REGIONAL INSTITUTE FOR POPULATION STUDIES

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DETERMINANTS OF INFANT MORTALITY IN TANZANIA

BY

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DECLARATION

I **Kwalu Samwel Dede**, certify that apart from reference to other works, which have been duly acknowledged, this dissertation is the result of my own research work carried under the supervision of **Dr. Delali Margaret Badasu**.

None of the work has been reproduced or represented for the award of an academic certificate. I am therefore solely responsible for any shortcomings that may be found in this research work.

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Mr. KWALU SAMWEL DEDE Date

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ABSTRACT

This study set out to examine the determinants of infant mortality in Tanzania. Data from the Tanzania Demographic and Health Survey (TDHS), 2010 were used. A total number of 2,976 children who were born to women aged 15-49 years during the period of one year preceding the survey were involved during the study. The specific objectives of this study were; to describe the mothers' background characteristics, to establish the relationship between mothers' background variables and infant mortality and to make recommendations for infant centered health interventions to improve infant survivorship in Tanzania.

Infant mortality was the dependent variables of the study. This variable was predicted by type of place of residence, zones of residence, educational attainment, household wealth index, place of delivery, and employment status as independent variables. The independent variables were assumed to work through intermediate variables which include; main floor materials, source of drinking water, type of toilet facilities, age of the mother, birth interval, birth order, sex of the child and breastfeeding.

The Microsoft Excels, Statistical Package for Social Science (SPSS) and STATA software were used for the analysis of the data. Chapter one of this report is an overview of the problem at global to the area specific (Tanzania) level; the statement of the problem, objectives and the rationale of the study. The study hypothesized that; mothers with no education are more likely to experience infant deaths compared to mothers with secondary and higher education and mothers

living in urban areas are less likely to experience infant mortality than women living in rural areas.

The bivariate analysis was conducted at 95% confidence level to establish the relationship between infant mortality and background characteristics of the mother. During this stage of analysis, place of delivery, household wealth index, breastfeeding, birth interval and sex of child showed a significant association with infant mortality.

Subsequently, the binary logistic regression was conducted at 95% confidence level to examine the independent effect of background variables on infant mortality. The results (Model III) obtained indicated that zones of residence, breastfeeding and birth interval were the significant determinants of infant mortality.

Generally, after running the regression model (Model IV) which included only the variables which were significant at either bivariate and/or multivariate level; zones of residence, place of delivery, breastfeeding and birth interval emerged as the significant determinants of infant mortality. Therefore, this study is not an exceptional one, as other studies have come out with similar findings.

DEDICATION

I dedicate this work to my beloved family; my wife Neema Onesphoro Morio, My daughters Witness, Winfrida and Wema for their prayers and tolerances during my absence.

You really made my work and academic achievements a success, may our Almighty God bless you.

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LIST OF ABBREVIATIONS AND ACRONYMS

CBOs	Community Based Organizations
CBS	Central Bureau of Statistics
DHS	Demographic and Health Survey
FBOs	Faith Based Organizations
GDP	Gross Domestic Product
IMR	Infant Mortality Rate
IRDP	Institute of Rural Development Planning
MDGs	Millennium Development Goals
MoHSW	Ministry of Health and Social Welfare
MPhil	Masters of Philosophy
Ms-Excel	Microsoft Excel
NGOs	Non-Government Organizations
OR	Odd Ratios
PhD	Doctors of Philosophy
POPS	Population Studies
RIPS	Regional Institute for Population Studies
SPSS	Statistical Package for Social Science
TDHS	Tanzania Demographic and Health Survey
THMIS	Tanzania Health Management Information System
UNICEF	The United Nation's Children Fund
URT	United Republic of Tanzania
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.
Zone	An area distinguished on the basis of a particular characteristic, use, restriction, function etc.
Birth Interval	Duration between the preceding the succeeding birth
Birth Order	The n^{th} 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

CHAPTER ONE

INTRODUCTION

1.1 Background

Infant mortality is the probability of a new born baby dying before its first birthday (TDHS, 2010, Metitantas et al, 2010, Nair et al, 2011, Frey and Field, 2000). It is a factor that is associated with the wellbeing of a population (Nair et al, 2011, Arikand Arik, n: d). 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). Even though death is a biological event, mainly caused by a specific disease, the demographic study of the determinants of infant and child mortality will often concentrate on cultural, environmental, social and behavioural factors which may influence the likelihood of ill health, disease and death in early infancy (Stroobant, 2001).

Mortality is therefore the demographic processes that reflect the health status of a population and hence the state of socio-economic conditions of a country (Ntimba and Mbago, 2005).

One signal advance for human welfare has been the decline in infant mortality rates (IMRs) since the end of World War II. The rate for the developing world fell from 174 deaths per 1,000 live births to 52 over 55 years. At the start, more than one of six infants under age one died compared with one out of 20 by the end. Progress was slower in sub-Saharan Africa, which includes most of the "least developed" countries, where the rate fell from 194 deaths per 1,000 births to about 85. Meanwhile, the IMR in the developed world plummeted from 59 to a mere six.

High rates of infant mortality in Africa continue to be a major public health concern today, despite the fact that most deaths can be prevented from well known, relatively low cost technologies. Between 1990 and 2006, there was a reduction in the number of child deaths globally from 13 to just fewer than 10 million per year. The vast majority of these deaths occurred in developing countries and from preventable causes such as malaria, diarrhoea and others (Handa et al, 2008). Despite the fact that 90 percent of these causes of infant and child death are preventable by known and affordable interventions (Black et al., 2003 in Handa et al, 2008), their decline in infant and child mortality has slowed considerably over time, from an annual reduction of 2.2 percent between 1970 and 1985 to around 1.3 percent since then, with the slowest declines occurring in sub Saharan Africa (Murray, Laakso et al., 2007 in Handa et al, 2008). This has led to renewed efforts by the global community to support public health care services in poor countries. Several new global health initiatives have sought to draw attention to the Millennium Development Goal 4 (MDG4) and to increase resources and partnerships that seek to reduce infant and child mortality in developing countries. Collectively, these initiatives are known as the global campaign for the health MDGs.

The fourth United Nations MDG calls for a two-thirds reduction in the 1990 infant mortality rate by 2015. Progress has been made, but total deaths still run at about 6 million per year. It is therefore timely to examine the demographic determinants of infant deaths, which operate in addition to direct health measures that reduce both rates and numbers of deaths within the demographic categories.

According to Ntimba and Mbago, (2005), Tanzania has made a great effort to reduce infant and child mortality through various means. Significant success has been recorded with regards to the immunization program, control of communicable diseases and nutritional interventions. The

1992 Tanzania Population Policy indicated that mortality has declined substantially over decades as a result of improved access to health care and environmental sanitation.

The infant mortality rate is normally calculated from information drawn from mothers' reports (birth histories) based on the assumption that adult mortality is not very high, and that there is little or no correlation between mortality risks of mothers and that of their children (URT, 2000 in Ntimba and Mbago, 2005).

1.2 Statement of the Problem

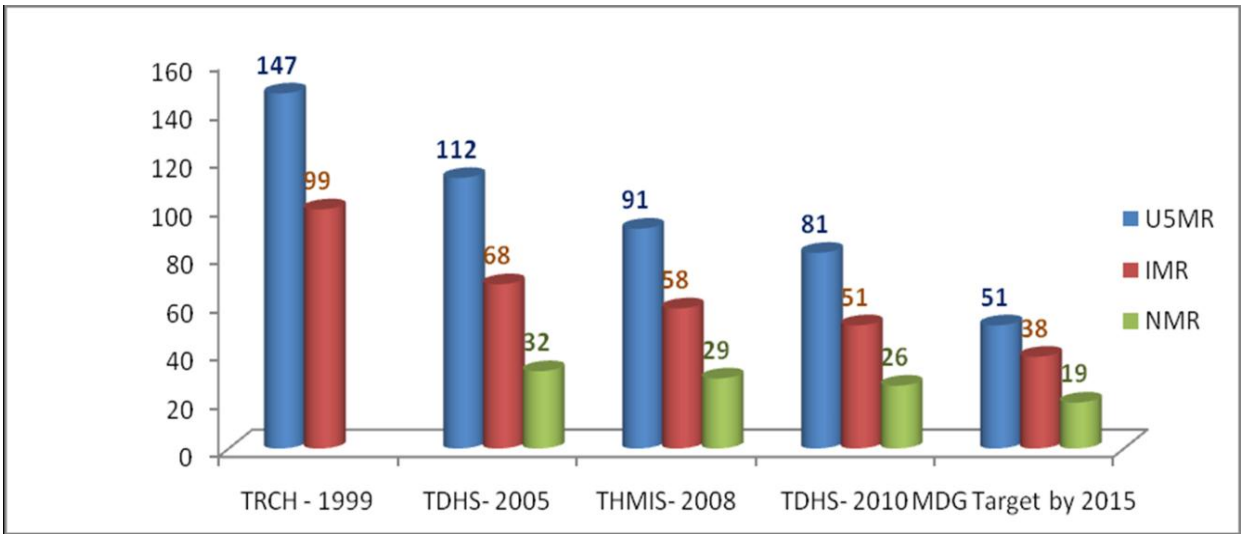
Infant mortality is an indicator of population health and a measure of global health inequalities. Despite advances in medical sciences and acknowledgement of the role of hygiene and sanitation, survival of infants continues to be a challenge worldwide (Nair et al, 2011).

The study of infant mortality is therefore important in any given society because; infant mortality is recognized as a general health indicator of a population. Studies have shown that infant mortality has a high correlation with social factors and negative health outcomes. 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).

Sub-Saharan Africa is a region that suffers from the highest rates of infant mortality across the globe. The infant mortality in this region was recorded to be 94 deaths per 1000 live births in the early 2000's (Frisbie, 2004) with the infant mortality rates of countries such as Tanzania reaching up to 100 deaths per 1,000 live births (Madise , 2003). As indicated in figure 1 below,

Tanzania's IMRs is still amongst the highest in the Sub-Saharan region and is thus a cause for concern (URT, 2010).

Figure 1: Neonatal, Infant and Under-five Mortality Rate



Source: Tanzania Health Sector Performance Report, 2010

The infant mortality decline in Tanzania has been a result of various efforts such as Immunization program, control of communicable diseases and other nutritional interventions; yet it is still higher (51/1,000 live births). Thus, the study is intended to assess the influence of the determinants leading to the persisting high rates of infant mortality in Tanzania.

1.3 Objective of the Study

The general objective of the study was to explore the determinants of infant mortality in Tanzania. Its specific objectives were:-

i. To examine the determinants of infant mortality in Tanzania using 2010 DHS data

ii. To establish the relationship between mother's background variables and infant mortality in Tanzania using 2010 DHS data

iii. To make recommendations for infant centered health interventions for improvement of infants' survivorship in Tanzania.

1.4 Rationale of the Study

Of all human values, longevity is accepted as paramount. Governments all over the world are therefore committed to the goal of extending the lives of their people. Loss of life during early years is undoubtedly a setback to the realization of development of a country. The setback can be seen from two angles; firstly the overall economy of a county and secondly the economic and social aspect of the nuclear families within the country.

The high infant mortality rates may hamper the development of a country as it reduces potential human resource for future challenges. Thus, if it is not well addressed there will be a time where the aged population will be very high promising for low productivity due to lack or inadequate working force.

It is very clear that, in the African context, childbearing is a fundamental building block of a family. The motivation to do this study is that, *infant loss cannot be under-estimated in any society irrespective of its development.*

Thus, a reluctant fight against infant mortality may result into unstable nuclear families, conflicts among society as well as among family members, either by accusing each other of witchcrafts or by social isolation. Therefore it is important to continue asking ourselves "To what extend do these determinants influence infant mortality in Tanzania?

Also infant deaths have a cost implication at both household and national levels. Taking care of an ill infant requires financial, human and time resources. This means that an affected family will always utilize these resources unproductively since at an ultimate end the child dies. For

example, in some of the ethnic groups in Tanzania the grieving period ranges from three to seven days, thus time loss for other productive activities.

Thus, if the government of Tanzania in collaboration with other stakeholders such as Non-Governmental Organizations (NGOs), Community Based Organizations (CBOs) and Faith Based organizations (FBOs) will pay a maximum attention to infant mortality; it can necessitate stable nuclear families, happier homes, togetherness, cheerful working environment and eventually a healthier household economic status. The aggregate of all these will map for a sound national economy by ensuring availability of man power to overcome the future challenges of the country.

This study is therefore be useful in various ways including; widening of knowledge, academic achievement, identification of the major determinants of infant mortality and the stratification of underprivileged societies. In turn this will call for appropriate health policies which can lead to sound health interventions and eventually positive contributions towards infant mortality decline in Tanzania.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Declines in mortality rates can occur either because the composition of subgroups changes in the population, with their different rates, or because the rates themselves change. In the case of infant mortality, the rates differ according to certain subgroups of births: whether the birth comes close to a previous birth, occurs to a young mother or older mother, or at a high birth order. Quite apart from rates, the numbers of deaths within each subgroup depend on numbers of births, which, in turn, reflect numbers of women and their fertility rates. Changes in all of these can be followed over time to decompose the numbers of deaths. Some declines reflect composition changes, others reflect changes in the subgroup rates, and still others reflect net changes in numbers of women and in their fertility histories (Ross, 2010).

2.2 Maternal Education and Infant Mortality

Universally, there are several literatures that focus on the determinants of infant and child mortality. For example (Cadwell 1979, in Mustafa and Odimegwu, 2008) reported the effect of maternal education and age of mother at first birth in reduction of infant mortality. He put up a 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.

Mustafa and Odimegwu, (2008) also indicate that infant mortality is attributed to a complex interplay of socio-economic, demographic, environmental, biomedical and cultural factors. They also note some evidences from studies that used data of censuses like (Tulasidhar, 1993) and demographic surveillance systems (Bhuiyat, 1991) which show the same mortality differential by maternal education.

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

Zerai, (1996 in Kembo and Ginneken, 2009) examined socio-economic and demographic variables in a multi-level framework to determine conditions influencing infant survival in Zimbabwe. He employed Cox regression analysis to the 1988 Zimbabwe DHS data to study socioeconomic determinants of infant mortality. The unique 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 supports assertions that child survival is strongly impacted by mass education.

Ntimba and Mbago, (2005) conducted a study on "Some socio-economic and demographic determinants of infant and child mortality in Karagwe District in Kagera region of Tanzania". The results of their study indicated 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.

2.3 Employment Status of the Mother and Infant Mortality

Employment status refers to the type of employment a person is engaged in, in return for regular payment. Ideally, Ntimba and Mbago, (2005) presumed that, every woman aged 15-49 years in the area they conducted the study, should be engaged in one form of employment or another; though, not all mothers responded to have been engaged in any form of employment for regular payment. The results of their study showed that employed mothers were about 2.3 times less likely to experience child deaths compared to unemployed mothers.

2.4 Place of Residence of the Mother and Infant Mortality

The variation in climate and vegetation can explain differences in morbidity and mortality by area, place or zone of residence. For example a child born by a mother residing in a very dry land where crop cultivation is not easy, may have a problem in obtaining body protective foods especially if the family is not rich enough to buy from the shops.

According to the study conducted by Sello, (2003), using Lesotho DHS (2001), showed that children born in mountainous areas were more likely to die compared to children born in lowland areas. He argued that lowlands have larger area for cultivation and the lowest altitude compared to mountain areas.

Other studies have shown that, mothers living in rural areas are more likely to experience higher infant deaths compared to those residing in urban areas. This can be attributed by 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.

2.5 Household Wealth Index and Infant Mortality

The wealth index is a method developed by the World Bank aimed at measuring the socioeconomic level of a household in a ranked order. It uses principal-component analysis on the basis of respondents' household assets, amenities, and services. Accordingly, the population is divided into five categories from the poorest fifth to the richest fifth (Mutunga, 2004).

In the 2010 TDHS, this variable covered information on ownership of many properties ranging from a television to a bicycle or a car, as well as dwelling characteristics like source of water, sanitation facilities and type of material used in flooring. In low-income countries, because of the

difficulty in measuring the income of the households, the wealth index is believed to be a good proxy for measuring the economic status of households (Mutunga, 2004). Generally, several studies have indicated that children born by mothers with poor household index are more likely to experience infant mortality than children born by mothers with rich household index.

2.6 Place of Delivery and Infant Mortality

Proper medical attendance and hygienic condition during delivery can reduce the risk of complications and infections and possibly deaths for both the mother and the baby (Gyimah, 2004). Gyimah contented that, mothers who delivered at health facilities were less likely to experience infant mortality than those who delivered at home.

Thus, for sound reduction of health risks of the mother and the child, the health-facility-based deliveries should be increased.

2.7 Environmental Contamination and Infant Mortality

Improved sanitation lowers mortality by the mechanism of less exposure of the children to contaminated environment. In turn, this makes them less susceptible to disease and eventually death. Various studies have established the effects of type of toilet facility on infant mortality. Incidence of infectious diseases such as diarrhoea is seen to be influenced by the state of the environment. This type of toilet facility may facilitate pollution and contamination of the environment and consequently affect infant mortality.

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

unprotected sources, experience high infancy deaths than children born by mothers whose drinking water is from protected sources.

2.8 Maternal Age and Infant Mortality

Several studies revealed that, age of the mother is statistically significant in explaining infant and child mortality. For example; mothers who had their first birth before attaining 20 years are about 2.4 times more likely to have child death compared to those who had theirs at ages 20-34 (Ntimba and Mbago, 2005). It is generally expected that children born to young mothers (aged less than 20 years) and those born to older mothers (aged 40-49 years) should have higher mortality than those born to mothers aged 20-39 years (Mustafa and Odimegwu, 2008, Kembo and Ginneken, 2009).

