3.038	.283
Northern Upper(W&E)	2.278	1.132	4.585	.021
Age in 5 years group				.138
15-19 (RC)	1.000			
20-24	1.178	.463	3.002	.731
25-29	.957	.381	2.406	.926
30-34	1.492	.593	3.753	.395
35-39	1.509	.578	3.938	.400
40-44	.864	.294	2.538	.791
45-49	.688	.192	2.464	.565
Highest level of Education				.885
No Education (RC)	1.000			
Primary	1.046	.712	1.537	.818
Source of Drinking Water				
Unimproved (RC)	1.000			
Improved	1.519	1.086	2.125	.015
Place of Delivery				.219
Home (RC)	1.000			
Government sector	.811	.589	1.119	.202
Private sector	1.321	.734	2.378	.353
Other	.653	.043	9.888	.758
Ethnicity				.087
Akan (RC)	1.000			
Ga Adangme	1.065	.481	2.357	.877
Ewe	1.405	.736	2.683	.302
Guan	2.981	1.466	6.063	.003
Mole Dagbani	1.258	.747	2.116	.388
Other	1.322	.769	2.274	.313
Employment Status				
Not Working (RC)	1.000			
Working	1.242	.823	1.874	.303

Table 6.3: Variations in Infant Mortality by Socio-economic, Demographic and Intermediate Variables (Model III) Cont'

Type of Toilet Facility				.292
No facility (RC)	1.000			
Flush Toilet	1.358	.740	2.492	.323
Pit Latrine	1.353	.927	1.974	.117
Preceding Birth Interval				.230
<18 months (RC)	1.000			
18-24 months	.653	.323	1.317	.234
25-35 months	.603	.319	1.140	.119
36 +	.539	.292	.994	.048
Months of Breastfeeding				1.000
Ever Breastfed (RC)	1.000			
Never Breastfed	.993	.417	2.366	.987
Other	.000	0.000		.999
Birth order number				.009
1-3.	1.000			
4-6.	.903	.614	1.327	.602
7+	2.006	1.113	3.613	.020
Constant	.023			.000

-2 Log likelihood = 2136.222 1658.162^a Nagelkerke R Square .041 Total Number of Observations 5695. Source: 2014 GDHS Data

From the results in Table 6.3, birth order number appeared significant with infant deaths. Women with the higher birth order had odds ratio of 2.006, indicating that they were 1.006 times more likely to experience infant deaths than the women with birth order between 1-3 (RC).

6.4: Effect of Maternal and Intermediate Variables by the Principle of Parsimony

Further regression analysis was conducted by selecting variables which were significant either at bivariate or multivariate level or both by the recent 2014 GDHS data set in order to identify the variables that are still significant to infant deaths in Ghana. Variables which were found significant at the bivariate and multivariate levels are Ethnicity and Birth order. Region of residence and type of toilet facility was found significant only at bivariate level. Model IV in Table 6.4 comprised of four variables which explained 2.3 percent of the variations in the dependent variable compared to model III which explained 4.1 percent of the dependent

variable. By comparing the two models; it is verified (based on the principle of parsimony) that the important factors that are still relevant to infant deaths in Ghana according to the 2014 GDHS were: -

1. Ethnicity
2. Birth Order Number

Table 6.4: Variations in Infant Mortality by Selected Significant Variables (Model IV)

	Exp (B)	95% C.I. for EXP(B)		Sig.
		Lower	Upper	
Ethnicity				.008
Akan (RC)	1.000			
Ga Adangme	1.051	.534	2.068	.886
Ewe	1.232	.703	2.159	.467
Guan	3.256	1.761	6.022	.000
Mole Dagbani	1.250	.784	1.992	.348
Other	1.096	.675	1.781	.711
Type of Toilet Facility				
No Facility (RC)	1.000			
Flush Toilet	1.150	.700	1.889	.580
Pit Latrine	1.096	.802	1.498	.564
Birth Order Number				.001
1-3 (RC)	1.000			
4-6	1.008	.763	1.332	.955
7+	1.954	1.356	2.817	.000
Region				.076
Western (RC)	1.000			
Central	1.698	.880	3.276	.114
Greater Accra	1.071	.484	2.367	.866
Volta	1.447	.671	3.121	.347
Eastern	1.740	.897	3.376	.101
Ashanti	2.512	1.352	4.669	.004
Brong Ahafo	1.421	.738	2.739	.293
Northern region (Upper W & E)	1.922	1.010	3.659	.047

-2Log likelihood = 2139.805 Nagelkerke R Square .023 Total number of observations 5695. Source: 2014 GDHS Data.

