THE RELATIONSHIP BETWEEN MOTHERS' MATERNAL AGE AND INFANT MORTALITY IN ZIMBABWE

BY

ZIPHOZONKE BRIDGET DUBE

STUDENT NUMBER: 0702508D

A RESEARCH PROJECT SUBMITTED TO THE SCHOOL OF SOCIAL SCIENCES, UNIVERSITY OF WITWATERSRAND, JOHANNESBURG, IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN THE FIELD OF DEMOGRAPHY AND POPULATION STUDIES

APRIL 2012

SUPERVISOR: PROF. CLIFFORD ODIMEGWU

DECLARATION

I **Ziphozonke Bridget Dube;** declare that this research report is my own work. It is submitted for the degree of Master of Arts in Demography and Population Studies at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any other degree or examination in any other university.

…….... [Signature of candidate]

..……day of .....…..... 20…...

ACKNOWLEDGEMENTS

First and foremost I would like to thank God for making this possible and for seeing me through all the difficulties I have faced during the course of my Masters degree.

I would like to thank my supervisor, Professor Clifford Odimegwu, who assisted me through the whole process and ensured that I performed to the best of my ability at all times. Without him it would not be possible to have completed this dissertation.

I would also like to make special mention to my tutor and mentor Nicole DeWet, who was always willing to spare her time and help me with any difficulties I faced during process of compiling my research.

I would also like to extend my sincerest thanks to Elizabeth Trew, for proof reading my research. Lastly, I would like to thank my family and friends for their love, support and encouragement throughout the period of my studies. I would not have been able to achieve this level in my academic career without them.

ABBREVIATIONS

AIDS - Acquired Immune Deficiency Syndrome

ARV- Anti Retroviral

CSO - Central Statistics Office

DHS - Demographic and Health Survey

HIV- Human Immunodeficiency Virus

MDG - Millennium Development Goals

OR - Odds Ratios

UN - United Nations

ZDHS - Zimbabwe Demographic and Health Survey

Contents:

List of Tables:

List of Figures:

Abstract:

Background: This study examined the relationship between mothers' age at first birth and infant mortality in Zimbabwe. Childbearing at a significantly young age has been noted to be a predictor of infant mortality, as children born to young mothers are at a greater risk of early death.

Methods: This is a cross-sectional, secondary study which uses the data from the Zimbabwe Demographic and Health Survey 2005-2006. The population of interest in this study are women of reproductive ages in Zimbabwe, who have had children within the last five years prior to the survey. A total of 4074 women are used as the sample in this study. The dependent variable is infant mortality, which is understood as the deaths of infants between the period of birth and their first birthday. The independent variables include demographic, socio-economic and reproductive characteristics of the women. The analysis of data was undertaken at three levels. Univariate analysis, binary logistic regression and multivariate logistic regression were conducted. In addition, stepwise logistic regression was applied to the multivariate analysis to analyse the relationship between the significant variables found in the study in relation to infant mortality.

Results: This study confirmed an association between mothers' age at first birth and infant mortality as infants born to mothers of 18 years and younger suffer higher risk of infant mortality, as they have a 33% increased risk in comparison to infants born to older women. This indicates the need for policy development focused on the issue adolescent childbearing and how childbearing can be delayed in Zimbabwe in order to reduce infant mortality. Furthermore the reproductive characteristics of the mother prove to have great impact on infant mortality within the country. Thus the importance of policies focused on women's reproductive health care.

Conclusions: This study confirms that mothers' age at first birth is a central influential factor in infant mortality in Zimbabwe. Infant mortality cannot be isolated from the characteristics of mothers, in particular her age at first birth, as they are more often the primary care-givers thus have immense influence on whether the infants survive or not.

Chapter1: Introduction

1.1 Background

Infant mortality has been a major issue across the world for many years, particularly in the Sub-Saharan African region. Sub-Saharan African countries have the highest infant mortality rates in the world, with infant mortality of 104 deaths per 1000 live births in 1990's, while the infant mortality rate for other less developed nations was 71 deaths per 1000 live births (Kalipeni, 2000). Frisbie's (2004) study demonstrated that even in the 2000s the infant mortality rate in this region remained the highest in the world at 94 deaths per 1000 live births in comparison to the rest of Africa at 88 deaths per 1000 live births and 61 deaths per 1000 live births in other less developed nations.