2.9 Breastfeeding and Infant Mortality

According to World Health Organization (WHO, 2003) infant-feeding guidelines recommend 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. In line with the WHO recommendations, Tanzania has been implementing a number of initiatives to improve infant feeding practices, which include the National Strategy and Implementation Plan on Infant and Young Child Nutrition, the baby-friendly hospital initiatives and the training of health workers on infant-feeding skills. Despite these efforts, breastfeeding practices and especially early initiation and exclusive breastfeeding remain suboptimal in Tanzania (Victor et al, 2012).

The study conducted by Mustafa and Odimegwu, (2008) in Kenya indicated that; the most important determinant of infant mortality is breastfeeding status 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.

Nutritional factor such as breastfeeding matters because; it provides the critical micronutrients and antibodies to infants and hence lowers exposure to potentially contaminated foods. A study by Handa et al, (2008) 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).

2.10 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 Odimwegu, (2011) births of order six or higher with short preceding birth intervals have the highest mortality risk, that is multiple births are associated with an

elevated mortality risk. In general short birth interval raises the vulnerability of infectious and parasitic diseases and exposing children to malnutrition.

2.11 Sex of the Child and Infant Mortality

A child's sex has been shown to affect the probability of infant and child mortality: Owing to biological factors, male infants have a higher risk of mortality during the first year of life, as highlighted for example 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).

Male children generally experience slightly higher mortality during infancy and childhood than the female children. Evidence from demographic literature attributes the excess mortality among male children mostly to their higher biological risks during the first year of life.

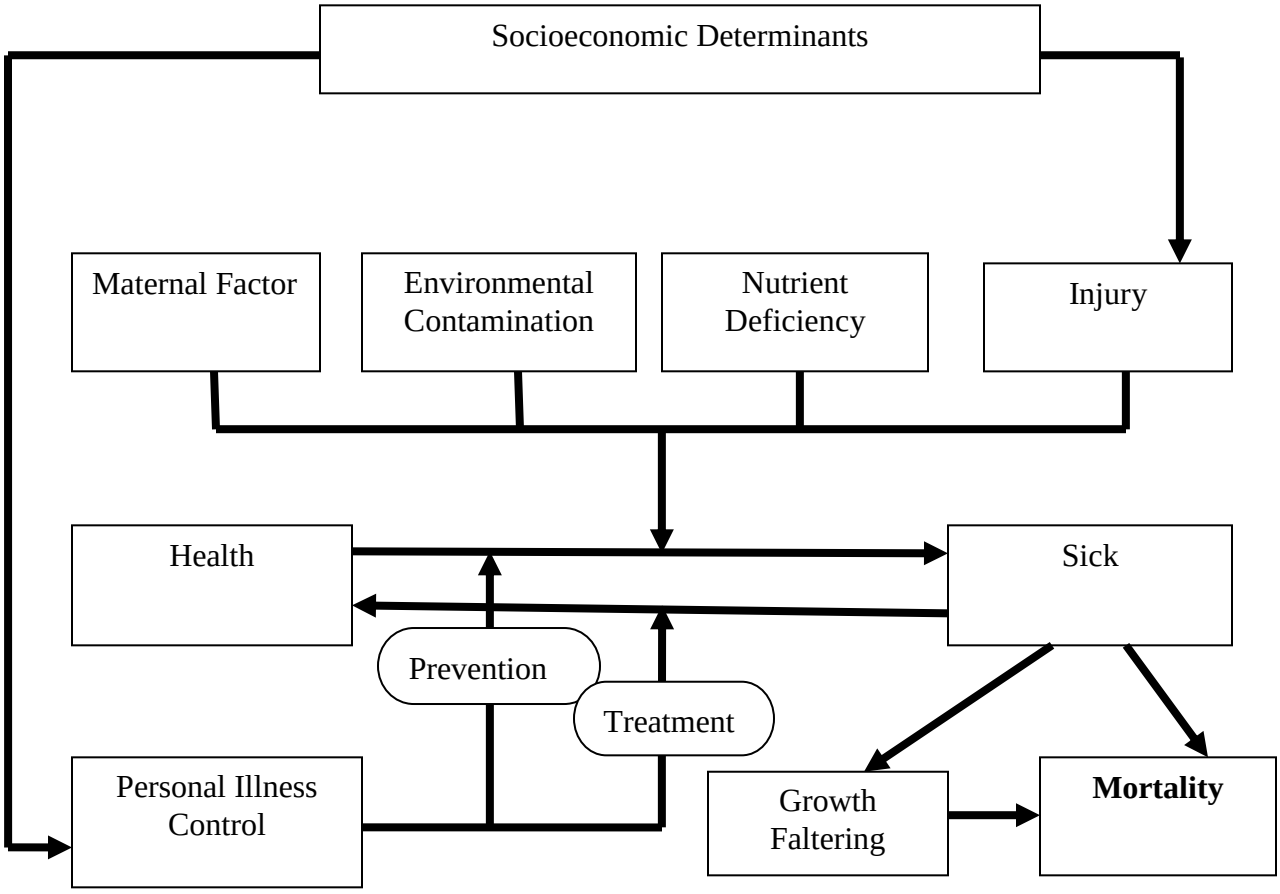
For example, the study conducted by Goro, (2007) in the three region of Ghana; namely Northern region, Upper West and Upper East. The study found that, infant mortality for males in the Upper East region was higher (84 per 1,000 live births) than females (74 per 1,000 live births).

2.12 Conceptual Framework

The concern to understand the complex web of factors affecting childhood mortality has led to the formation of several conceptual frameworks such as those 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, appears to be the most comprehensive and coherent. It takes into account 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 determinants of infant mortality (as part of childhood mortality) in a developing population such as Tanzania's. However its major limitations lies 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

A modified version of the framework is therefore adopted for this study (Fig.3). The modifications are basically based on the available information in the 2010 TDHS data. That means only variables on which information was collected are included in the framework.

The framework explicitly defines five sets of intermediate variables.1) Fertility factors (birth interval and birth order), 2) Biological factor (sex of the child), 3) Nutritional factor

(breastfeeding), 4) Environmental factors (source of drinking water, main floor and type of toilet facilities) and proximate factors (place of delivery and distance from health facility) through which maternal variables (such as, mother's educational attainment, employment status of the mother, place of residence of the mother, zone of residence of the mother and wealth index of the household) operate to influence the survival chances of a child.

Maternal educational attainment, maternal employment status, type of place residence of the mother, zone of residence of the mother, wealth index of the household and age of the mother both directly and indirectly affect the 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 is important because it facilitates her integration into a society impacted by traditional customs, colonialism, and neo-colonialism. Education heightens her 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, 1989).

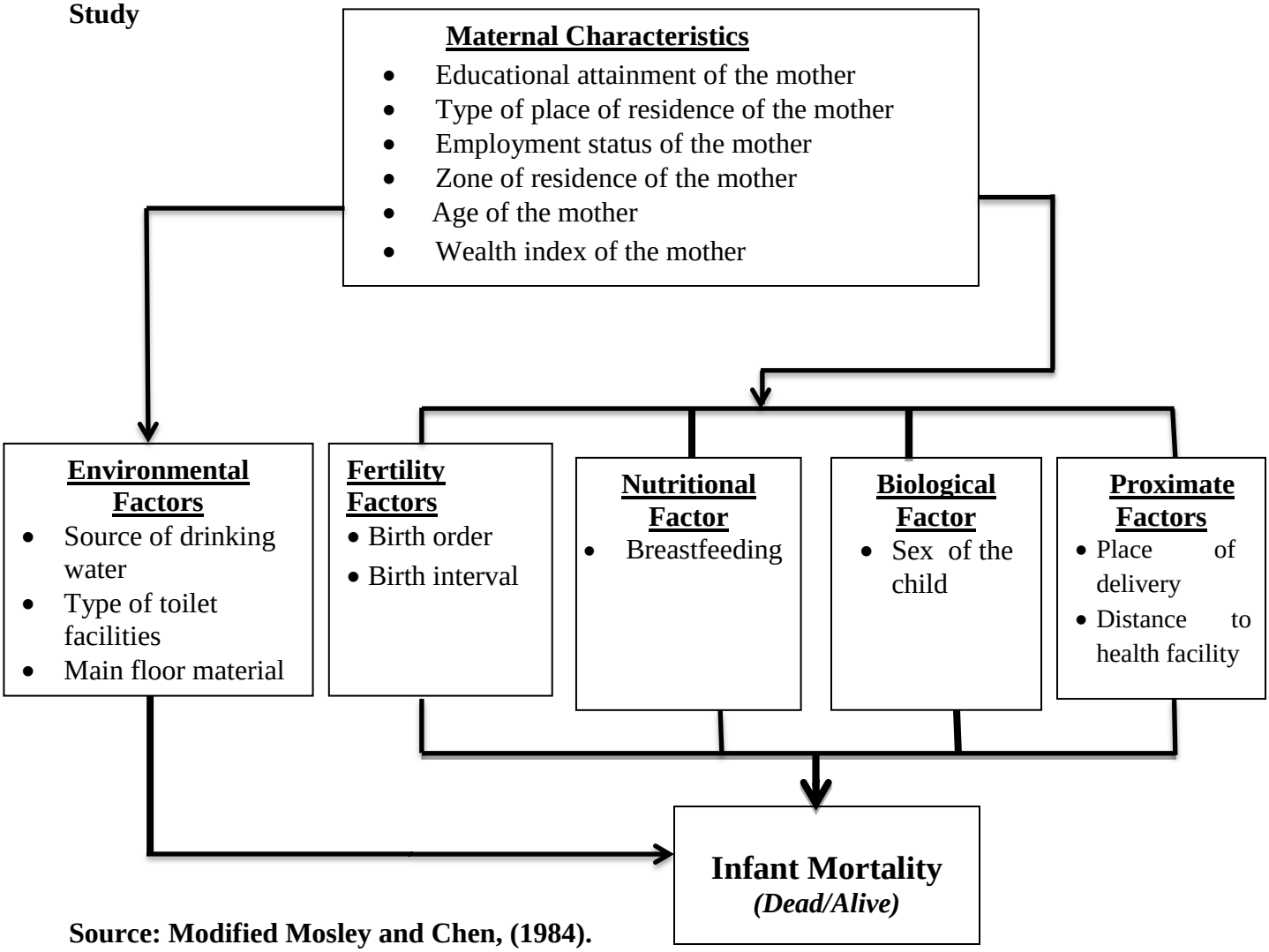
Maternal education also increases awareness of the germ theory of disease (Louis Pasteur in the 1880s) and the growing agreement that "the mother needed education in proper infant care practice" especially regarding feeding practices. Major emphasis was thus placed on breast-feeding, on providing clean and adequate food for the non-breastfed infant – heating of milk and sterilization of bottles were important innovations in this regard –and on keeping the baby and its direct environment clean (Stroobant, 2001).

Economically, wealth and mother's education are expected to affect child survival in many ways. Wealth is expected to influence whether or not the family can adequately provide for the child,

while mother's education is expected to influence the quality of the child's care (Handa et al, 2008). By examining the relationship between mother's education and various proximate determinants of child mortality, Mosley and Chen (1984), Basu and Stephenson,(2005) cited in Handa et al, (2008), show that most proximate determinants improve with mother's education, with the exception of birth interval, age of the mother, parity, or whether or not treatment is sought for various maternal and childhood illnesses.

Nutritional factor, such as breastfeeding, also matter, as it provides the critical nutrients and antibodies to infants and lowers exposure to potentially contaminated foods (Handa et al, 2008). An employed woman is 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 exposing to disease infections as the building of body immunity is denied through short duration breastfeeding.

Figure 2.2: The Conceptual Framework of the Determinants of Infant Mortality of the Study



Source: Modified Mosley and Chen, (1984).

2.13 Hypothesis

i. Mothers with no education are more likely to have their infants die as compared to mothers with secondary education and higher.

ii. Mothers living in urban areas are less likely to experience infant mortality compared to women living in rural areas.

CHAPTER THREE

METHODOLOGY

3.1 Data Sources

The study used data from the 2010 Tanzania Demographic and Health Survey (TDHS). The primary objective of the 2010 TDHS data set was to provide 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 is collected. For children who died, respondents were asked to provide information on their age at death.

The survey also provides information on socio-economic background of the respondents including; educational attainment, employment status, type of place of residence, region of residence and place of delivery among others. Also; information on sources of drinking water and toilet facilities were collected as part of environment factors. Information nutritional status was provided in form of breast feeding.

The maternal information such as age of the mother at first birth, 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 Tanzania.

3.2 Methods of Data Analysis

During the analysis stage, Statistical Package for Social Science (SPSS), STATA and Microsoft-Excel were used as tools of analysis. STATA was used in running the Univariate, Bivariate and Multivariate analysis while Microsoft-Excel and SPSS were employed to generate figures and filtering of data respectively.

3.2.1 Univariate 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 is a method of summarizing the variables used in the study.

3.2.2 Bivariate Analysis

The bivariate analysis is the second level of analysis which was undertaken in this study. This was performed on each independent (maternal, environmental, fertility, proximate, nutritional and biological variables against the dependent variable (infant mortality). This then indicated the extent to which each of the variables was associated with the infant mortality. Pearson Chi-square test was run at 5% confidence level. This test, reports Chi-square value, indicating the nature of the relationship between each independent and dependent variable.

3.2.3 Multivariate Analysis

The third stage of the analysis was the multivariate logistic regression test. At this point all the independent and dependent variables were subjected into one model. This was done to determine the extent to which all the background variables have an impact on infant mortality.

More specifically, the study focuses on the extent to which mothers' education has an impact on infant mortality when other variables are present. This method tests for confounding. The 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 multivariate logistic regression tests were run at 5% significance level, and the p-values and the odd ratios (OR) were analysed for statistical significance for each background variable of the mother.

Table 3: Measurement of the Variables

Variable	Measurement
Background (Independent and Intermediate) Variables	
Educational attainment	0=None education, 1=Incomplete Primary, 2=Complete Primary, 3=Incomplete secondary, 4=Complete secondary or Higher
Employment status of the mother	0=Not Working, 1=Working
Mother's type and place of residence	0=Urban, 1=Rural
Zones of Residence	1 =Western zone: (Tabora, Shinyanga, Kigoma), 2=Northern zone: (Kilimanjaro, Tanga, Arusha, Manyara), 3=Central zone: (Dodoma, Singida), 4=Southern Highlands zone: (Mbeya, Iringa, Rukwa), 5=Lake zone: (Kagera, Mwanza, Mara), 6=Eastern zone: (Dar es Salaam, Pwani, Morogoro), 7=Southern zone: (Lindi, Mtwara, Ruvuma), 8=Zanzibar zone: (Unguja North, Unguja South, Town West, Pemba North, Pemba South)
Wealth index	0=poor, 1=middle, 2=rich
Place of delivery	0=Home, 2=Government Hospital, 3=Private Hospital, 4=Others
Source of drinking water	0=Unimproved(piped water, protected wells and bottled water), 2=Improved(unprotected wells, rain water, 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, 3=Other (drinks other than breast milk)
Sex of the child	0=male, 1=female
Dependent Variable	
Infant mortality	0=No, 1=Yes

3.3 Sampling Techniques

The 2010 TDHS sample was designed to provide estimates for the entire country, for urban and rural areas in the Mainland, and for Zanzibar, the island. For specific indicators such as contraceptive use, the sample design allowed the estimation of indicators for each of the 26 regions. To estimate geographic differentials for certain demographic indicators, the regions of mainland Tanzania were collapsed into seven geographic zones. Although these are not official administrative zones, this classification is used by the Reproductive and Child Health Section of the Ministry of Health and Social welfare (MoHSW). Zones were used in each geographic area in order to have a relatively large number of cases and a reduced sampling error. It should be noted that the zones, as defined below, differ slightly from the zones used in the 1991-92 and 1996 TDHS reports but are the same as those in the 2004-05 TDHS and the 2007-08 Tanzania Health Management Information System (THMIS).

- Western zone: *Tabora, Shinyanga, Kigoma*
- Northern zone: *Kilimanjaro, Tanga, Arusha, Manyara*
- Central zone: *Dodoma, Singida*
- Southern Highlands zone: *Mbeya, Iringa, Rukwa*
- Lake zone: *Kagera, Mwanza, Mara*
- Eastern zone: *Dar es Salaam, Pwani, Morogoro*
- Southern zone: *Lindi, Mtwara, Ruvuma*
- Zanzibar zone: *Unguja North, Unguja South, Town West, Pemba North, Pemba South*

A representative probability sample of 10,300 households was selected for the 2010 TDHS. The sample was selected in two stages. In the first stage, 475 clusters were selected from a list of enumeration areas in the 2002 Population and Housing Census. Twenty-five sample points were

selected in Dar es Salaam, and 18 were selected in each of the other twenty regions in mainland Tanzania. In Zanzibar, 18 clusters were selected in each region for a total of 90 sample points.

In the second stage, a complete household listing was carried out in all selected clusters between July and August 2009. Households were then systematically selected for participation in the survey. Twenty-two households were selected from each of the clusters in all regions, except for Dar es Salaam where 16 households were selected.

All women aged 15-49 years who were either permanent residents in the households were included in the 2010 TDHS sample or visitors present in the household on the night before the survey were eligible to be interviewed.