CHAPTER SEVEN

SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.0 Introduction

This chapter is a summary of the results of the trends in infant deaths from 1988 to 2014. In addition, it presents an overview of the findings on the factors associated with infant deaths in Ghana from 1988 to 2014. The chapter also provides recommendations for policy and programme action to reduce the incidence of infant deaths in Ghana.

7.1 Summary

The general objective of the study was to examine the trends and differentials in infant deaths in Ghana from 1988-2014 using 1988, 1993, 1998, 2003, 2008 and 2014 GDHS data sets, so as to establish the relationships between mothers' background characteristics and infant mortality in Ghana over time. Its specific objectives include describing the demographic, socio-economic and environmental factors of mothers of children under one year of age from 1988-2014, establishing the relationship between mother's background characteristics and infant death, and finally, making recommendations for health-centred policy and programme interventions to improve infants' survivorship in Ghana. The socio-economic and demographic factors examined in this study include highest level of education of the mother, type of place of residence, region of residence, employment status, ethnicity and age of the mother. The intermediate variables examined were; sources of drinking water, type of toilet facilities, place of delivery, breastfeeding, birth order, birth interval and sex of the child.

The following hypotheses were proposed during this study: (1) children born to mothers with higher level of education are less likely to die before age one compared to those born to mothers with no education (2) Children born to mothers who used flush toilets are less likely to die before age one compared to those who use pit latrines (3) Children born to mothers whose

source of water is improved are less likely to die before age one compared to those with unimproved source.

To meet the objectives of the study and test the proposed hypotheses, data from GDHS 1988, 1993, 1998, 2003, 2008 and 2014 of Ghana were used. The study focused on 4136, 2203, 3194, 3639, 2909 and 5695 children (singleton) respectively who were born to women aged 15-49 years during the period of one year prior to each survey date.

The relationship between infant mortality and the various background characteristics of the study population was examined at three different levels. These levels were; univariate analysis, bivariate analysis and multivariate analysis. The univariate analysis was used to examine the distribution of children by mothers' background characteristics. At the bivariate level, linear logistic regression was applied where Pearson Chi square test was employed to test for association between mothers' background characteristics and infant mortality while multivariate analysis was applied using binary logistic regression to identify which of the mother 's background characteristics independently influence infant mortality in Ghana. The results of the bivariate and multivariate analysis showed similar findings, with few variations. The results at the bivariate level indicated the variables that were significant by each of the six successive data sets from 1988 to 2014. The 1988 data showed age of the mother, region of residence, ethnicity, birth order, birth interval, breast feeding and sex of the child as the significant factors associated with infant deaths. The 1993 data saw type of toilet facility, place of delivery, source of drinking water, birth interval, birth order and breastfeeding as significant factors associated with infant deaths. In 1998, region of residence, level of education of the mother, place of delivery, source of drinking water, birth interval and breastfeeding were significant. Factors that were significant in 2003 are age of the mother, birth interval, and breastfeeding. 2008 saw region of residence, ethnicity of mothers, birth interval, birth order

and breastfeeding as significant as 2014 saw region of residence, ethnicity, type of toilet facility and birth order as significant factors to infant deaths. However, employment status of the mother was found insignificant across the years from 1988 to 2014. Also, the results at the bivariate showed a declining trend in infant deaths by each determinant with some variables being insignificant to infant deaths as others remain significant even till 2014.

Multivariate analysis through binary regression model was conducted at 95% confidence level at four different stages, based on four models. Model I showed the relationship between socio economic and demographic factors (working through environmental factors) and infant deaths. It was observed that these determinants explained 2.4 percent variations in the dependent variable (infant death) where ethnicity had statistically significant relationship with infant deaths. Following the hypothesis of the study, level of education and place of residence were not statistically significant factors of infant deaths therefore there is no evidence to support this claim.

Model II showed the relationship between intermediate variables and infant deaths. This model explained 1.5 percent variations in the dependent variable compared to Model I which explained 2.4 % variations in the dependent variable. During this stage birth order was found to be statistically significant to infant deaths.