The social-cultural and socio-economic factors in Sub-Saharan Africa have been highlighted, amongst others, as having a significant influence on these high rates of infant mortality in various studies including Omariba and others (2007). Social cultural factors include the vast ethnic and religious beliefs which exist in Sub-Saharan Africa, cultural practices and beliefs effect whether or not individuals seek bio-medical forms of health care during pregnancy and when their infant is in ill health (Omariba and others, 2007). In many cultures women's social status is increased by her ability to bear children this also increases her chance of marriage, thus Sub-Saharan African women have high fertility (Grieser et al, 2001). High fertility results in women having short birth intervals between pregnancies, these short birth intervals result in compromised health outcomes for both the mother and the child (Mturi and Curtis, 199).

Regarding the socio-economic factors, women in Sub-Saharan Africa often have little or no autonomy (Bohmer and Williamson, 2006) and as a result do not have the power to make decisions regarding their infant's health. Furthermore, there is a high rate of unemployment in Sub-Saharan Africa which then results in the inability of parents to seek medical assistance when the infant is in ill health due to lack of finances (Schell et al, 2007). Sub-Saharan Africa is a region which has vast spatial variation and each country is divided into rural and urban areas (Kalipeni, 2003). Urban areas are equipped with adequate recourses while rural areas lack resources including essential health facilities (Macassa et al, 2003). Moreover, people in rural areas often have an anti biomedical stance (Kalipeni, 2000). These factors contribute to the increased risk of mortality in rural areas. These socio-cultural and socio-economic factors

highlight the important issues that result in the high infant mortality in Sub-Saharan Africa in comparison to other regions in the world.

Similar to other Sub-Saharan African regions mortality is a key issue in Zimbabwe and has shown an increasing trend in the country over the years. Infant mortality rates are no exception, as they have also shown an increasing pattern in Zimbabwe. Fourteen years prior to the 2005-2006 survey infant mortality was recorder to be 40 deaths per 1000 live births; at the time of the survey this figure had increased to 60 deaths per 1000 live births (Zimbabwe Demographic and Health Survey, 2007). It has been reported that three quarters of all childhood mortality in Zimbabwe occurs during infancy; furthermore, one quarter of these deaths occur in the first month of life (Zimbabwe Demographic and Health Survey, 2007).

Thus this study is concerned with infant mortality in Zimbabwe. Infant mortality has been recognised for many years as an indicator of health status of any given country (Reidpath and Allotey, 2003). Furthermore, the infant mortality rate reflects the association between infant mortality and other factors related to population health status, including social, environmental and economic factors (Reidpath and Allotey, 2003).

The determinants of infant mortality in Zimbabwe vary to a great extent and act as barriers in the attainment of the fourth United Nations Millennium Development Goal. The aim of the Millennium Development Goal is to reduce mortality in the world by up to two thirds in the year 2015 (Sachs and Mc Arthur, 2005). In relation to this Millennium Development Goal, Zimbabwe has a relatively long way to go. Its target is to decrease under-five mortality to 27 deaths per 1000 live births. With only three years left to meet this goal, there is a pressing need to address the issue of mortality in Zimbabwe in order to achieve the Millennium Development Goals targets of reduced mortality.

Zimbabwe faces many challenges with regard to decreasing infant mortality within the country. These include the economic insecurity, deteriorated health services and the devastating effects of the HIV pandemic within the country (Sanders and Davis, 1988, Grieser et al, 2001). Zimbabwe's economy has suffered a major blow in past years. The economic problems experienced there can be attributed to various factors (Clemens and Moss, 2005). The economy has a major impact on infant mortality as it affects all sectors of a country, including the health and the employment sectors, which are directly associated with child health outcomes (Clemens and Moss, 2005).

The economic crisis led to the deteriorated health system within the country (Mashamba and Robson, 2001). As a result, the basic health services in Zimbabwe have decreased. Moreover, basic health is now inadequate to meet the needs of society. Kalipeni (2000) argued that the deteriorated health services were due to decreased expenditure on healthcare. In the period 1991 to 1994 alone, a 35% decrease in expenditure occurred. This is an indication of the extent to which health services decreased in Zimbabwe, which can explain the high HIV prevalence in the country.

HIV/AIDS is one of the major health crises in Zimbabwe and acts as a challenge to attaining the goal of decreased infant mortality there (Kalipeni, 2000). Amongst Southern Africa, Zimbabwe has been one of the countries hardest hit by the HIV pandemic. The ZDHS (2007) reported that 18% of adults in Zimbabwe between the ages of 15 and 49 were living with HIV and 21% of these HIV infected adults were women. The sixth Millennium Development Goal aims to prevent the spread of HIV and other diseases worldwide (Sachs and Mc Arthur, 2005), thus stressing the importance of understanding HIV prevalence within the country. A major concern with HIV is that HIV infected mothers have a chance of infecting their infants during and after pregnancy, as the study by Grieser and others (2001) found that in the year 2000, 7% of the existing HIV positive cases in Zimbabwe were as a result of maternal transmission. Furthermore infants are impacted by HIV pandemic in the event of the passing of their mother. Mothers are often the primary care givers (Zijennah et al, 2004).and if infants lose their primary care giver and nurturer they are less likely to survive their first year of life. HIV/AIDS, therefore, is a key obstacle in the fight against infant mortality within Zimbabwe.