The number of observation in this study was 2,976 representing the number of live births (singleton births) to the interviewed mothers in the past one year preceding the date of the survey. The selection was done to allow at least one full calendar year of exposure for all the children. Thus, the study used information for those who were born in the past one year preceding the survey and this accounts for 2,976 births with 148 deaths before the first birthday giving infant mortality rate (IMR) of 50 per 1000 live births. The selection of the sample also took into account the assumption that, women will remember their birth history than when a longer period is considered.

3.4 Limitation of the Study

The dependent variable in this study is 'infant mortality'. The study recorded the infant mortalities at the time 0-11 months in the past year prior to the survey and infants who died after the 11^{th} month were not included.

Therefore, there is the possibility that, the infant mortality calculated may be lower than the infant mortality in reality; because some mothers tend not to report deaths of the infants. Though

young mothers usually under-report early childbearing, who could impact the findings of this study, this was minimized by including only births in the past one year prior to the survey.

3.5 Organization of the Study

The study is organized into seven chapters. Chapter one is on the background of the study, statement of the problem and rationale of the study as well as the objectives of the study. Literature review, conceptual framework and hypothesis of the study comprises 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 is all about the profile of the study area and descriptive statistics of the study population. Chapter five is about the association between background characteristics of the study population and infant mortality. Chapter six examined and identified the important determinants of infant mortality in Tanzania. The seventh chapter summarizes the results of the study as well as giving conclusion and recommendations based on the major findings.

CHAPTER FOUR

THE PROFILE OF TANZANIA AND BACKGROUND CHARACTERISTICS OF THE STUDY POPULATION

4.1 Introduction

It is important to examine the distribution of the children by both socio-economic and demographic characteristics of their mothers. This is because; these characteristics have influence on infant mortality. The socioeconomic characteristics included in this study are, type of place of residence of the mother, zones of residence of the mother, educational attainment of the mother, source of drinking water, type of toilet facilities, main floor material, employment status of the mother, distance to the health facility, household wealth index and place of delivery. The demographic characteristics include age of the woman at first birth, breastfeeding, birth order, birth interval and sex of the child.

4.2 Profile of the Study Area

4.2.1 Geography

The United Republic of Tanzania is the largest country in East Africa, covering 940,000 square kilometers, 60,000 of which is inland water. Tanzania lies south of the equator and shares borders with eight countries: Kenya and Uganda to the North; Rwanda, Burundi, the Democratic Republic of Congo, and Zambia to the West; and Malawi and Mozambique to the South.

Tanzania has an abundance of inland water, with several lakes and rivers. Lake Tanganyika runs along the western border and is Africa's deepest and longest freshwater lake and the world's second deepest lake. Lake Victoria, the world's second largest lake, drains into the Nile River, which flows to the Mediterranean Sea. The Rufiji River is Tanzania's largest river, and it drains into the Indian Ocean south of Dar Es Salaam. Although there are many rivers, only the Rufiji and the Kagera, which empties into Lake Victoria, are navigable by anything larger than a canoe.

One of Tanzania's most distinctive geological features is the Great Rift Valley, which was caused by geological faulting throughout eastern Africa and is associated with volcanic activity in the northeastern regions of the country. Two branches of the Great Rift Valley run through Tanzania. The western branch holds Lakes Tanganyika, Rukwa, and Nyasa, while the eastern branch, which ends in northern Tanzania, includes Lakes Natron, Manyara, and Eyasi. Except for a narrow belt of 900 square kilometres along the coast, most of Tanzania lies 200 meters or more above sea level and much of the country is higher than 1,000 meters. In the north, Mount Kilimanjaro rises to 5,895 meters—the highest point in Africa.

The main climatic feature for most of the country is the long dry spell from May to October, followed by a period of rainfall between November and April. The main rainy season is from March to May, along the coast and around Mount Kilimanjaro, with short periods of rain arriving between October and December. In the western part of the country, around Lake Victoria, rainfall is well distributed throughout the year, with the peak period falling between March and May (TDHS, 2010).

4.2.2 Political History

Tanzania (formerly Tanganyika) became independent of British colonial rule in December 1961. One year later, on 9 December 1962, it became a republic, severing all links with the British crown except for its membership in the Commonwealth. The offshore island of Zanzibar became independent on 12 January 1964, after the overthrow of the rule of the sultanate. On 26 April 1964, Tanganyika and Zanzibar joined to form the United Republic of Tanzania.

Tanzania is currently operating under a multiparty democratic system of government, with the president and the national assembly members being elected every five years. Tanzania's president can hold office for a maximum of two five-year terms. For administrative purposes,

mainland Tanzania is divided into 21 regions, and Zanzibar is divided into 5 regions. Each region is subdivided into several districts (TDHS, 2010).

4.2.3 Economy

Tanzania has a mixed economy. Agriculture, comprised of crop growing, animal husbandry, forestry, fishery, and hunting, played a key role in past years. In the current economy, activities in the service industry account for 42 percent of the gross domestic product (GDP). In 2009 the agricultural sector grew by 3.2 percent compared with growth of 4.6 percent in 2008 (National Bureau of Statistics, 2009).

During the same period, the growth rate of crops decreased from 5.1 percent to 3.4 percent and that of livestock decreased from 2.6 percent in 2008 to 2.3 percent in 2009. Drought during the 2008-2009 planting season caused these decreases in growth, particularly in the northern part of Tanzania, where there was inadequate pasture and water for livestock.

In 2009, the GDP grew by 6.0 percent, which compared poorly with 7.4 percent growth in 2008. The slowdown in growth for 2009 was attributed to the impact of the global financial crisis as well as the drought in 2008-2009, which affected agricultural production, hydro-electric power generation, and industrial production. They all contribute significantly to total GDP (Ministry of Finance and Economic Affairs, 2009).

The 2009 GDP at current prices is Tshs. 28,212,646 million, which is equivalent to Tshs 15,721,301 million at 2001 constant prices. With an estimated population on the Tanzania Mainland of 40.7 million in 2009, the per capita income is Tshs. 693,185 ($ 462) at current prices, compared to Tshs. 628,259 ($ 418) in 2008, indicating an increase of 10.3 percent.

The changes in the economy have implications for human wellbeing including survival of the children in any country including Tanzania.

4.2.4 Population

Tanzania has undertaken four population and housing censuses since achieving independence in 1961. The first census, conducted in 1967, reported a total population of 12.3 million, whereas according to the 2002 census, the population has increased to 34.4 million. Although the population of Tanzania has tripled in the past four decades, the country is still sparsely populated. Despite the scarcity of population, density is high in some parts of the country and has been increasing over time. In 1967, the average population density was 14 persons per square kilometre; by 2002, it had increased to 39 persons per square kilometre.

The high population growth rate in Tanzania has been brought about by high fertility and declining mortality levels. According to the 2002 census, the life expectancy at birth is 51 years. The population of Tanzania has continued to be predominantly rural despite the increase in proportion of urban residence over time, from 6 percent in 1967 to 23 percent in 2002.According to the World Fact Book of United States, (2013), the rate of urbanization was estimated to be4.7 percent in 2012 with the proportion of urban residence being 26 percent.

4.2.5 Maternal and Child Health

Tanzania has made considerable progress in the reduction of child mortality. Under-five mortality rates continue to drop –from 112 deaths per 1,000 live births in 2005 to 81 in 2010.

The deaths of infants under one year old also decreased from 68 to 51 per 1,000 live births over the same period. The continuing decline can be attributed to Government commitments to increase use of key health interventions, such as sustained high coverage of routine under- five immunizations, vitamin A supplementation, the use of insecticide treated bed nets and better drugs to treat malaria. Tanzania is close to meeting the 2015 Millennium Development Goal of reducing child mortality (MDG 4). However, current efforts need to be sustained and scaled up

in some areas in order to maintain and build on achievements. High population growth for example places additional strain on service provision at all levels. Pockets of low performance for key interventions also have an impact. For example, fluctuations in routine measles immunization of children under-five years has led to outbreaks and necessitated emergency measles campaigns. Despite improvements, about 390 children under five die every day of mainly preventable and treatable conditions (UNICEF, 2012; PRB, 2012).

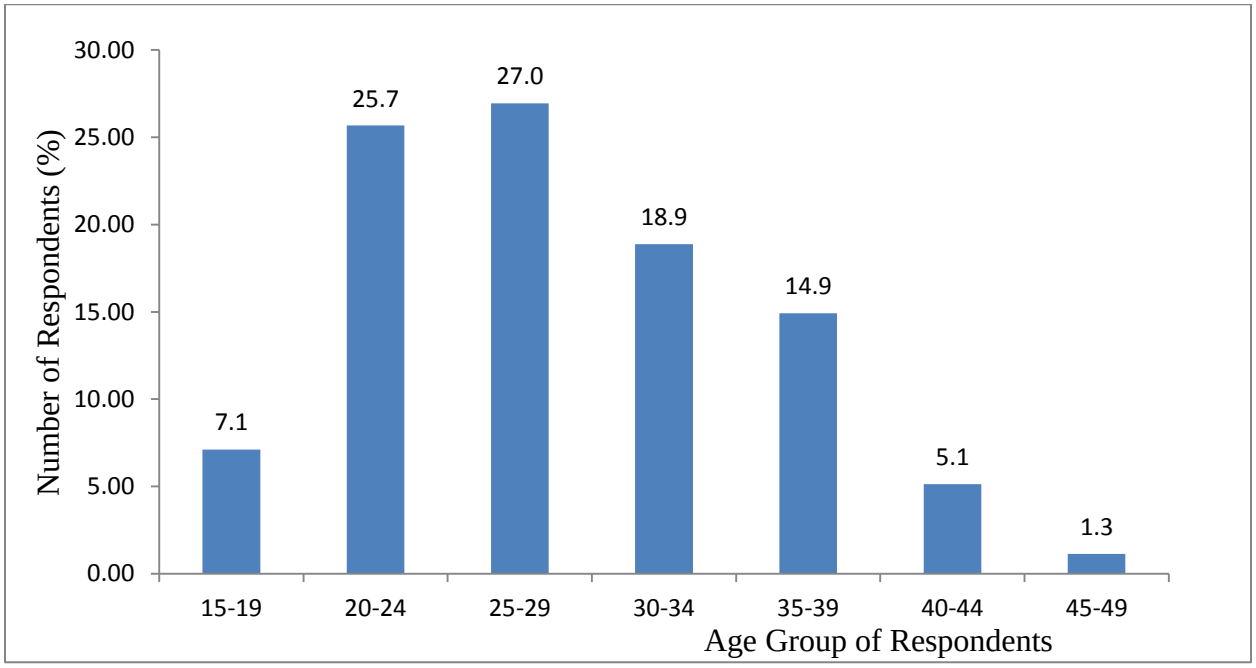
4.3 Mothers' Background Characteristics

The background characteristics included in this study are, type of place of residence of the mother, zones of residence of the mother, educational attainment of the mother, sources of drinking water, types of toilet facilities, main floor material, employment status of the mother, distance to the health facility, 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.

4.3.1 Age of the Mother

It can be seen from Figure 4.1 that the majority (71.5%) of the mothers are aged 20-34 years. Less than a tenth are teenagers (15-19) and the rest (21.3%) are 35 years and over. Thus, majority of children were born by mothers aged 20-39 years.

Figure 4.1: Percentage Distribution of Mothers by Age



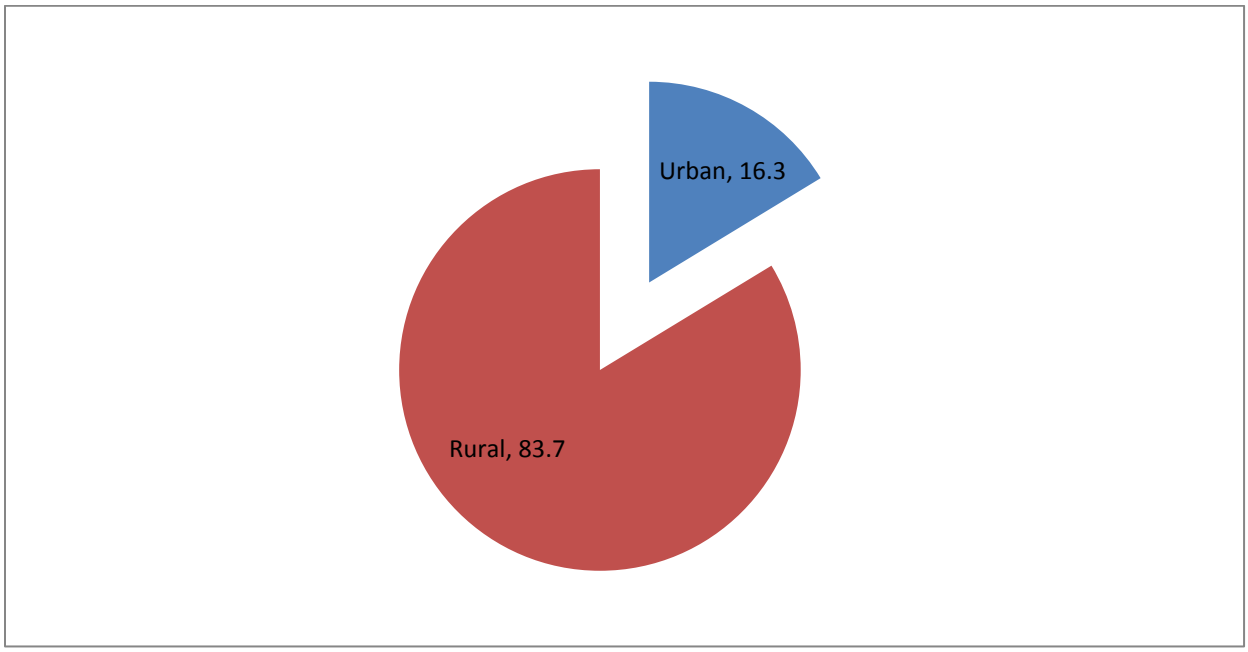
Source: Generated from 2010 TDHS Data

4.3.2 Type of Place of Residence of Mothers

The population of Tanzania has continued to be predominantly rural despite the increase in proportion of urban residents over time, from 6 percent in 1967 to 23 percent in 2002.The percentage urban population of Tanzania was about 26% in 2010. This indicates that the large segment of the Tanzania's population (about 74%) is still living in rural areas. This is reflected by the percentage distribution of the mothers by the type of place of residence of the mother (Figure 4.2). The results showed that 83.7% and 16.7% of the children are born by mothers living in rural and urban areas respectively.

The distribution of the mothers by residential status has implications for their children's survival status. Rural areas have higher mortality rate than urban areas. Since the majorities (83.7%) of the mothers are found in rural areas, the survival chances of their children may be relatively low.

Figure 4.2: Percentage Distribution of Mothers by Place of Residence



Source: Generated from 2010 TDHS Data

4.3.3 Zone of Residence of Mothers

The United Republic of Tanzania (URT) is a union of Tanganyika and Zanzibar with a total of 26 regions by 2010. These regions were divided into 8 zones for the purpose of the study. The division is based mainly on the similarities of the regions by characteristics such as weather conditions and socio-economic aspects. These zones include (with the regions in brackets); Western zone (Tabora, Shinyanga and Kigoma), Northen zone (Kilimanjaro, Tanga, Arusha and Manyara), Central zone (Dodoma and Singida), Southern Highlands zone (Mbeya Iringa and Rukwa), Lake zone (Kagera, Mwanza and Mara), Eastern zone (Dar Es Salaam, Pwani and Morogoro), Southern zone (lindi, Mtwara and Ruvuma) and Zanzibar zone (Unguja North, Unguja South, Town West, Pemba North and Pemba South).

The results show that about 40 percent of the children reside in two out of the eight zones- Western and Zanzibar. Another 16 percent reside in Lake Zone while a little more than a tenth of them are in Northern and Southern Highlands Zones.

Table 4.1: Percentage Distribution Mothers by Zones of Residence

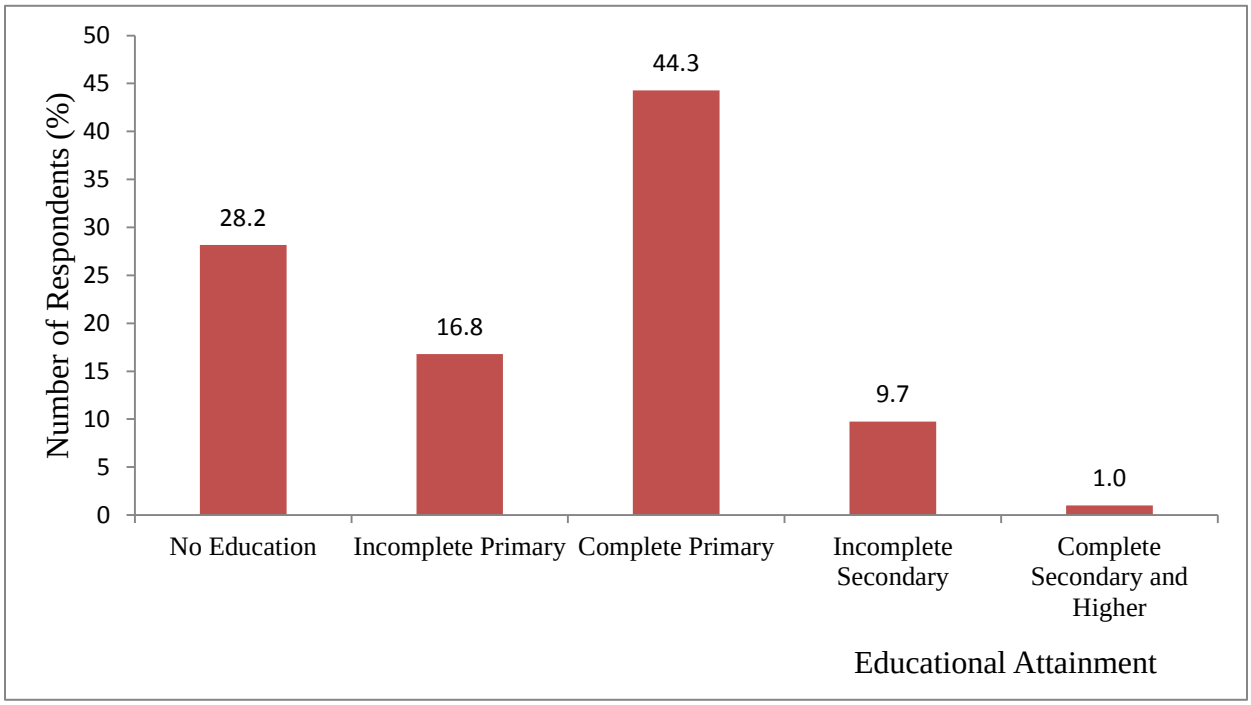
Zones of Residence	Frequency	Percentage (%)
Western Zone	585	19.7
Northern Zone	318	10.7
Central Zone	282	9.5
Southern Highlands Zone	318	10.7
Lake Zone	487	16.4
Eastern Zone	211	7.1
Southern Zone	196	6.6
Zanzibar Zone	579	19.5
Total	**2976**	**100.0**

Source: Generated from 2010 TDHS Data

4.3.4 Education Status of Mothers

The largest percentages of the children were born by mothers with complete primary school education (44.3%) followed by mothers with no education (28.2%). Those with mothers who have incomplete primary education, incomplete secondary education and complete secondary education also form 28.5 percent. The results are shown in Figure 4.3.