Model III also showed the relationship between both socio-economic and intermediate variables. It was observed that the model explained 4.1 percent variations in the dependent variable. Birth order was significantly associated with infant deaths at 95 % confidence level. Model IV, comprised of two socio-economic and two demographic variables, which were observed to be significant at bivariate and or multivariate levels. This model was employed

mainly to examine the validity of the Principle of Parsimony. After the regression analysis, it was observed that, 2.3% of the variations in the dependent variable is explained by the independent variable and this is not quite different from the results in model II (2.4%). Thus, the validity of the principle of Parsimony in this study was confirmed. During this analysis two important variables were found to have a significant influence on infant death. They are ethnicity and birth order. Ethnicity being significant confirms Suwal (2001) in "The main determinants of infant mortality in Nepal", that ethnicity was among the most influential risk factors. Birth order of the mother confirms Mustafa and Odimegwu, (2011) that births order six or higher have the highest mortality risk.

7.2 Conclusion

The results of the study have shown that apart from employment status of the mother which was not significant throughout the six successive GDHS's, other factors such as place of residence, region of residence, age of the mother, type of toilet facilities, sources of drinking water, place of delivery and birth interval, breastfeeding and sex of the child proved significant at a point in time in the data sets but became insignificant in 2014 at the multivariate level, leading to a decline in infant deaths over time. However, ethnicity and birth order remain significant in 2014 and must be considered important factors affecting infant deaths in Ghana. Even though place of residence, region of residence, age of the mother, employment status, type of toilet facilities, sources of drinking water, place of delivery and birth interval, breastfeeding and sex of the child are not significant predictors of infant mortality at multivariate level, they are associated with lower deaths among infants. Factors such as region of residence and source of drinking water were also significant in 2014 but at the bivariate. Since Model IV explained the variations in the dependent variable by 2.3 percent, it implies that, there are other determinants of infant mortality in Ghana. The trend in infant deaths in

Ghana shows a decline from 1988 to 2014 with ethnicity and birth order remaining significant predictors in 2014.

7.3 Recommendations

The following recommendations are made based on the findings of the study:

- i. Education on addressing Infant deaths issues in general should be fashioned to suit each ethnic group.

- ii. This study has found parity level or birth order as a significant predictor of infant death. It is imperative for health managers and planning authorities to channel resources toward addressing fertility controls in Ghana.

The Ghana Health services through the CHPs should intensify family planning campaigns especially in the rural areas so as to reduce infant deaths in Ghana.

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APPENDIX A
BIVARIATE RELATIONSHIP BETWEEN SELECTED BACKGROUND
CHARACTERISTICS AND IN FANT DEATHS

1988						
Infant Deaths (%)						
Background characteristics			No	Yes	Percent	Total
Age in groups						
15-19	93.4%		6.6%	100.0%		181
20-24	89.1%		10.9%	100.0%		868
25-29	89.7%		10.3%	100.0%		1185
30-34	89.2%		10.8%	100.0%		852
35-39	90.4%		9.6%	100.0%		616
40-44	87.9%		12.1%	100.0%		282
45-49	78.9%		21.1%	100.0%		152
Total	89.2%		10.8%	100.0%		4136
$\chi^2 = 21.63$		df =6		Asymp. Sig = 0.001		
Region						
Western	90.4%		9.6%	100.0%		363
Central	82.9%		17.1%	100.0%		473
Greater Accra	92.0%		8.0%	100.0%		402
Eastern	92.1%		7.9%	100.0%		597
Volta	90.3%		9.7%	100.0%		504
Ashanti	89.1%		10.9%	100.0%		709
Brong Ahafo	91.6%		8.4%	100.0%		538
Upper W,E & Northern	85.5%		14.5%	100.0%		550
Total	89.2%		10.8%	100.0%		4136
$\chi^2 = 40.808$		df =7		Asymp. Sig= 0.000		
Highest level of education						
No education	88.3%		11.7%	100.0%		1851
Primary	89.9%		10.1%	100.0%		2080
Secondary	90.5%		9.5%	100.0%		179
Higher	92.3%		7.7%	100.0%		26
Total	89.2%		10.8%	100.0%		4136
$\chi^2 = 3.287$		df =3		Asymp. Sig= 0.349		

Source of drinking water					
	improved	90.3%	9.7%	100.0%	1053
	unimproved	88.8%	11.2%	100.0%	3083
	Total	89.2%	10.8%	100.0%	4136
		$\chi^2 = 1.766$	df =1	Asymp. Sig= 0.184	
Ethnicity					
		1910	238		
	Akan	88.9%	11.1%	100.0%	2148
	Ga Adangme	90.7%	9.3%	100.0%	334
	Ewe	91.1%	8.9%	100.0%	631
	Guan	94.1%	5.9%	100.0%	85
	Mole				
	Dagbani	86.0%	14.0%	100.0%	520
	Other	89.7%	10.3%	100.0%	418
	Total	89.2%	10.8%	100.0%	4136
		$\chi^2 = 11.325$	df =5	Asymp. Sig= 0.045	
Employment Status					
	Not Working	88.6%	11.4%	100.0%	1915
	Working	89.7%	10.3%	100.0%	2220
	Total	89.2%	10.8%	100.0%	4136
		$\chi^2 = 1.325$	df =1	Asymp. Sig= 0.250	
Place of Delivery					
	Home	90.7%	9.3%	100.0%	1229
	Government	90.4%	9.6%	100.0%	1658
	Private	87.8%	12.2%	100.0%	1136
	Other	88.7%	11.3%	100.0%	62
	Total	89.7%	10.3%	100.0%	4085
		$\chi^2 = 6.992$	df =3	Asymp. Sig= 0.072	
Type of Toilet facility					
		1495	189		
	No Facility	88.8%	11.2%	100.0%	1684
	Flush Toilet	95.0%	5.0%	100.0%	141
	Pit Latrine	89.2%	10.8%	100.0%	2311
	Total	89.2%	10.8%	100.0%	4136
		$\chi^2 = 5.304$	df =2	Asymp. Sig= 0.071	
Sex of child					
	Male	88.0%	12.0%	100.0%	2103
	Female	90.5%	9.5%	100.0%	2033
	Total	89.2%	10.8%	100.0%	4136
		$\chi^2 = 6.399$	df =1	Asymp. Sig= 0.011	

Religion				
Catholic	90.0%	10.0%	100.0%	681
Other christian	90.1%	9.9%	100.0%	2052
Moslem	88.1%	11.9%	100.0%	446
Traditional	86.2%	13.8%	100.0%	406
No religion	88.4%	11.6%	100.0%	533
Other	77.8%	22.2%	100.0%	18
Total	89.2%	10.8%	100.0%	4136
$\chi^2 = 9.374$		$df = 5$	Asymp. Sig= 0.095	

1993

Background characteristics	Infant Deaths			Total
	No	Yes	Percent	
Age 5-year groups				
15-19	94.8%	5.2%	100.0%	154
20-24	93.3%	6.7%	100.0%	505
25-29	93.8%	6.2%	100.0%	585
30-34	92.4%	7.6%	100.0%	501
35-39	94.1%	5.9%	100.0%	273
40-44	91.6%	8.4%	100.0%	143
45-49	90.7%	9.3%	100.0%	43
Total	93.3%	6.7%	100.0%	2204
$\chi^2 = 2.887$		$df = 6$	Asymp. Sig= 0.823	
Region				
Western	90.8%	9.2%	100.0%	206
Central	92.2%	7.8%	100.0%	231
Greater Accra	94.5%	5.5%	100.0%	199
Eastern	94.6%	5.4%	100.0%	239
Volta	93.3%	6.7%	100.0%	238
Ashanti	94.8%	5.3%	100.0%	400
Brong Ahafo	94.8%	5.2%	100.0%	211
Upper W, E & Northern	91.9%	8.1%	100.0%	480
Total	93.3%	6.7%	100.0%	2204
$\chi^2 = 7.219$		$df = 7$	Asymp. Sig= 0.406	
Highest educational level				
No education	92.2%	7.8%	100.0%	876
Primary	93.5%	6.5%	100.0%	1206
Secondary	98.1%	1.9%	100.0%	107
Higher	100.0%	0.0%	100.0%	15
Total	93.3%	6.7%	100.0%	2204