Figure 4.3: Percentage Distribution of Mothers by Maternal Education

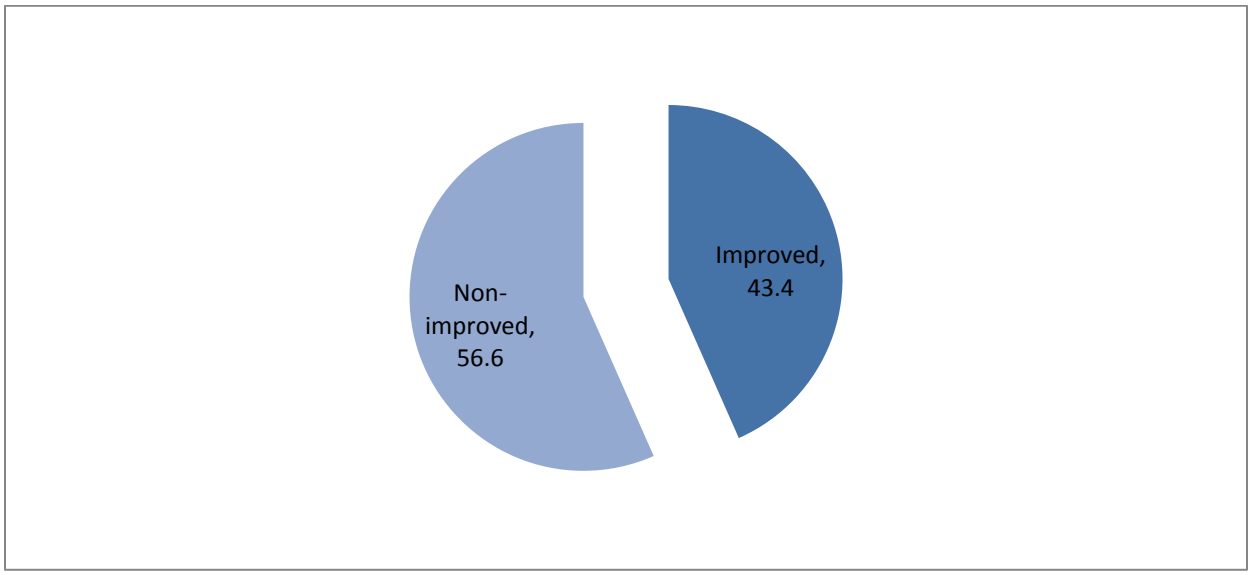


Source: Generated from 2010 TDHS Data

4.3.5 Sources of Drinking Water of Mothers

Source of water as an environment aspect within which people live has an effect on their health. Water-related diseases are major causes of death among children. For the purposes of this study, water source has been categorized into two main groups which are Non-improved sources (unprotected wells, surface water, river water, dam, lake, ponds, streams, canals, irrigation channels and others) and improved sources (piped water, protected wells and bottled water*)*. It can be seen from Figure 4.4 that, 56.6% and 43.4% of the mothers rely on water from non-improved and improved sources respectively. This implies that more than half of mothers give water from non-improved sources to their infants. This is a threat to the survival of infants and the population at large.

Figure 4.4: Percentage Distribution of Mothers by Source of Drinking Water



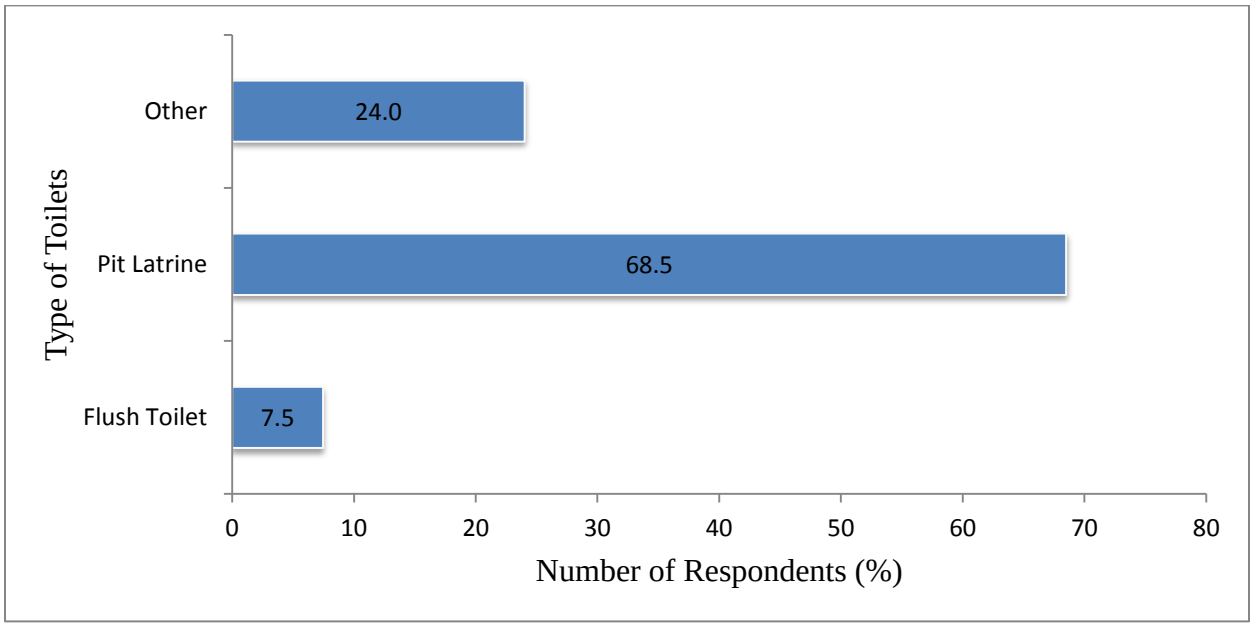
Source: Generated from 2010 TDHS Data

4.3.6 Type of Toilet Facilities of Mothers

Type of toilet also plays a great role as an aspect within which people live. Like the source of water, type of toilet facilities of the mother is divided into three categories namely flush toilets, pit latrines and others (No facility, bush, field, composite toilet, bucket toilet and hanging toilet*)*. The flush toilet is the most improved. Risk of diarrhoea and other infectious diseases are associated with use of pit latrine and other types.

Results in Figure 4.5 indicate that 68.5% of the respondents use pit latrines, 24.0% use other types of toilet and only 7.5% use flush toilet. Thus, the proportion using pit latrine is higher than that of flush toilets. Over two-thirds (68.5%) of the children are exposed to infections because of the use of pit latrines.

Figure 4.5: Percentage Distribution of Mothers by Type of Toilet Facilities

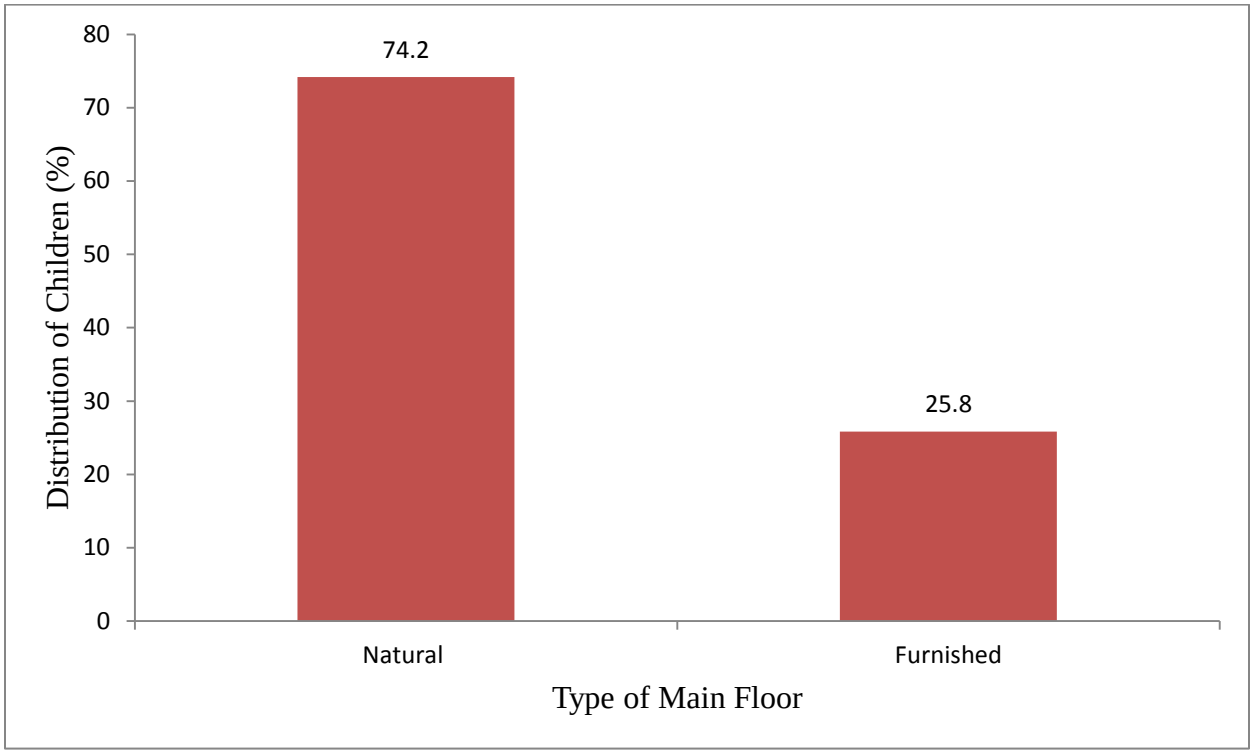


Source: Generated from 2010 TDHS Data

4.3.7 Type of Main Floor of the House of Mothers

The type of floor can impact on infant mortality in several ways. For instance an earth (natural) floor can be a host of various viruses and bacteria which can adversely affect the health of the child. The result of the study showed that 74.2% of the main floor of the dwellings of the children is natural floor while only 25.8% live in dwellings with furnished floor (Figure 4.6). According to several studies people living in houses with natural floors are more likely to be attacked by diseases due to high possibility of the floor to be the host of viruses and bacteria.

Figure 4.6: Percentage Distribution of Mothers by Type of Main Floor of the House

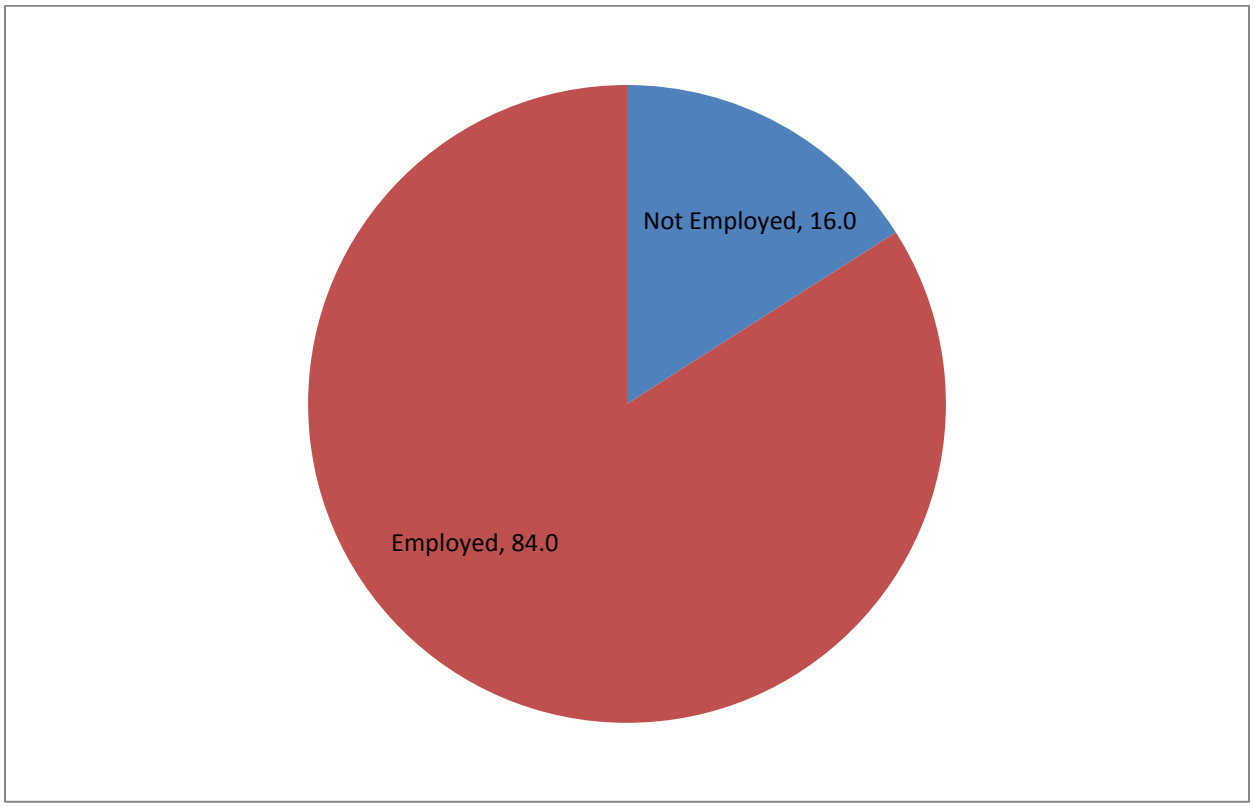


Source: Generated from 2010 TDHS Data

4.3.8 Employment Status of Mothers

The results in Figure 4.7 indicated that 85.0% of the infants were born by mothers who were employed while 15.0% were born by mothers who were not employed. This result suggests that 85.04% of the infants might have been subjected to food supplement during the first three months after birth. This is due to the government circular where maternity leave is only 90 days. Subjecting an infant to foods other than breast milk may invite diseases due food contamination as a result of poor hygiene. Such children may also not build enough immunity from breastfeeding because of short duration of breastfeeding.

Figure 4.7: Percentage Distribution of Mothers by Maternal Employment

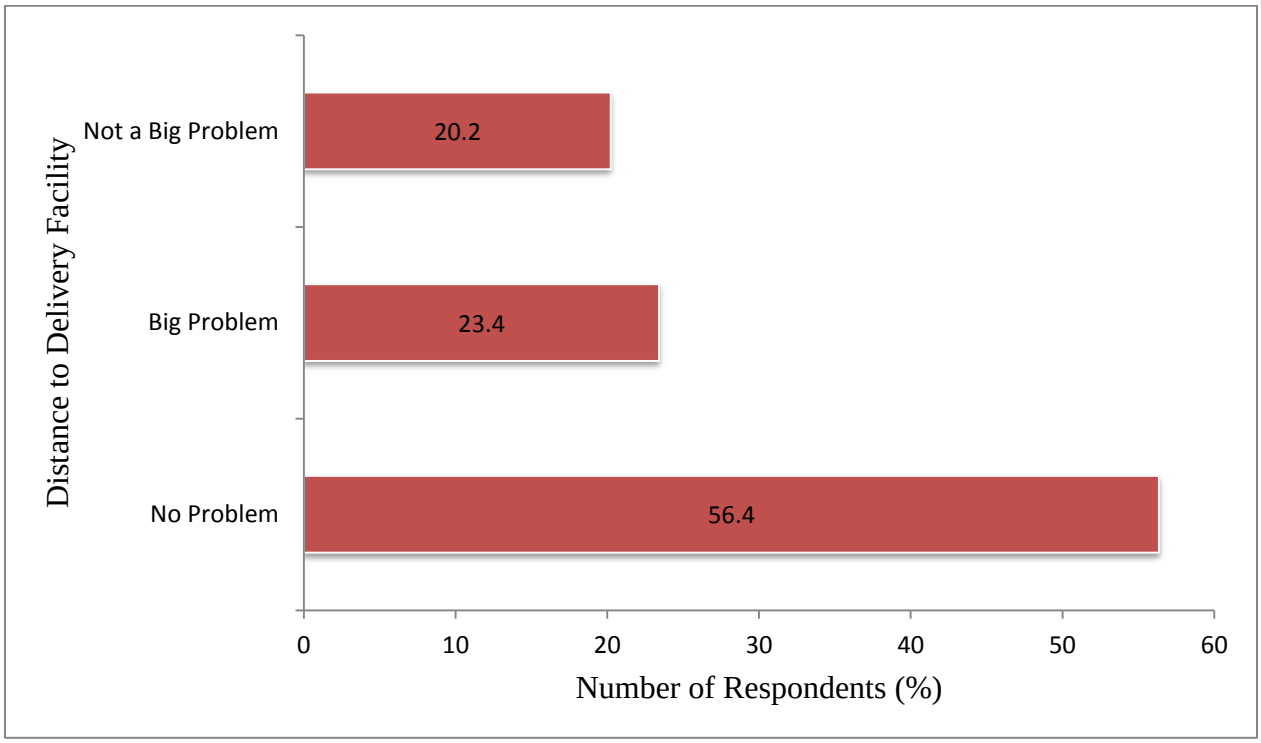


Source: Generated from 2010 TDHS Data

4.3.9 Distance to Delivery Facility of Mothers

Distance to delivery facilities is also one of the factors which may impact the infant mortality. That is women who live far away from the delivery facilities are more likely to experience infant mortality than their counterparts because of delay in receiving health services. From the results (Figure 4.8), 56.4% of the children, their mother lived near the health facility while 43.7% of the children belong to women who lived far from the health facility. This may imply there was a high possibility of women who lived far from the health facility that they gave birth on their way to the delivery services; and thus subjecting their children into contaminated environment, and making them prone to infectious diseases.