	$\chi^2 = 6.743$	df =3	Asymp. Sig= 0.081		
Source of Drinking water					
Unimproved	92.6%	7.4%	100.0%	1577	
Improved	95.0%	5.0%	100.0%	626	
Total	93.3%	6.7%	100.0%	2203	
	$\chi^2 = 4.312$	df =1	Asymp. Sig= 0.037		
Ethnicity					
Akan	92.5%	7.5%	100.0%	1067	
Ga Adangme	94.0%	6.0%	100.0%	150	
Ewe	96.3%	3.7%	100.0%	297	
Guan	88.5%	11.5%	100.0%	61	
Mole Dagbani	92.5%	7.5%	100.0%	373	
Other	95.1%	4.9%	100.0%	223	
Total	93.3%	6.7%	100.0%	2171	
	$\chi^2 = 9.163$	df =5	Asymp. Sig= 0.103		
Employment Status					
Not working	94.4%	5.6%	100.0%	448	
working	93.0%	7.0%	100.0%	1751	
Total	93.3%	6.7%	100.0%	2199	
	$\chi^2 = 1.189$	df =1	Asymp. Sig= 0.276		
Place of Delivery					
Home	93.5%	6.5%	100.0%	1256	
Government	94.1%	5.9%	100.0%	695	
Private	94.8%	5.2%	100.0%	233	
Other	60.0%	40.0%	100.0%	10	
Total	93.7%	6.3%	100.0%	2194	
	$\chi^2 = 19.592$	df =3	Asymp. Sig= 0.000		
Type of toilet facility					
No facility	92.0%	8.0%	100.0%	765	
Flush Toilet	98.9%	1.1%	100.0%	91	
Pit Latrine	93.6%	6.4%	100.0%	1347	
Total	93.3%	6.7%	100.0%	2203	
	$\chi^2 = 6.749$	df =2	Asymp. Sig= 0.034		
Religion					
No religion	92.7%	7.3%	100.0%	328	
Catholic	92.1%	7.9%	100.0%	378	
Other Christians	94.0%	6.0%	100.0%	1103	
Muslim	91.3%	8.7%	100.0%	277	
Traditional	96.5%	3.5%	100.0%	113	
Total	93.3%	6.7%	100.0%	2199	
	$\chi^2 = 5.518$	df =4	Asymp. Sig= 0.238		

	Infant Deaths			Total
	No	Yes	Percent	
Age 5-year groups				
15-19	91.3%	8.7%	100.0%	115
20-24	90.7%	9.3%	100.0%	709
25-29	93.2%	6.8%	100.0%	866
30-34	94.1%	5.9%	100.0%	615
35-39	90.9%	9.1%	100.0%	506
40-44	90.7%	9.3%	100.0%	291
45-49	96.8%	3.2%	100.0%	94
Total	92.3%	7.7%	100.0%	3196
$\chi^2 = 11.694$		df = 6	Asymp. Sig = 0.069	
Region of residence				
Western	92.3%	7.7%	100.0%	413
Central	88.4%	11.6%	100.0%	379
Greater Accra	95.7%	4.3%	100.0%	329
Eastern	96.2%	3.8%	100.0%	338
Volta	93.7%	6.3%	100.0%	430
Ashanti	94.4%	5.6%	100.0%	514
Brong Ahafo	89.6%	10.4%	100.0%	260
Upper W, E & Northern	88.7%	11.3%	100.0%	531
Total	92.3%	7.7%	100.0%	3194
$\chi^2 = 37.301$		df = 7	Asymp. Sig = 0.000	
No education				
No education	90.6%	9.4%	100.0%	1229
Primary	92.0%	8.0%	100.0%	649
Secondary	94.0%	6.0%	100.0%	1287
Higher	93.5%	6.5%	100.0%	31
Total	92.3%	7.7%	100.0%	3196
$\chi^2 = 10.683$		df = 3	Asymp. Sig = 0.014	
Source of drinking water				
Unimproved	91.3%	8.7%	100.0%	2242
Improved	94.5%	5.5%	100.0%	951
Total	92.3%	7.7%	100.0%	3193
$\chi^2 = 9.527$		df = 1	Asymp. Sig = 0.002	
Ethnicity				
Akan	92.2%	7.8%	100.0%	1676
Ga Adangme	94.8%	5.2%	100.0%	233
Ewe	94.5%	5.5%	100.0%	438
Guan	91.3%	8.7%	100.0%	46
Mole Dagbani	89.4%	10.6%	100.0%	263
Other	91.3%	8.7%	100.0%	539
Total	92.3%	7.7%	100.0%	3195
$\chi^2 = 9.268$		df = 5	Asymp. Sig = 0.099	