Figure 4.8: Percentage Distribution of Mothers by Distance to Delivery Facility

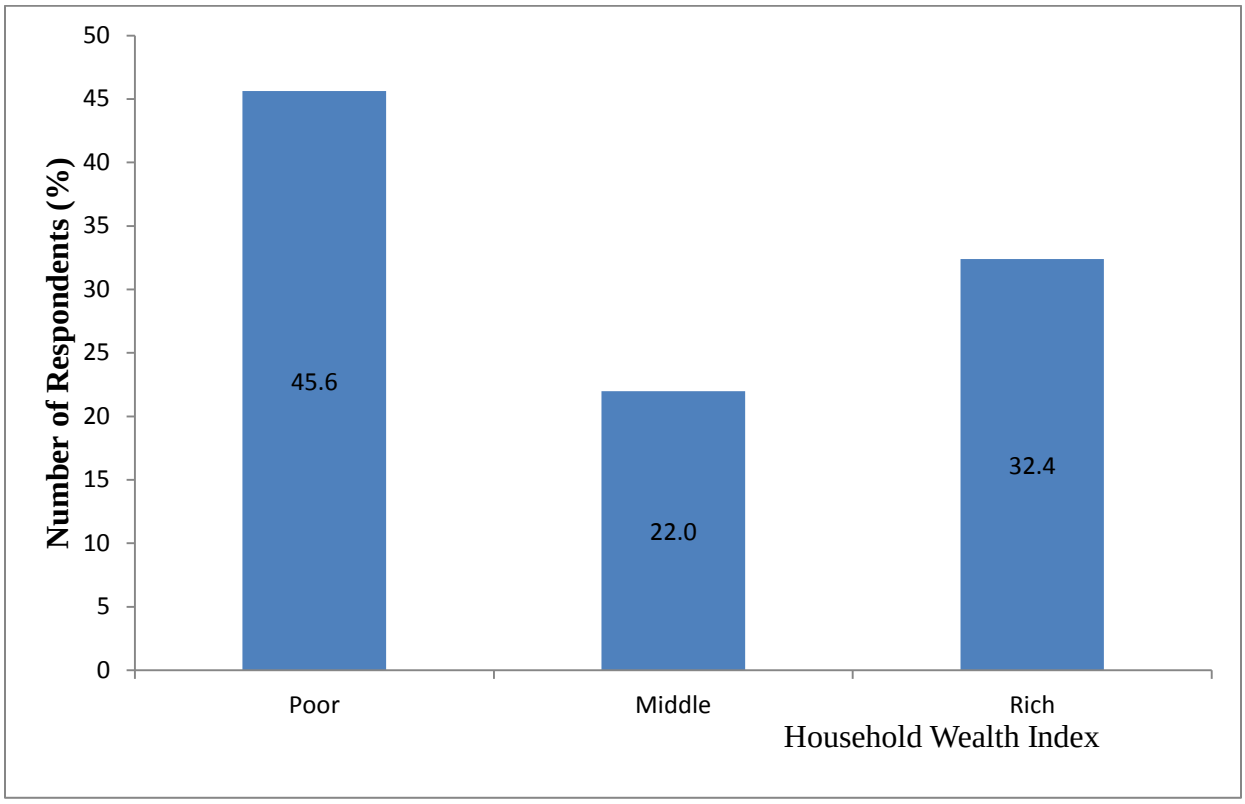


Source: Generated from 2010 TDHS Data

4.3.10 Household Wealth Index of Mothers

Poor families often inadequately supply the basic needs of their children than their counterparts (rich families). Poor supply of basic needs such as medication, food supplements among others, may subject the children to poor health and eventually to death. The results showed that 45.6% of the study children belong to the poor families, 22.0% belong to the middle families and 32.4% to the rich families (Figure 4.9). This indicated that about half of the children belong to the poor families and hence are more likely to experience infant mortality than their counterparts.

Figure 4.9: Percentage Distribution of Mothers by Household Wealth Index



Source: Generated from 2010 TDHS Data

4.3.11 Place of Delivery of Mothers

Table 4.2 showed that, 52.3% of the children were delivered at home followed by 38.1% of the children who were delivered at public sector health facilities. Also 7.7 percent and 1.8 percent of the children were delivered at the private health sector facilities and other places (such as at the farm and on the way to the health facility).

Place of delivery is an important aspect which can determine the infant survivorship. Women who deliver at home are more likely to experience infant mortality than their counterparts since they lack services from skilled birth attendants.

Table 4.2: Percentage Distribution of Mothers by Place of Delivery

Place of Delivery	Frequency	Percentage
Home	1557	52.3
Public Sector	1135	38.1
Private Sector	230	7.7
Other	54	1.8
Total	**2976**	**100.0**

Source: Generated from 2010 TDHS Data

Table 4.3 summarizes the results of the descriptive statistics of the distribution of the children by breastfeeding, birth order and birth interval. According to the analysis 93.2 percent of the children were ever breastfed, while 4.4 percent were never breastfed and 2.4 were given non-breast milk such as animal's milk and other drinks.

Table 4.3 also show that 54.1%, 31.2% and 14.7% of the women had total number of births between 1-3, 3-6 and 7 or 7+. The higher the births order the more likely the infant deaths.

The birth interval results showed that, 20.7% of the children were the first born, 4.2% were born less than 18 months preceding the subsequent birth of the respective mother while 14.3%, 30.8% and 30.2% were born at interval of 18-24 months, 25-35 months and 36 or 36+ months preceding the later birth of their respective mothers. Several studies have revealed that the less the interval between births the more likely the infant death.

Table 4.3: Percentage Distribution of Mothers by Selected Fertility and Nutritional Factors

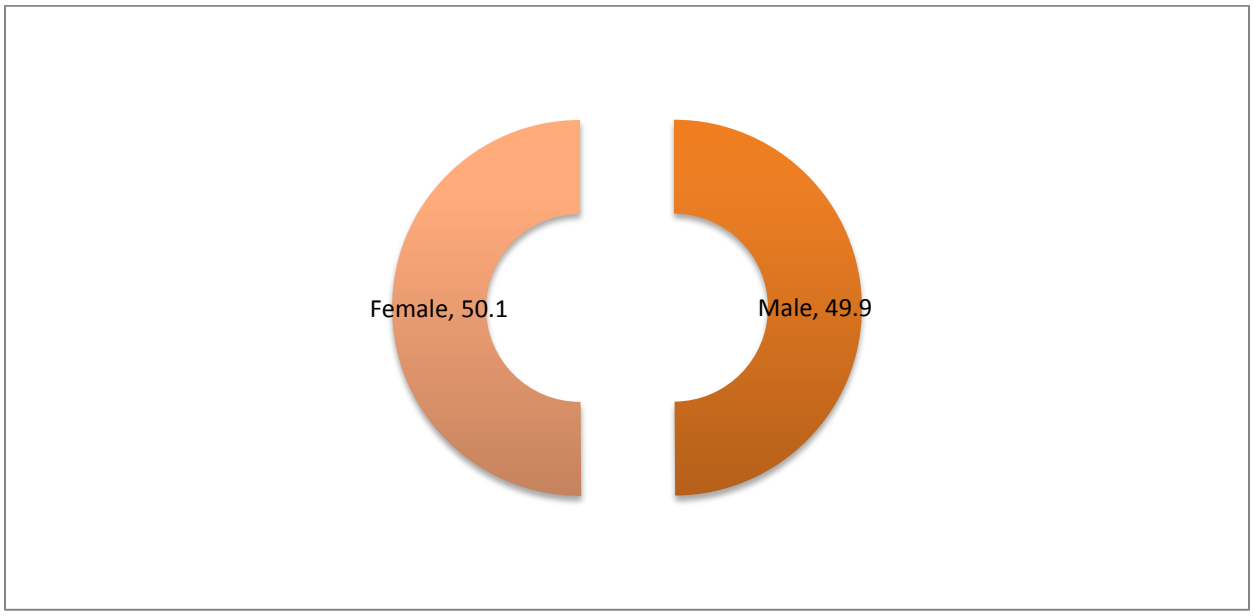
Variable	Frequency	Percentage
Breastfeeding		
Never	132	4.4
Ever	2773	93.2
Other	71	2.4
Total	**2976**	**100.0**
Birth Order		
1-3 births	1611	54.1
4-6 births	928	31.2
7 or 7+ births	437	14.7
Total	**2976**	**100.0**
Birth Interval		
First Birth	615	20.7
< 18 months	124	4.2
18-24 months	424	14.3
25-35 months	915	30.7
36 or 36+ months	898	30.2
Total	**2976**	**100.0**

Source: Generated from 2010 TDHS Data

4.3.12 Sex of the Child

Sex of the child is an important factor when studying infant mortality. Several literatures has shown that a sex differentials exits in survival chances of infants. This differentials favour the female sex to male (Figure 4.10).

Figure 4.10: Percentage Distribution of children by Sex



Source: Generated from 2010 TDHS Data

The results in the above figure indicated that, children born in the year preceding the survey, 50.1% were females while 49.9% were males.

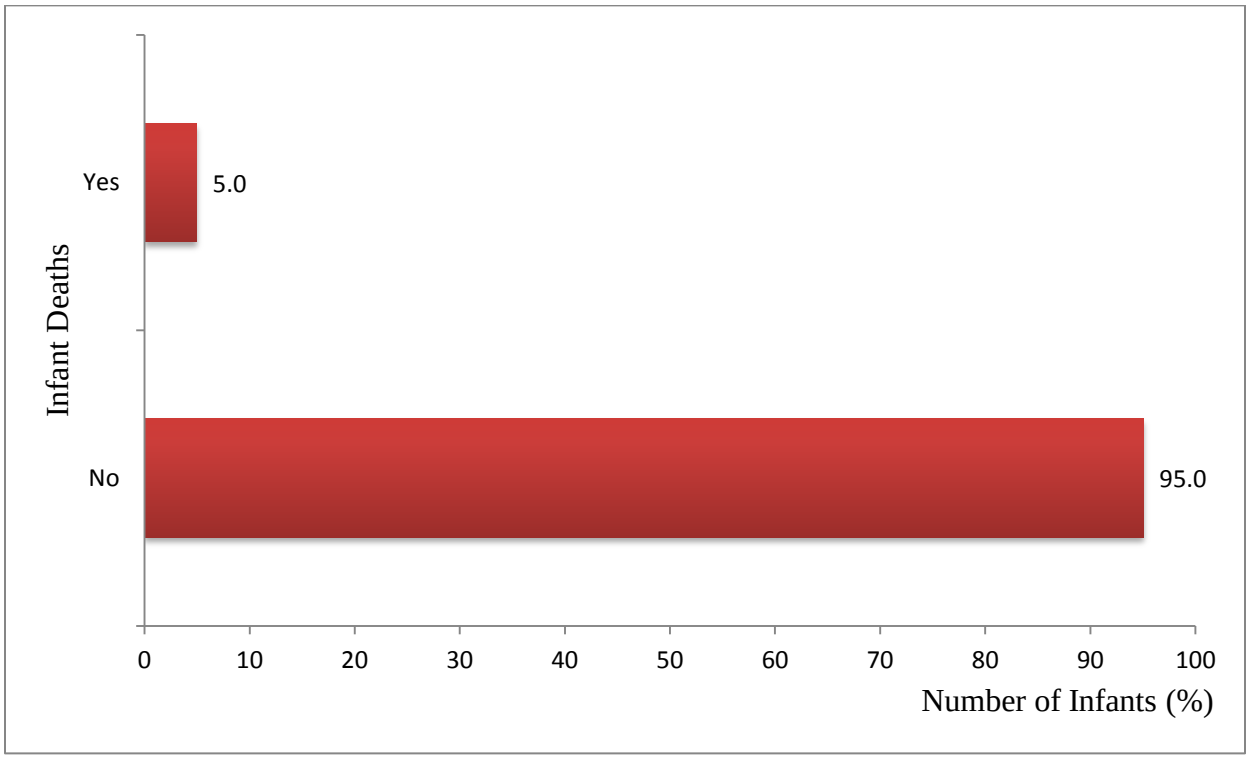
4.3.13 Infant Mortality

Out of 2976 singleton children born in the year preceding the survey 148 (5.0%) died while 2828 (95.0%) survived during the infancy age. This implies that there were t 50 infant deaths in every 1000 live births (Figure 4.11). This was calculated by direct method as follows:-

Infant Mortality rate (IMR) is given by the formula:

IMR=[Total number of deaths in a year(s)/Total number of births in that year(s)] x1000

Figure4.11: Percentage Distribution of Children by Infant Mortality



Source: Generated from 2010 TDHS Data

CHAPTER FIVE

MOTHER'S BACKGROUND CHARACTERISTICS AND INFANT MORTALITY

5.1 Introduction

The bivariate analysis conducted in this study examined the relationship between selected mothers' characteristics and infant mortality. The mothers' characteristics included; type of place of residence, zone of residence, educational attainment, place of delivery, household wealth index, employment status, age at first birth, breastfeeding and birth interval. Sex of the child is also included as Children's factor. Pearson's Chi-Square test was used to examine the association between the selected variables and infant mortality.

The association indicated that, place of residence, educational attainment, sources of drinking water, type of toilet facilities; main floor materials; employment status and distance from home to the health facility were not significantly related with infant mortality. Zones of residence, household wealth index and place of delivery had significant relationship with infant deaths.

Also, variables such as age at first birth and birth order were not significantly related with infant mortality while breastfeeding, sex of the child and birth interval had significant relationship with infant mortality.

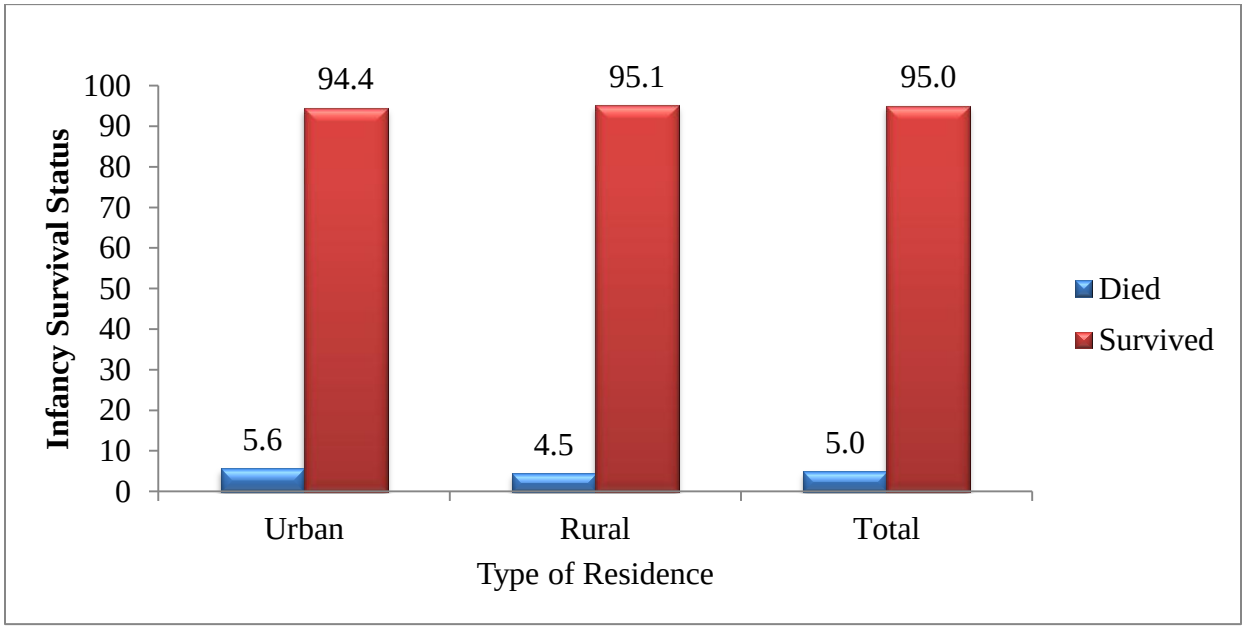
5.2 Socio-economic/Environmental Characteristics and Infant Mortality

A test of association between socio-economic characteristic and infant mortality was conducted using Pearson Chi-square test at 5% confidence level.