Employment Status					
	Not working	90.6%	9.4%	100.0%	448
	Working	92.6%	7.4%	100.0%	2746
	Total	92.3%	7.7%	100.0%	3194
		$\chi^2 = 2.058$	df =1	Asymp. Sig= 0.152	
Religion					
	No religion	92.7%	7.3%	100.0%	301
	Catholic	93.3%	6.7%	100.0%	446
	Other Christian	92.9%	7.1%	100.0%	1799
	Muslim	91.3%	8.7%	100.0%	369
	Tradition	87.5%	12.5%	100.0%	280
	Total	92.3%	7.7%	100.0%	3195
		$\chi^2 = 11.049$	df =4	Asymp. Sig= 0.026	
Place of Delivery					
	Home	91.4%	8.6%	100.0%	1778
	Government	93.7%	6.3%	100.0%	1045
	Private	96.2%	3.8%	100.0%	341
	Other	93.8%	6.3%	100.0%	16
	Total	92.7%	7.3%	100.0%	3180
		$\chi^2 = 12.083$	df =3	Asymp. Sig= 0.007	
Type of toilet facility					
	No facility	91.8%	8.2%	100.0%	992
	Flush toilet	97.6%	2.4%	100.0%	123
	Pit Latrine	92.2%	7.8%	100.0%	2079
	Total	92.3%	7.7%	100.0%	3194
		$\chi^2 = 5.116$	df =2	Asymp. Sig= 0.077	

2003

	Child is dead			Total
	No	Yes	Percent	
Age 5-year groups				
15-19	91.1%	8.9%	100.0%	124
20-24	92.0%	8.0%	100.0%	679
25-29	93.3%	6.7%	100.0%	953
30-34	90.9%	9.1%	100.0%	810
35-39	93.1%	6.9%	100.0%	626
40-44	88.7%	11.3%	100.0%	302
45-49	87.4%	12.6%	100.0%	143
Total	91.8%	8.2%	100.0%	3637
$\chi^2 = 12.752$			df=6	Asymp. Sig= 0.047
Region				
Western	90.5%	9.5%	100.0%	367
Central	92.1%	7.9%	100.0%	304
Greater Accra	94.1%	5.9%	100.0%	389
Eastern	90.3%	9.7%	100.0%	298
Volta	93.1%	6.9%	100.0%	362
Ashanti	90.8%	9.2%	100.0%	685
Brong Ahafo	91.5%	8.5%	100.0%	400
Upper W, E & Northern	92.1%	7.9%	100.0%	833
Total	91.8%	8.2%	100.0%	3638
$\chi^2 = 6.369$			df=7	Asymp. Sig= 0.497
Highest educational level				
No education	91.3%	8.7%	100.0%	1466
Primary	90.2%	9.8%	100.0%	844
Secondary	93.2%	6.8%	100.0%	1290
Higher	95.0%	5.0%	100.0%	40
Total	91.8%	8.2%	100.0%	3640
$\chi^2 = 7.170$			df=3	Asymp. Sig= 0.067
Source of Drinking Water				
Unimproved	91.5%	8.5%	100.0%	2582
Improved	92.6%	7.4%	100.0%	1053
Total	91.8%	8.2%	100.0%	3635
$\chi^2 = 1.231$			df=1	Asymp. Sig= 0.267
Ethnicity				
Akan	91.7%	8.3%	100.0%	1705
Ga Adangme	93.1%	6.9%	100.0%	262
Ewe	92.1%	7.9%	100.0%	442
Guan	89.5%	10.5%	100.0%	86

Mole Dagbani	92.0%	8.0%	100.0%	601
Other	90.9%	9.1%	100.0%	541
Total	91.8%	8.2%	100.0%	3637
<hr/>				
$\chi^2 = 1.803$	df =5	Asymp. Sig= 0.876		
<hr/>				
Employment Status				
Not Working	92.9%	7.1%	100.0%	393
Working	91.7%	8.3%	100.0%	3215
Total	91.8%	8.2%	100.0%	3608
<hr/>				
$\chi^2 = .682$	df =1	Asymp. Sig= 0.409		
<hr/>				
Religion				
No Religion	91.1%	8.9%	100.0%	237
Catholic	89.7%	10.3%	100.0%	437
Other Christian	92.5%	7.5%	100.0%	2156
Muslim	91.0%	9.0%	100.0%	655
Traditional	92.1%	7.9%	100.0%	151
Total	91.8%	8.2%	100.0%	3636
<hr/>				
$\chi^2 = 4.605$	df =5	Asymp. Sig= 0.466		
<hr/>				
Place of Delivery				
Home	92.4%	7.6%	100.0%	1942
Govt	91.4%	8.6%	100.0%	1319
Private	94.2%	5.8%	100.0%	342
Other	92.3%	7.7%	100.0%	13
Total	92.2%	7.8%	100.0%	3616
<hr/>				
$\chi^2 = 2.979$	df =3	Asymp. Sig= 0.395		
<hr/>				
Type of Toilet Facility				
No facility	90.9%	9.1%	100.0%	1154
Flush Toilet	94.8%	5.2%	100.0%	251
Pit Latrine	91.9%	8.1%	100.0%	2229
Total	91.8%	8.2%	100.0%	3634
<hr/>				
$\chi^2 = 4.327$	df =2	Asymp. Sig= 0.115		
<hr/>				
Sex of child				
Male	91.6%	8.4%	100.0%	1841
Female	92.0%	8.0%	100.0%	1798
Total	91.8%	8.2%	100.0%	3639
<hr/>				
$\chi^2 = .203$	df =1	Asymp. Sig= 0.652		
<hr/>				