5.2.1 Mother's Place of Residence and Infant Mortality

Several literatures have found that children born by mothers living in rural areas have higher chances of dying compared to the children born by mothers residing in the urban areas (Desta, 2011: 60, Gyamfi, 2002). The results of this study showed otherwise, because the variable had no significant association with infant mortality at a Pearson Chi-square of 0.43 and a P-value of 0.51 as indicated in Figure 5.1.

Figure 5.1: Relationship between Mother's Place of Residence and Infant Mortality



χ2=0.43, P-value=0.51, %=Percentage, Number of Observations=2976
Source: Generated from 2010 TDHS Data

The results in Figure 5.1 show that, there was no significant relationship between the place of residence of the mother and infant mortality. The results also show that among the children born by mothers residing in the urban areas 5.6% died, while among the children born by mothers residing in the rural areas 4.5% died. This differential can be due to the fact that, amenities such

water supply, toilet facilities, roads and others are poorly distributed, as results the environments in the urban centers are highly contaminated.

5.2.2 Mother's Zone of Residence and Infant Mortality

Although zone of residence was not significant at 95% confidence level, it was found significant at 90% confidence level with a Chi-square of 13.28 ($\chi 2 = 13.28$) and a P-value of 0.07. The results are presented in Table 5.1 and discussed.

Table 5.1: Relationship between Mother's Zone of Residence and Infant Mortality

Zone of Residence	Infancy Survival Status (%)	
	Died	**Survived**
Western Zone	4.1	95.9
Northern Zone	5.0	95.0
Central Zone	2.1	97.9
Southern Highlands Zone	6.3	93.7
Lake Zone	5.1	94.9
Eastern Zone	8.5	91.5
Southern Zone	6.1	93.9
Zanzibar Zone	4.7	95.3
Total (N/%)	**148 (5.0)**	**2828(95.0)**

χ2=13.28, P-value=0.07, N=Number, %=Percentage
Source: Generated from 2010 TDHS Data

The results in Table 5.1 show that, the first three zones with high proportion of infant mortality are Eastern zone 8.5%, Southern Highlands Zone 6.3% and Southern zone 6.1%. The two zones with lower proportion of infant mortality are Central zone 2.1% and Western zone 4.1%.

More deaths in the Eastern zone may be attributed by the women who are crowded in Dar es Salaam city for casual works with low salaries such bar maid, house girls and others who either get teenage pregnancy or unwanted pregnancies. But also would be contributed by the fact that Eastern zone is a coastal area which is prone to high malaria endemicity.

This is an indication that, there is a significant infant mortality differential among zones of residence. The study conducted by Sello, (2003) using the Lesotho Demographic and Health Survey, 2011 and Sartorius et al, (2011), in South Africa conforms to this study.

5.2.3 Mother's Educational Attainment 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 association with infant and child mortality. The results of the study on this variable is presented in Table 5.2 and discussed; but the variable was not significant in relation to infant mortality at a Pearson Chi-square of 5.82 ($\chi 2$=5.82) and P-value of 0.21.

Table 5.2: Relationship between Mother's Educational Attainments and Infant Mortality

Educational Attainment	Infancy Survival Status (%)	
	Died	**Survived**
No Education	4.7	95.4
Incomplete Primary	6.0	94.0
Complete Primary	5.3	94.7
Incomplete Secondary	2.4	97.6
Complete Secondary and Higher	6.7	93.3
Total (N/%)	**148 (5.0)**	**2828(95.0)**

χ2=5.82, P-value=0.21, N=Number, %=Percentage
Source: Generated from 2010 TDHS Data

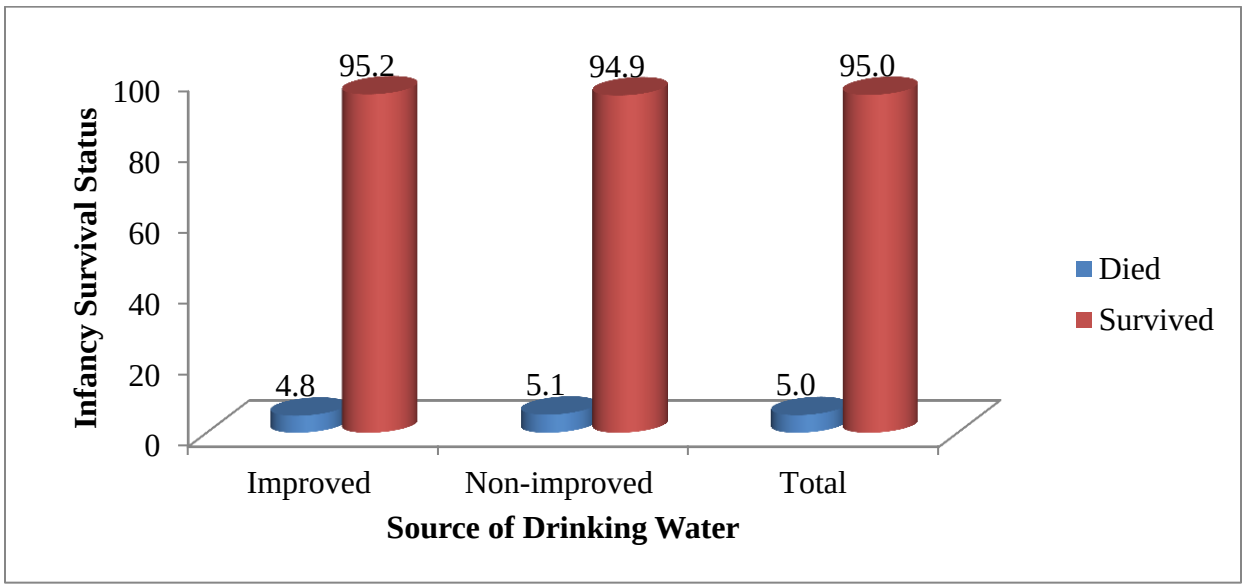
The results in Table 5.2 show that, children born by mothers with complete primary secondary education and higher had an IMR of 67 per 1,000 live births, followed by children born by mothers with incomplete primary education (IMR=60/1,000), complete primary (53/1,000), no education (47/1,000); while the lowest IMR was experienced among children born by mothers with incomplete secondary education.

The results suggests that deaths among infants is more prominent among children born by mothers with complete and higher educational attainment followed by children born by mothers with incomplete primary educational attainment. This may be due to the fact that mothers with secondary education and higher have lesser time to take care of their new born babies.

5.2.4 Mother's Source of Drinking Water and Infant Mortality

Sources of drinking water were categorized into improved sources and non- improved sources. After the Pearson Chi-square test analysis, the variable was not significantly associated with infant mortality at a $\chi 2=0.14$ with a P-value of 0.71. The results in Figure 5.2 indicated that 5.1% of the deaths of infants occurred were of children born by mothers whose sources of water were non-improved while 4.8% were of children born by mothers whose sources of drinking water were improved. This may be a result of using contaminated water from un-improved sources.

Figure 5.2: Relationship between Mother's Source of Drinking Water and Infant Mortality



χ2=0.14, P-value=0.71, %=Percentage, Number of Observations=2976
Source: Generated from 2010 TDHS Data

5.2.5 Mother's Toilet Facilities and Infant Mortality

The Pearson Chi-square test showed that there was no significant association between types of toilet facility of the mother with infant survival status. The $\chi 2=0.56$ and a P-value of 0.76 was observed. The results indicated that, among the children born by mothers who used flush toilets, 5.86% died, while 5.0% of the children born by mothers who used pit latrines died and 4.6% of the children born by mothers who used other type of toilets died (Table 5.3). This result was contrary to the expectations, because the children born by mothers who used other type toilets such bush, field hanging and composite are expected to experience high infant mortality compared to their counterparts.

Table 5.3: Relationship between Mother's Toilet Facilities and Infant Mortality

Type of Toilet Facility	Infancy Survival Status (%)	
	Died	**Survived**
Flush Toilet	5.9	94.1
Pit Latrine	5.0	95.0
Other*	4.6	95.4
Total (N/%)	**148 (5.0)**	**2828(95.0)**

χ2=0.56, P-value=0.76, N=Number, %=Percentage
****=Hanging toilet, Bush, Field, Composite toilet, Bucket toilet***
Source: Generated from 2010 TDHS Data

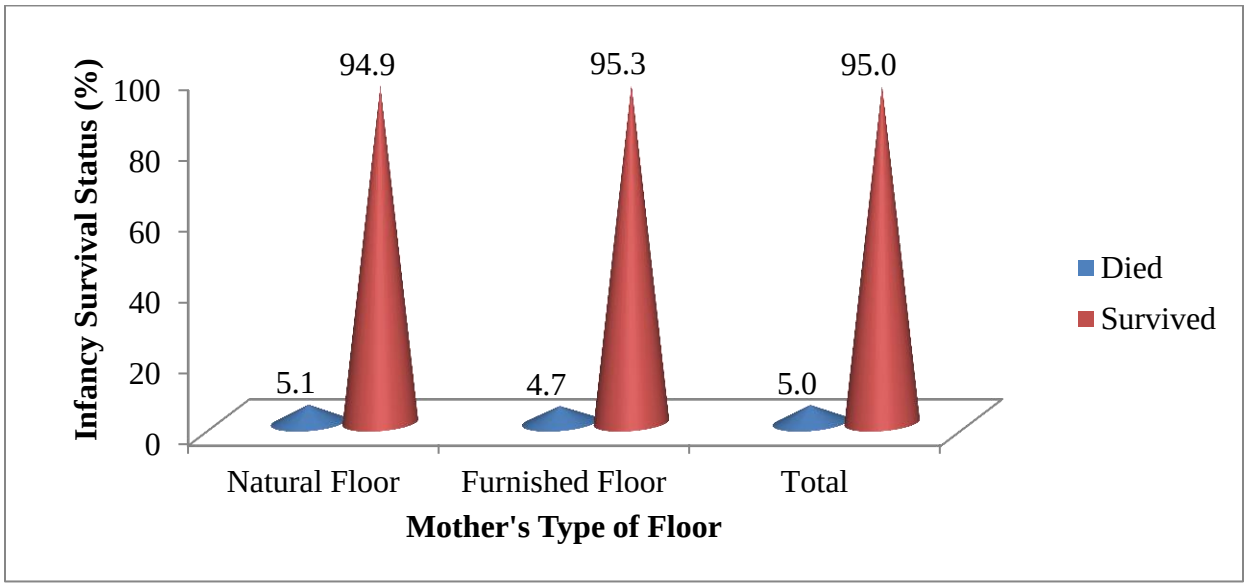
5.2.6 Mother's House Main Floor Material and Infant Mortality

The results of this variable are presented in Figure 5.3 and discussed. It was clearly observed that, among children born by mothers living in natural floor 5.1% died; while children born by mothers whose houses had furnished floors 4.7% died.

This can be because of natural floor houses being host of bacteria and other disease germs.

Generally, the variable was not significantly associated with infant mortality at Pearson Chi-square of 0.19 and P-value of 0.67.

Figure 5.3: Relationship between Mother's House Main Floor Material and Infant Mortality



χ2=0.19, P-value=0.67, %=Percentage, Number of Observations=2976
Source: Author's Construct Using 2010 TDHS Data

5.2.7 Mother's Employment Status and Infant Mortality

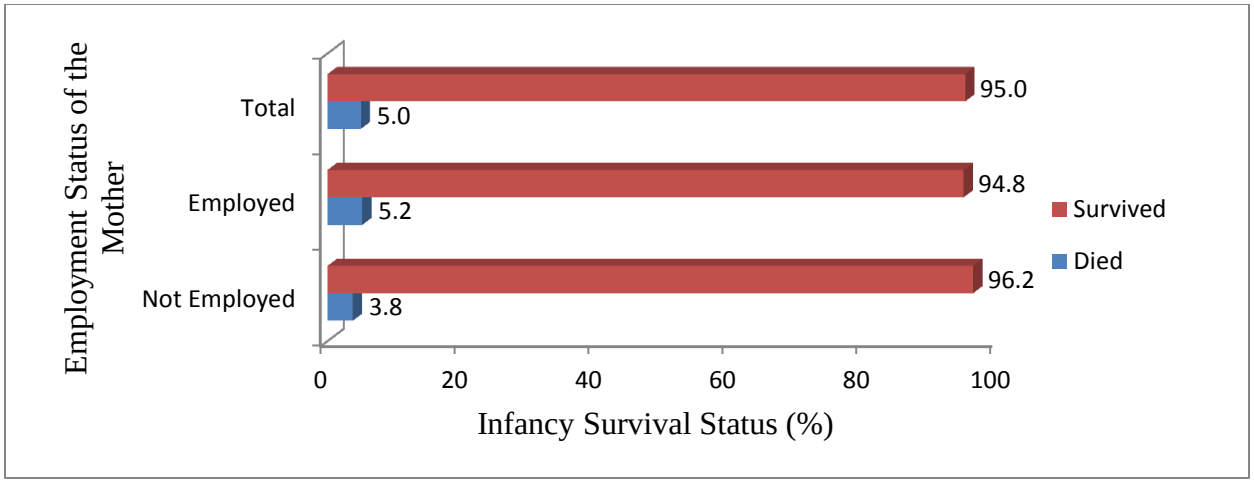
Studies in 19th-century in England show higher infant mortality in households with a working mother, which they attribute to the lack of mother's time for infant care, inadequate care, early introduction of artificial feeding and poor living conditions (Nair et al, 2011).

After the Pearson Chi-square test, it was observed that, the variable had no significant association with infant mortality at $\chi 2=1.68$ and a P-value of 0.20.

But the analysis showed that 5.2% of the deaths occurred to children born by mothers who were employed while 3.8% occurred to children born by mothers who were not employed in the period of one year preceding the survey in 2010.

These results conform to the studies conducted in the 19th century in England (Figure 5.4).

Figure 5.4: Relationship between Mother's Employment Status and Infant Mortality



χ2=1.68, P-value=0.20, %=Percentage, Number of Observations=2976
Source: Author's Construct Using 2010 TDHS Data

5.2.8 Mother's Distance from Home to Health Facility and Infant Mortality

The Chi-square analysis of this variable showed that, IMR was 55,50 and 48 per 1,000 live births among children born by mothers who had no problem, had big problem and who were in a not a big problem category from home to the health facility respectively. Therefore; mothers living far from health facilities experience more infant deaths than mothers who have no problem to reach the health facilities.

The variable was not significant at 95% confidence level with a Pearson Chi-square of 0.48 and a P-value of 0.79 (Table 5.4).

Table 5.4: Relationship between Mother's Distance from Home to Health Facility and Infant Mortality

Distance to Health Facility	Infancy Survival Status (%)	
	Died	Survived
No Problem	4.8	95.2
Big Problem	5.5	94.6
Not a Big Problem	5.0	95.0
Total (N/%)	**148 (5.0)**	**2828(95.0)**

χ2=0.48, P-value=0.79, N=Number, %=Percentage
Source: Author's Construct Using 2010 TDHS Data

5.2.9 Mother's Household Wealth Index and Infant Mortality

Household wealth index also showed a significant association at 95% confidence level with a Chi-square of 6.85 ($\chi 2$ =6.85) and a P-value of 0.03. Under this variable, 4.2% of the infant died were born by mothers from poor families, 4.8% from rich families and 6.9% from middle income families. The results suggested that children born by mothers from poor families experience higher infant mortality compared to those born by mothers from middle income and rich families (Table 5.5).

Table 5.5: Relationship between Household Wealth Index and Infant Mortality

Distance to Health Facility	Infancy Survival Status (%)	
	Died	Survived
Poor	4.2	95.8
Middle	6.9	93.1
Rich	4.8	95.2
Total (N/%)	**148 (5.0)**	**2828(95.0)**

χ2=6.85, P-value=0.03, N=Number, %=Percentage
Source: Author's Construct Using 2010 TDHS Data

Beyond expectation, the results did not follow the usual pattern, which is, deaths decrease with improvements in household status. This can be due to the fact that, families with middle wealth index may be involved in more casual works that may ruin their time to care for the newly born babies. The findings are contrary to the study conducted by Victora et al, (2003) in the Lancet

vol. 362, (2003) and Ssewanyana and Younger, (2007) conducted in Uganda which showed that wealth index was negatively correlated with infant mortality.

5.2.10 Mother's Place of Delivery and Infant Mortality

Place of delivery in the study showed the highest significance of all socio-economic variables selected. This variable showed an association of 95% confidence level on infant mortality with a Chi-square of 14.87 ($\chi 2$ =14.87) and a P-value of 0.002. The category differentials of infant mortality under this variable were; delivery at home accounted for infancy deaths of 48.65% followed by delivery at public sector, private sector and other places which accounted for 34.46%, 11.17% and 5.41% 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 than their counterparts. Results are presented in Table 5.6.

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.

Table 5.6: Relationship between Mother's Place of Delivery and Infant Mortality

Place of Delivery	Infancy Survival Status (%)	
	Died	**Survived**
Home	4.6	95.4
Public Sector	4.5	95.5
Private Sector	7.4	92.6
Other*	14.8	85.2
Total (N/%)	**148 (5.0)**	**2828(95.0)**

χ2=14.87, P-value=0.002, N=Number, %=Percentage
****=Farm, on the way to the Delivery Facility***
Source: Author's Construct Using 2010 TDHS Data

5.3 Maternal Characteristics and Infant Mortality

The relationship between maternal/environmental factors and infant mortality were also examined using the Chi-square test at 95% confidence level. In this analysis age of the mother, breastfeeding, birth order, birth interval and sex of the child were studied. The results are presented in Tables 5.7, 5.8, 5.9 and Table 5.10 as well as in Figure 5.5.

5.3.1 Maternal Age and Infant Mortality

Maternal age was not significantly associated to infant mortality with a Pearson Chi-square of 1.91 and a P-value of 0.928.

The results also indicated that, among the children who died at the age of 0-11months, 6.4% were born by mothers aged between 40-44 years, 5.4% were born by mothers who were aged between 25-29 years and 2.6% were born by mothers who were aged between45-49 years. The results are presented in Table 5.7.

The results do not conform with many studies, where women aged less than 20 years and 40+ years are expected to experience high rate of IMR (Dube, 2012). This can be a result of data misreporting especially young ages and older ages.

Table 5.7: Relationship between Maternal Age and Infant Mortality

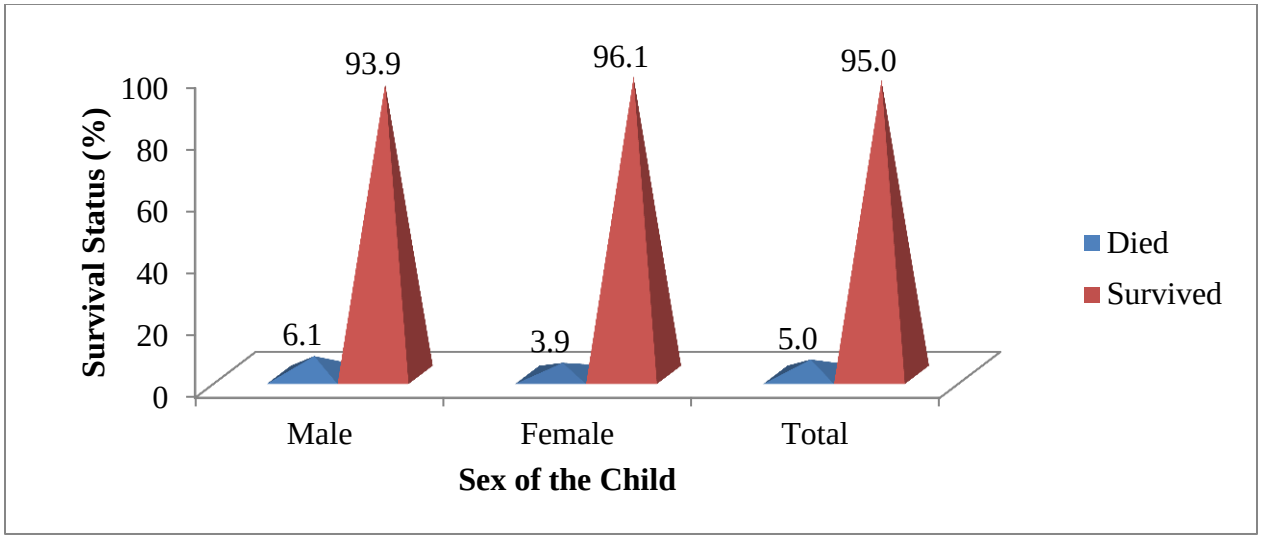
Age of the Mother	Infancy Survival Status	
	Died	Survived
15-19	4.7	95.3
20-24	4.8	95.2
25-29	5.4	96.4
30-34	4.5	95.5
35-39	5.0	95.0
40-44	6.4	93.6
45-49	2.6	97.4
Total (N/%)	**148 (5.0)**	**2828(95.0)**

χ2=1.91, P-value=0.928, N=Number, %=Percentage
Source: Author's Construct Using 2010 TDHS Data

5.3.2 Sex of the Child and Infant Mortality

Sex of the child also showed a high significant association with infant mortality at 95% significant level with a Chi-square of 7.42 ($\chi 2$ =7.42) and the P-value of 0.01. The analysis indicates than 6.1% of the deaths were of male infants while 3.9 were of female infants. This goes in line with the theories that male children die more at any infancy age than their counterparts (females).

Figure 5.5: Relationship between Sex of the Child and Infant Mortality



χ2=7.42, P-value=0.01, %=Percentage, Number of Observations=2976
Source: Author's Construct Using 2010 TDHS Data

5.3.3 Breastfeeding and Infant Mortality

The result in Table 5.8 shows that, 667infants who were never breastfed died in every 1000 live births; 18 per 1000 live births who were breastfed died and 127 infants who were given milk other than breastfeeding died in every 1000 live births. Generally, duration of breastfeeding as one of the factors affecting infant mortality, was observed to have a significant with infant mortality with at a Chi-square of 1100 ($\chi 2$ =1100) and a P-value of 0.000. That is to say the variable was significant at 95% confidence level. The results suggested that breastfeeding is an important component to the survivorship of any newly born baby in Tanzania according to the 2010 TDHS.

Table 5.8: Relationship between Breastfeeding and Infant Mortality

Duration of Breastfeeding	Infancy survival Status (%)	
	Died	**Survived**
Never	66.7	33.33
Ever	1.84	98.16
Other*	12.68	87.32
Total (N/%)	**148 (4.97)**	**2828(95.03)**

χ2=1100, P-value=0.000, N=Number, %=Percentage
****=milk other than breastfeeding***
Source: Author's Construct Using 2010 TDHS Data

5.3.4 Birth Order and Infant Mortality

As shown in Table 5.9, birth order was insignificantly related to infant mortality. The analysis using the Pearson chi-square test showed a P-value of 0.46.

The analysis of the variable showed that among the children born by mothers with birth order 1-3, 5.3% died, children born by mothers with birth order 4-6, 4.9% died and those who were born by mothers with birth order seven and above, 4.0% died at infancy age.

Therefore, according to 2010 TDHS, infants who were born by mothers with birth order 1-3 experience higher infant deaths than the other birth orders.

Table 5.9: Relationship between Birth Order and Infant Mortality

Birth Order	Infancy Survival Status (%)	
	Died	**Survived**
1-3 births	5.3	94.7
4-6 births	4.9	95.1
7+ births	4.0	96.0
Total (N/%)	**148 (5.0)**	**2828(95.0)**

χ2=1.57, P-value=0.46, N=Number, %=Percentage
Source: Author's Construct Using 2010 TDHS Data

5.3.5 Birth Interval and Infant Mortality

Birth interval was categorized into first a birth; birth occurred less than 18 months, 18-24 months 25-35 months and 36 or 36+ months preceding the earlier birth. After the analysis the variable was observed to have a statistical significant association to infant mortality at 95% confidence level with a Chi-square of 17.86 ($\chi 2$ =17.86) and the P-value of 0.001.

The results indicates that 5.4% of the deaths occurred to infants of the women who gave birth for the first time in their child bearing period while 12.1%, 5.0%, 3.5% and 5.2% were infant deaths occurred to children who were born at an interval of <18 months, 18-24 months, 25-35 months and 36+ months births respectively following the earlier birth of their respective mothers. Thus, the high proportion of infants died was born by mothers who gave birth at an interval of less than 18 months.

This is supported by many literatures such a study conducted by Mekonnen, (2011) in Ethiopa, found that, birth interval of less than 18 months increases the chances of an infant to die.

Table 5.10: Relationship between Birth Interval and Infant Mortality

Birth Interval	Infancy Survival Status (%)	
	Died	Survived
First Birth	5.4	94.6
< 18 months	12.1	87.9
18-24 months	5.0	95.0
25-35 months	3.5	96.5
36+ months	5.2	94.8
Total (N/%)	**148 (5.0)**	**2828(95.0)**

$\chi 2$=17.86, P-value=0.001, N=Number, %=Percentage

Source: Author's Construct Using 2010 TDHS Data

CHAPTER SIX

DETERMINANTS OF INFANT MORTALITY IN TANZANIA

6.1 Introduction

Binary logistic regression models were used for the analysis. Logistic regression is an appropriate method for the multivariate analysis when the dependent variable is dichotomous (Ghamfi, 2003). The dependent variable in this study is dichotomous, that is whether the child dies or survives 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:-

$$\text{Log } (P_i/\ 1\text{-}P_i) = X_i P_i$$

Where P_i represents 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 (Ghamfi, 2003).

The resulting odd ratios (OR) indicate the nature of the net impact of independent variable on the probability of the outcome occurring. Odd ratios greater than one (OR>1) indicates 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 lack or absence of relationship between the independent (predictor) variables and the dependent (predicted) variable; which in this study is the infant mortality.

In the logistic analysis, the socio-economic factors (type of place of residence, zones of residence, educational attainment, place of delivery, distance from health facilities, employment status of the mother and household wealth index) were used as independent variables.

Intermediate variables included; age of the mother, breastfeeding, sex of the child, birth order and birth interval. Others were; sources of drinking water, type of toilet facilities and type of main floor materials.

STATA was employed in analyzing the data at this stage. Four models were generated. The first model (Model I) examined the statistical relationship between socio-economic variables and infant mortality. Model II was geared to investigate 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 four socio-economic variables (zone of residence, place of delivery, household wealth index and educational attainment) and three intermediate variables (breastfeeding, birth interval and sex of the child). The selection of variables for Model IV based on observed statistical 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.

6.2 Impact of Maternal Factors on Infant Mortality

Logistic regression of infant mortality by maternal characteristics working through environmental factors was conducted to examine their relationship to the outcome. After the analysis, it was observed that 3.6% (R^2=0.036) explains the variations in the independent variable.

Table 6.1: Variations in Infant Mortality by Selected Maternal Variables (Model I)

Variable	β-Value	Standard Error	Odd Ratios	P-value
Constant	-6.25	0.017	0.031	0.000
Type of Place of Residence				
Urban **(RC)**			1.000	
Rural	-0.810	0.224	0.796	0.418
Zones of Residence				
Western Zone**(RC)**			1.000	
Northern Zone	1.140	0.534	1.501	0.254
Central Zone	-1.610	0.220	0.470	0.106
Southern Highlands Zone	1.260	0.473	1.492	0.207
Lake Zone	0.430	0.340	1.137	0.668
Eastern Zone	2.400	0.781	2.277*	**0.016**
Southern Zone	1.390	0.632	1.686	0.163
Zanzibar Zone	1.760	0.586	1.782	0.079
Educational Attainment				
No Education**(RC)**			1.000	
Incomplete Primary	1.100	0.342	1.327	0.273
Complete Primary	0.490	0.248	1.115	0.624
Incomplete Secondary	-1.730	0.207	0.455	0.840
Complete Secondary and Higher	0.180	0.916	1.155	0.856
Age of the Mother				
15-19**(RC)**			1.000	
20-24	0.330	0.577	1.178	0.738
25-29	0.600	0.724	1.372	0.549
30-34	0.330	0.706	1.209	0.745
35-39	1.050	1.242	1.948	0.296
40-44	1.250	2.016	2.618	0.211
45-49	0.940	3.834	3.138	0.349
Employment Status				
Not Employed**(RC)**			1.000	
Employed	1.470	0.439	1.528	0.141

Variable	β-Value	Standard Error	Odd Ratios	P-value
Household Wealth Index				
Poor **(RC)**			1.000	
Middle	2.190	0.354	1.616*	**0.028**
Rich	0.340	0.382	1.122	0.735

Number of observations=2976, χ^2 =42.34, df=24, P-Value=0.0118, R^2=0.0360, *=P<0.05, RC=Reference Category
Source: Author's Construct Using 2010 TDHS Data

According to the results in Table 6.1, two factors had significant relationship with the dependent variable. These include Zone of residence and household wealth index.

Under Zones of residence, Western zone was taken as the reference category. Eastern zone was found to have a significant relationship with infant mortality at 95%. That is women living in Eastern zone with odd ratios of 2.277 were 1.277 times more likely to experience infant mortality compared to the women living in Western zone (RC).

This can be caused by an influx of young women migrating into Dar es Salaam seeking for casual works, but also due to poor living standards of people living in the slums of some places of the city such as Vingunguti, Manzese and others. Also Dar es Salaam being a coastal area is prone to malaria incidences.

Household wealth index also had a statistical significant relationship with the dependent variable. This was categorized into poor household wealth index, middle household wealth index and rich household wealth index. The regression results indicated that, women with middle household wealth index had odd ratios of 1.616 implying that they were 61.6% more likely to experience infant mortality than those with poor household wealth index (RC).

As it has been stated in chapter two, this result showed unusual trend of infant mortality. It was expected that children born by women with poor wealth index would experience higher infant

mortality than those born to women in middle and rich household wealth indices. This may be due to the fact that women with poor wealth index have more time to care (breastfeed) for their newly born babies than their counterparts.

Educational attainment was not significantly related to infant mortality, yet it was found that women with primary education had odds of 1.327, implying that, they were 33% more likely to experience infant mortality than women with no education. Also women with incomplete secondary education were about 54.5% (odds=0.455) less likely to experience infant mortality than women with no education (RC).

6.3 Impact of Intermediate Factors on Infant Mortality

Logistic regression of infant mortality basing on intermediate variables was conducted to examine how these factors influence the infant mortality. The results showed that, 39.1% (R^2=0.3908) explains the variations in infant mortality.

Table 6.2: Variations in Infant Mortality by Selected Intermediate Variables (Model II)

Variable	β -Value	Standard Error	Odd Ratios	P-value
Constant	4.040	3.166	6.715	0.000
Source of Drinking Water				
Improved **(RC)**			1.000	
Non-improved	0.520	0.207	1.103	0.601
Type of Toilet Facilities				
Flush Toilet **(RC)**			1.000	
Pit Latrine	-0.840	0.263	0.742	0.399
Other	-0.690	0.309	0.751	0.487
Main Floor Material				
Natural**(RC)**			1.000	
Furnished	-0.550	0.270	0.836	0.579

Variable	β -Value	Standard Error	Odd Ratios	P-value
Breastfeeding				
Never **(RC)**			1.000	
Ever	-19.520	0.002	0.010*	**0.000**
Other	-6.420	0.029	0.072*	**0.000**
Birth Order				
1-3 births **(RC)**			1.000	
4-6 births	-1.070	0.202	0.789	0.284
7 or 7+ births	-0.250	0.322	0.914	0.799
Distance from Health Facility				
No Problem**(RC)**			1.000	
Big Problem	0.910	0.269	1.221	0.365
Not a Big Problem	0.560	0.260	1.136	0.578
Place of Delivery				
Home **(RC)**			1.000	
Public Sector	-0.390	0.189	0.922	0.693
Private Sector	1.440	0.463	1.543	0.149
Other	3.090	1.476	3.579*	**0.002**
Birth Interval				
< 18 months **(RC)**			1.000	
First Birth	-2.670	0.134	0.285*	**0.008**
18-24 months	-1.850	0.197	0.418	0.064
25-35 months	-3.100	0.112	0.256*	**0.002**
36 or 36+ months	-2.110	0.173	0.408*	**0.035**
Sex of the Child				
Male**(RC)**			1.000	
Female	-1.270	0.166	0.757	0.204

Number of observations=2976, χ^2=459.86, df=11, P-Value=0.0000, R^2=0.3908
****=P<0.05, RC=Reference Category***
Source: Author's Construct from 2010 TDHS Data

Birth interval, place of delivery and breastfeeding emerged as statistically significant determinants of infant mortality.

Results in Table 8 (Model II) indicated that women who had their child for the first time had odd ratios of 0.285 indicating that they were 71.5% less likely to experience infant mortality compared to those with birth interval of less than 18 months (RC). Likewise, women who spaced their births at an interval of 18 to 24 months had odd ratios of 0.418 indicating that they were 58.2% less likely to experience infant mortality than the women who spaced their births at an interval less than 18 months. On the other hand women who spaced their births between 25 to 35 months or 36 to 36+ months had odd ratios of 0.256 and 0.408 respectively, indicating that they were 74.4% and 59.2% less likely to experience infant mortality than women who spaced their births less than 18 months.

This result indicates that, birth interval is inversely proportion to infant mortality, though the rate increases when a women spaces the births at a long interval (36+ Months).

Place of delivery also had a significant relationship with infant mortality. This variable was categorized into home, public sectors, and private sectors and other (such as delivery on the way to hospital, TBA places and others). The home category was taken as a reference category. Women who delivered in places other than public and private sectors had odd ratios of 3.580; this implies that they were 2.580 times more likely to experience infant mortality than the women who delivered at home (RC).

Women who deliver at home lack skilled birth attendant's services, but also deliver in environments which are sometimes contaminated, and thus, subjects the newly born baby to disease infections and eventually to loss of life.

Breastfeeding was grouped into three main categories (never breastfed, ever breastfed and other). The other category includes women who introduced food (such as animal milk and drinks) other than mother's milk to their new born babies. Children who were never breastfed are taken as reference category in this case.

Children who were ever breastfed had odd ratios of 0.010 indicating that they were 99% less likely to experience infant mortality than the infants in the reference category. But children who were given milk and drinks other than breast milk had odd ratios of 0.072 indicating that they were 92.8% less likely to experience infant mortality than children who were never breastfed (RC).

Therefore breastfeeding is very essential at an infancy age.