2008

Mother's Characteristics	Child is dead			Total
	No	Yes	Percent	
Age 5-year groups				
15-19	96.6%	3.4%	100.0%	116
20-24	93.7%	6.3%	100.0%	568
25-29	95.1%	4.9%	100.0%	811
30-34	94.1%	5.9%	100.0%	593
35-39	92.6%	7.4%	100.0%	501
40-44	92.0%	8.0%	100.0%	225
45-49	91.5%	8.5%	100.0%	94
Total	93.9%	6.1%	100.0%	2908
$\chi^2 = 7.293$ df=6 Asymp. Sig= 0.299				
Region				
Western	95.9%	4.1%	100.0%	271
Central	91.5%	8.5%	100.0%	293
Greater Accra	95.1%	4.9%	100.0%	346
Eastern	97.1%	2.9%	100.0%	244
Volta	94.1%	5.9%	100.0%	255
Ashanti	93.6%	6.4%	100.0%	545
Brong Ahafo	95.6%	4.4%	100.0%	272
Upper W, E & Northern	91.7%	8.3%	100.0%	684
Total	93.8%	6.2%	100.0%	2910
$\chi^2 = 17.574$ df=7 Asymp. Sig= 0.014				
Highest educational level				
No education	93.3%	6.7%	100.0%	952
Primary	92.5%	7.5%	100.0%	722
Secondary	94.8%	5.2%	100.0%	1163
Higher	98.6%	1.4%	100.0%	70
Total	93.8%	6.2%	100.0%	2907
$\chi^2 = 7.424$ df=3 Asymp. Sig= 0.060				
Ethnicity				
	1250	77		
Akan	94.2%	5.8%	100.0%	1327
Ga Adangme	94.4%	5.6%	100.0%	143
Ewe	96.4%	3.6%	100.0%	361
Guan	94.0%	6.0%	100.0%	84
Mole Dagbani	94.1%	5.9%	100.0%	597
Other	89.9%	10.1%	100.0%	396
Total	93.9%	6.1%	100.0%	2908
$\chi^2 = 15.282$ df=5 Asymp. Sig= 0.009				

Employment Status					
	Not Working	92.0%	8.0%	100.0%	299
	Working	94.1%	5.9%	100.0%	2598
	Total	93.9%	6.1%	100.0%	2897
		$\chi^2 = 2.136$	df =1	Asymp. Sig= 0.144	
Religion					
	No Religion	92.1%	7.9%	100.0%	126
	Catholic	94.8%	5.2%	100.0%	343
	Other Christians	94.8%	5.2%	100.0%	1691
	Muslim	92.8%	7.2%	100.0%	552
	Traditional	89.0%	11.0%	100.0%	191
	Total	93.9%	6.1%	100.0%	2907
		$\chi^2 = 13.084$	df =5	Asymp. Sig= 0.023	
Source of Drinking Water					
	Unimproved	93.8%	6.2%	100.0%	1701
	Improved	94.0%	6.0%	100.0%	1207
	Total	93.9%	6.1%	100.0%	2908
		$\chi^2 = 0.087$	df =1	Asymp. Sig= 0.768	
Place of Delivery					
	Home	93.9%	6.1%	100.0%	1223
	Government	94.2%	5.8%	100.0%	1407
	Private	94.5%	5.5%	100.0%	255
	Other	92.3%	7.7%	100.0%	13
	Total	94.1%	5.9%	100.0%	2898
		$\chi^2 = 0.323$	df =3	Asymp. Sig= 0.956	
Type of Toilet Facility					
	No Facility	93.2%	6.8%	100.0%	852
	Flush	93.4%	6.6%	100.0%	256
	Pit Latrine	94.3%	5.7%	100.0%	1791
	Total	93.9%	6.1%	100.0%	2899
		$\chi^2 = 1.286$	df =2	Asymp. Sig= 0.500	
Sex of child					
	Male	93.5%	6.5%	100.0%	1510
	Female	94.4%	5.6%	100.0%	1399
	Total	93.9%	6.1%	100.0%	2909
		$\chi^2 = .903$	df =1	Asymp. Sig= 0.342	