6.4 Impact of Maternal and Intermediate Variables on Infant Mortality

Model III is a logistic regression of both socio-economic and intermediate variables. In this model zone of residence, educational attainment, place of delivery, birth interval and breastfeeding had significant relationship with infant mortality. The model indicated a Chi-square of 495.77 with a probability of 0.0000 and R^2 of 0.4213. The R^2 of 0.4213 implies that the variations in infant mortality were explained by 42.13 percent by the model. This results 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 Maternal and Intermediate Variables (Model III)

Variable	β -Value	Standard Error	Odd Ratios	P-Value
Constant	2.220	5.491	6.498	0.027
Type of Place of Residence				
Urban **(RC)**	-	-	1.000	-
Rural	-1.050	0.240	0.690	0.294
Zones of Residence				
Western Zone **(RC)**	-	-	1.000	-
Northern Zone	1.450	0.957	1.999	0.148
Central Zone	0.040	0.596	1.025	0.966
Southern Highlands Zone	3.210	1.685	3.944*	**0.001**
Lake Zone	0.730	0.566	1.357	0.464
Eastern Zone	2.860	1.830	3.869*	**0.004**
Southern Zone	2.270	1.757	3.321*	**0.023**
Zanzibar Zone	3.400	2.135	4.696*	**0.001**
Educational Attainment				
No Education **(RC)**	-	-	1.000	-
Incomplete Primary	0.110	0.363	1.037	0.916
Complete Primary	0.300	0.321	1.093	0.762
Incomplete Secondary	-1.690	0.217	0.396	0.091
Complete Secondary and Higher	-0.110	0.956	0.888	0.912
Sources of Drinking Water				
Improved	-	-	1.000	-
Non-improved	-0.510	0.218	0.882	0.612
Type of Toilet Facilities				
Flush Toilet **(RC)**	-	-	1.000	-
Pit Latrine	-0.520	0.354	0.793	0.604
Other	-0.630	0.380	0.714	0.527

Variable	β -Value	Standard Error	Odd Ratios	P-Value
Main Floor Material				
Natural **(RC)**	-	-	1.000	-
Furnished	-0.240	0.370	0.905	0.808
Employment Status				
Not Employed**(RC)**	-	-	1.000	-
Employed	0.370	0.415	1.142	0.715
Distance from Health Facility				
No Problem**(RC)**	-	-	1.000	-
Big Problem	1.430	0.442	1.518	0.152
Not a Big Problem	1.330	0.460	1.502	0.184
Household Wealth Index				
Poor**(RC)**	-	-	1.000	-
Middle	-0.030	0.293	0.991	0.976
Rich	-0.410	0.355	0.840	0.680
Place of Delivery				
Home **(RC)**	-	-	1.000	-
Public Sector	-1.480	0.183	0.664	0.138
Private Sector	0.510	0.520	1.239	0.610
Other	1.990	1.606	2.949	**0.047**
Age of the Mother				
15-19 (**RC**)	-	-	1.000	-
20-24	0.420	0.644	1.242	0.676
25-29	0.500	0.747	1.324	0.619
30-34	0.210	0.725	1.140	0.837
35-39	0.980	1.320	1.942	0.329
40-44	0.830	1.666	2.000	0.405
45-49	0.680	2.967	2.359	0.495

Variable	β -Value	Standard Error	Odd Ratios	P-Value
Breastfeeding				
Never **(RC)**	-	-	1.000	-
Ever	-17.970	0.002	0.007*	**0.000**
Other	-6.510	0.020	0.040*	**0.000**
Birth Order				
1-3 births **(RC)**	-	-	1.000	-
4-6 births	-1.590	0.18	0.637	0.111
7 or 7+ births	-0.420	0.314	0.857	0.674
Birth Interval				
< 18 months**(RC)**	-	-	1.000	-
First Birth	-2.410	0.151	0.307*	**0.016**
18-24 months	-1.570	0.226	0.469	0.116
25-35 months	-2.760	0.13	0.285*	**0.006**
36 or 36+ months	-2.090	0.175	0.393*	**0.036**
Sex Of the Child				
Male (**RC)**	-	-	1.000	-
Female	-1.120	0.176	0.777	0.264

Number of observations=2976, χ^2=495.77, df=35, P-Value=0.0000, R^2=0.4213
****=P<0.05, RC=Reference Category***
Source: Author's Construct from 2010 TDHS Data

From the results in Table 6.4, Southern Highlands Zone, Eastern zone, Southern zone and Zanzibar zone show significant relationship with infant mortality. Women residing in the Southern Highlands zone had odds ratios of 3.944, indicating that they were 2.944 more likely to experience infant mortality than the women in Western zone.

Women living in Eastern, Southern and Zanzibar zones had odd ratios of 3.869, 3.321 and 4.696 respectively; these odd ratios suggest that children born by women residing in these three zones

were 2.869, 2.321 and 3.696times more likely to experience infant mortality respectively than the women in Western zone.

Southern Highlands and Southern zones are characterized by mountains topography, this leads to difficulties in constructing transportation networks especially from rural to urban areas where most of the health facilities are found. Thus women living in these areas lack health related expertise and facilities and thus their newly born babies lack essential health services.

Likewise Eastern and Zanzibar zones are Coastal areas where prevalence of malaria is high. But also the unique character of Zanzibar zone is by more than 90% occupied by Moslems, who by their culture abstain for 40 days after child birth before they resume sex. This culture may entail shorter birth interval duration, which is among the major determinants of infant mortality.

Regarding place of delivery, women who delivered in the places other than public and private sectors were 1.95 more likely to experience infant mortality than women who delivered at home. This may imply that, delivering in places such on the way to hospital or on the farm is even more dangerous than delivering at home.

Birth interval and breastfeeding results behaved almost the same as in Model II with an exception of the women who gave birth for the first time had odds of 0.307 implying that, they were 69% less likely to experience infant mortality than the women who spaced their births at an interval of less than 18 months. This category was significant at 95% in Model II with odds of 0.285.

6.5 Impact 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 at bivariate and multivariate level. Variables which were found significant at the bivariate and multivariate levels are zones of residence, place of delivery,

birth interval and duration of breastfeeding. Household wealth index was found significant only at bivariate level while educational attainment was significant only at multivariate level.

Model IV comprised of seven variables which explained 41.5 percent the variations in the dependent variable compared to model III which explained42.1 percent the dependent variable. By comparing the two models; it is verified (basing on the principle of parsimony) that the important determinants of infant mortality in Tanzania according to the 2010 TDHS were:-

i. Zones of residence of mother,
ii. Place of delivery,
iii. Birth interval and
iv. Breastfeeding.

The details of the results are shown in Table 6.4.

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

Variable	β -Value	Standard Error	Odd Ratios	P-value
Constant	2.56	2.018	3.838	0.011
Zones of Residence				
Western Zone **(RC)**			1.000	
Northern Zone	1.530	0.871	1.967	0.126
Central Zone	0.140	0.620	1.083	0.889
Southern Highlands Zone	3.230	1.626	3.879*	**0.001**
Lake Zone	0.630	0.521	1.290	0.529
Eastern Zone	2.880	1.795	3.843*	**0.004**
Southern Zone	2.120	1.555	2.996*	**0.034**
Zanzibar Zone	3.230	1.636	3.887*	**0.001**
Place of Delivery				
Home **(RC)**			1.000	
Public Sector	-1.330	0.187	0.700	0.182
Private Sector	0.650	0.533	1.303	0.517
Other	2.130	1.648	3.104*	**0.033**

Variable	β -Value	Standard Error	Odd Ratios	P-value
Household Wealth Index				
Poor **(RC)**			1.000	
Middle	-0.050	0.280	0.985	0.958
Rich	-0.240	0.276	0.931	0.811
Birth Interval				
< 18 months **(RC)**			1.000	
First Birth	-1.670	0.215	0.451	0.095
18-24 months	-2.950	0.120	0.266*	**0.003**
25-35 months	-2.270	0.162	0.368*	**0.023**
36 or 36+ months	-2.240	0.164	0.351*	**0.025**
Sex of the Child				
Male**(RC)**			1.000	
Female	-1.010	0.179	0.797	0.312
Breastfeeding				
Never **(RC)**			1.000	
Ever	-18.320	0.002	0.007*	**0.000**
Other	-6.720	0.120	0.039*	**0.000**

Number of observation=2976,χ^2 =488.36, df=23, P-Value=0.0000, R2=0.4150
=P<0.05, RC=Reference Category
Source: Author's construct from 2010 TDHS Data

CHAPTER SEVEN

SUMMARY, CONCLUSION AND RECOMMENDATIONS

7.1 Introduction

This chapter is a summary of the results of the study. In addition, it presents an overview of the findings on the determinants of infant mortality in Tanzania. The chapter also provides recommendations for policy and programme action to reduce the incidence of infant mortality in Tanzania.

7.2 Summary

The general objective of the study was to examine the determinants of infant mortality in Tanzania. Its specific objectives include describing the determinants of infant mortality, establishing the relationship between the determinants and infant mortality in Tanzania and finally, making recommendations for health-centered policy and programme interventions to improve infants' survivorship in Tanzania.

The socio-economic determinants examined in this study includes educational attainment of the woman, type of place of residence, zones of residence, employment status, household wealth index, distance from home to health facility, type of delivery and employment status of the mothers. The intermediate variables examined were; sources of drinking water, type of toilet facilities, main floor material, age of the mother, breastfeeding, birth order, birth interval and sex of the child.

The following hypotheses were proposed during this study: (1) mothers with no education are more likely to experience infant deaths as compared to mothers with mothers with secondary

education and higher and(2) mothers living in urban areas are less likely to experience infant mortality than mothers living in rural areas.

To meet the objectives of the study and test the proposed hypotheses, data from DHS, 2010 of Tanzania was used. The study focused on 2,976 children (singleton) who were born to women aged 15-49 years during the period of one year prior to the survey date. The main consideration of the respondents was all women of the child bearing age who slept in the household during the date of survey night. This was aimed at enabling the researcher to apply logistic regression model and ensure the final survivor status of the child is known.

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 mother's background characteristics. At the bivariate level, linear logistic regression was applied where Pearson Chi-square test was employed to test for association between mother's 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 Tanzania.

The results of the bivariate and multivariate analysis showed similar findings, with few variations. The results indicated that, in general breastfeeding, birth interval, place of delivery and zones of residence are the major determinants of infant mortality in Tanzania as per 2010 DHS data.

Again at bivariate level where Pearson Chi-square test was applied, household wealth index, place of delivery, breastfeeding, birth interval and sex of the child were found to be significantly associated with infant mortality at 5% confidence level. Mother's education, type of place of

residence, educational attainment, type of toilet facilities, main of floor material, sources of drinking water, distance from home to the health facility, employment status, age of the mother and birth order were not significantly associated to infant mortality.

Multivariate analysis through binary regression model was conducted at 95% confidence level at four different stages, based four models. Model I showed the relationship between socioeconomic determinants (working through environmental factors) and infant mortality. It was observed that these determinants explained 3.6 percent variations in the dependent variable (infant mortality) where, zones of residence, educational attainment (contrary to bivariate level), place of delivery and household wealth index had statistically significant relationship with infant mortality. In case of zones of residence, only Eastern zone was statistically significant related to infant mortality.

Following the hypothesis of the study, educational attainment and place of residence were not statistically significant determinants of infant mortality.

Model II showed the relationship between intermediate variables and infant mortality. This model explained 39.1 percent variations in the dependent variable compared to Model I which explained 3.6 % variations in the dependent variable. This might be due to the fact that socio-economic variables always work through proximate variable as explained by Mosley and Chen, (1984). During this stage birth interval and breastfeeding were found to be statistically significant related to infant mortality. Birth order, sex of the child (contrary to bivariate level) and age at first birth were found not significantly related to infant mortality.

Model III also showed the relationship between both socio-economic and intermediate variables. It was observed that the model explained 42.1 percent variations in the dependent variable. Zones of residence, place of delivery, birth interval and d breastfeeding were significant at

5%confidence level. Women residing in Southern Highland, Eastern, Southern and Zanzibar zones had high chances of experiencing infant mortality compared to respondents residing in the Western zone.

Model IV, comprised of four socio-economic and three 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, 41.5% explanation of the variations in the dependent variable which is not quite different from the results in model II (42.1%). Thus the validity of the principle of Parsimony in this study was confirmed. During this analysis four important variables were found to have a significant influence on infant mortality. They include Zones of residence, place of delivery, birth interval and breastfeeding.

7.3 Conclusion,

The results of the study have shown that:-

i. Zones of residence, place of delivery, birth interval and breastfeeding are the important determinants of infant mortality in Tanzania according to the 2010 TDHS data.
ii. Even though place of residence distance from health facility, age of the mother, type of toilet facilities, sources of drinking water and employment status of the mother are not significant predictors of infant mortality at multivariate level, they are associated with lower mortality among infants.
iii. Factors such as household wealth index and sex of the child were only significant at bivariate level while educational attainment was only significant at multivariate level of analysis. Apart from educational attainment other factors determine child survival.

iv. Since Model IV explained the variations in the dependent variable by 41.5 percent, it implies that, there are other determinants of infant mortality in Tanzania which explains the variations in the dependent variable by 58 percent.

7.4 Recommendations

Based on the following recommendations are made:-

i. Health interventions (such as delivery facilities) to vulnerable zones (Southern Highlands, Eastern, Southern and Zanzibar) should be increased.

ii. Maternity leave Policy should be revised so as to increase number of days rather than the current 90 days in order to improve breastfeeding.

iii. Educational campaigns on child spacing and breastfeeding strengthened.

iv. Enhancing programmes on infant health in Tanzania so as to ensure maximized infancy survivorship.

v. Finally, I recommend that, the individual-level variables should be considered in future studies of infant mortality. This is due the fact that the compound and community level variables do not contribute significantly to infancy deaths in Tanzania.

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APPENDIX 1: Summary of Bivariate Analysis

Variable	Infant Mortality		Pearson Chi-square ($\chi 2$)	P-value
	Died (148) N (%)	Survived (2828) N (%)		
Type of Place of Residence				
Urban	27 (5.57)	458 (94.43)	0.4329	0.511
Rural	121 (4.46)	2370 (95.54)		
Zone of Residence				
Western Zone	24 (4.10)	56 (95.90)		
Northern Zone	16 (5.03)	302 (94.97)		
Central Zone	6 (2.13)	276 (97.87)		
Southern Highlands Zone	20 (6.29)	298 (93.71)	13.2809	**0.066**
Lake Zone	25 (5.13)	462 (94.87)		
Eastern Zone	18 (8.53)	193 (91.47)		
Southern Zone	12 (6.12)	184 (93.88)		
Zanzibar Zone	27 (4.66)	552 (95.34)		
Educational Attainment				
No Education	39 (4.65)	799 (95.35)		
Incomplete Primary	30 (6.00)	470 (94.00)		
Complete Primary	70 (5.31)	1248 (94.69)	5.8165	0.213
Incomplete Secondary	7 (2.47)	283 (97.59)		
Complete Secondary and Higher	2 (6.67)	28 (93.33)		
Sources of Drinking Water				
Improved	62 (4.80)	1229 (95.20)	0.1405	0.708
Non-improved	86 (5.10)	1599 (94.90)		
Type of Toilet Facilities				
Flush Toilet	13 (5.86)	209 (94.14)		
Pit Latrine	102 (5.00)	1937 (95.00)	0.5634	0.755
Other	33 (4.62)	682 (95.38)		

Variable	Infant Mortality		Pearson Chi-square ($\chi 2$)	P-value
	Died (148) N (%)	Survived (2828) N (%)		
Main Floor Material				
Natural	112 (5.07)	2,095 (94.93)	0.1867	0.666
Finished	36 (4.68)	733 (95.32)		
Employment Status				
Not Employed	18 (3.79)	457 (96.21)	1.6756	0.196
Employed	130 (5.20)	2371 (94.80)		
Distance from Health Facility				
No Problem	80 (4.77)	1597 (95.23)		
Big Problem	38 (5.45)	659 (94.55)	0.4841	0.785
Not a Big Problem	30 (4.98)	572 (95.02)		
Household Wealth Index				
Poor	57 (4.20)	1301 (95.80)		
Middle	45 (6.88)	609 (93.12)	6.8480*	**0.033**
Rich	46 (4.77)	918 (95.23)		
Place of Delivery				
Home	72 (4.62)	1485 (95.38)		
Public Sector	51 (4.49)	1084 (95.51)	14.8674*	**0.002**
Private Sector	17 (7.39)	213 (92.61)		
Other	8 (14.81)	46 (85.19)		
Age at First Birth				
< 20 Years	83 (4.49)	1766 (95.51)		
20-29 Years	63 (5.71)	1040 (98.18)	2.7639	0.251
30-39 Years	2 (8.33)	22 (87.32)		
Breastfeeding				
Never	88 (66.67)	44 (33.33)		
Ever	51 (1.84)	2722 (98.16)	1100*	**0.000**
Other	8 (12.68)	62 (87.32)		

Variable	Infant Mortality		Pearson Chi-square ($\chi 2$)	P-value
	Died (148) N (%)	Survived (2828) N (%)		
Birth Order				
1-3 births	86 (5.34)	1525 (94.66)		
4-6 births	45 (4.85)	883 (95.15)	1.5693	0.456
7 or 7+ births	17 (3.89)	420 (96.11)		
Birth Interval				
First Birth	33 (5.37)	582 (94.63)		
< 18 months	15 (12.10)	109 (87.10)		
18-24 months	21 (4.95)	403 (95.05)	17.8629*	**0.001**
25-35 months	32 (3.50)	883 (96.50)		
36 or 36+ months	47 (5.23)	851 (94.77)		
Sex of the Child				
Male	90 (6.06)	1395 (93.94)	7.4175*	**0.006**
Female	58 (3.89)	1433 (96.11)		