Background Characteristics	Child Dead		Percent	Total
	No	Yes		
Age in 5-year groups				
15-19	96.9%	3.1%	100.0%	191
20-24	95.9%	4.1%	100.0%	966
25-29	96.1%	3.9%	100.0%	1449
30-34	94.9%	5.1%	100.0%	1389
35-39	93.9%	6.1%	100.0%	1015
40-44	95.2%	4.8%	100.0%	504
45-49	93.4%	6.6%	100.0%	181
Total	95.2%	4.8%	100.0%	5695
$\chi^2 = 10.331$ df =6 Asymp. Sig= 0.111				
Region				
Western	97.1%	2.9%	100.0%	545
Central	95.4%	4.6%	100.0%	517
Greater Accra	97.1%	2.9%	100.0%	475
Eastern	95.6%	4.4%	100.0%	500
Volta	95.2%	4.8%	100.0%	586
Ashanti	93.5%	6.5%	100.0%	522
Brong Ahafo	96.0%	4.0%	100.0%	594
Upper W, E & Northern	94.3%	5.7%	100.0%	1957
Total	95.2%	4.8%	100.0%	5696
$\chi^2 = 34.325$ df =9 Asymp. Sig= 0.000				
Highest educational level				
No education	95.1%	4.9%	100.0%	1561
Primary	95.1%	4.9%	100.0%	1141
Secondary	95.4%	4.6%	100.0%	2739
Higher	95.7%	4.3%	100.0%	254
Total	95.2%	4.8%	100.0%	5695
$\chi^2 = .325$ df =3 Asymp. Sig= 0.950				
Ethnicity				
Akan	96.0%	4.0%	100.0%	2090
Ga Adangme	96.2%	3.8%	100.0%	315
Ewe	95.6%	4.4%	100.0%	634
Guan	89.1%	10.9%	100.0%	137
Mole Dagbani	94.4%	5.6%	100.0%	1556
Other	95.3%	4.7%	100.0%	962
Total	95.2%	4.8%	100.0%	5694
$\chi^2 = 17.256$ df =5 Asymp. Sig= 0.004				

Employment Status				
No Working	95.9%	4.1%	100.0%	1002
Working	95.1%	4.9%	100.0%	4680
Total	95.2%	4.8%	100.0%	5682
$\chi^2 = 1.290$		df =1	Asymp. Sig= 0.256	
Source of Drinking				
Unimproved	95.5%	4.5%	100.0%	3403
Improved	94.9%	5.1%	100.0%	2293
Total	95.2%	4.8%	100.0%	5696
$\chi^2 = 1.161$		df =1	Asymp. Sig= 0.281	
Place of Delivery				
Home	94.8%	5.2%	100.0%	1822
Government	95.6%	4.4%	100.0%	3513
Private	93.5%	6.5%	100.0%	338
Other	95.0%	5.0%	100.0%	20
Total	95.2%	4.8%	100.0%	5693
$\chi^2 = 4.020$		df =3	Asymp. Sig= 0.259	
Type of toilet facility				
No facility	94.9%	5.1%	100.0%	1920
Flush Toilet	95.8%	4.2%	100.0%	730
Pit Latrine	95.3%	4.7%	100.0%	3046
Total	95.2%	4.8%	100.0%	5696
$\chi^2 = 17.382$		df =4	Asymp. Sig= 0.002	
Sex of child				
Male	95.0%	5.0%	100.0%	2940
Female	95.5%	4.5%	100.0%	2755
Total	95.2%	4.8%	100.0%	5695
$\chi^2 = 1.017$		df =1	Asymp. Sig= 0.313	