Infant mortality is an issue that cannot be isolated to one particular determinant, thus various studies have been conducted with the aim of identifying the most important factors. More importantly, rates and determinants of infant mortality are not static but are understood to change over time (Frey and Field, 2000). A study done by Kembo and Van Ginneken (2009) isolated important socio-economic and demographic determinants of infant mortality in Zimbabwe. This study isolates education as the main determinant in the study of infant mortality in Zimbabwe and found that the impact of mother's education had minimal impact on infant mortality. This finding is inconsistent with other studies, such as Zerai (1996), which found that maternal education had a huge impact on infant survival in Zimbabwe, in particular, education at a community level rather than at an individual level.

An additional study in Zimbabwe identified regional variation as an influential factor of infant mortality (Jhamba, 1999). It found that different regions experienced different infant

mortality rates as a result of the diverse health issues faced by each region (Jhamba, 1999). This is substantiated by Feresu and others (2005), who identified that Zimbabwean women in rural areas are at increased risk of infant mortality in comparison to Zimbabwean women in urban areas as a result of different levels of availability of health care facilities. Thus the residence of the mother, whether urban or rural, is identified in this study as an important determinant of infant mortality in Zimbabwe.

Kembo and Van Ginneken (2009) identified maternal factors of infant mortality as important although they were looked at as subsequent determinants rather than main determinants of infant mortality. These maternal factors were first identified by Mosley and Chen (1984): birth intervals, parity and mothers' age at first birth. Similar to Mosley and Chen's (1984) reasoning Kembo and Van Ginneken (2009) found that short birth intervals and high parity increases risk of infant mortality and similarly age had a comparable impact if mothers are too young or too old. Although Kembo and Van Ginneken (2009) highlighted the role of mothers' age at first birth, it was addressed as a subsequent rather than major determinant of infant mortality thus there is a need for further studies in Zimbabwe. These studies need to determine the true extent to which infant mortality in impacted by mothers' age at first birth in particular because of the importance that has been placed in mothers age at first birth as a determinant of infant mortality in other studies.

The importance of identifying mothers' age at first birth as an influential factor in isolation to the other socio-economic and demographic factors in Zimbabwe is as a result of findings in previous studies in Sub-Saharan Africa. These studies have largely established that mothers, who are young, particularly those who are 18 years of age and less at first birth, are more likely to experience grave maternal outcomes in comparison to mothers bear children between the ages of 20 and 35 (Rutstein, 2000). An overwhelming 85% of mothers in Sub-Saharan Africa bear children before the age of 24 (Canning et al 2010). Additionally, on average the adolescent's fertility rate is between 120 and 160 per 1000 women in most Sub-Saharan regions (Singh, 1998), which is unacceptably high. As a result of the consequences linked to early child bearing, the mothers' age at first birth has been isolated as the determinant of particular interest in this study of infant mortality in Zimbabwe. Furthermore, mothers' age at first birth is the focus as young childbearing is on the increase in Zimbabwe (Mashamba and Robson, 2001).

Mashamba and Robson (2001) found that the adolescent fertility rate was relatively high in Zimbabwe in the late 1990's, with 14% of all births in the country accounted for by women

who were younger than 20 years of age. The ZDHS (2007) report recorded the fertility rate of 15 to 19 year olds to be 99 births per 1000 women between the period of 2005 and 2006. These findings indicate that 21% of the young women aged between 15 and 19 years in Zimbabwe had already experienced childbirth (Zimbabwe Demographic and Health Survey, 2007), although this could be lower than the recorded findings as childbearing at younger ages is largely underreported due to social stigmas that exist (Mashamba and Robson, 2001).

In a country like Zimbabwe where there is a relatively high rate of young childbearing, there is the need to explore mothers' age at first birth in particular as an influential factor on infant mortality. Furthermore, the consequences of childbearing at a lower age go far beyond the risk of infant mortality. These mothers are young, usually unmarried with low incomes, living in areas with little access to health care and often have low education levels (Ehlers et al, 2010).

This study proposes the idea that the maternal age of the mother, as seen in studies across Sub-Saharan Africa plays a major role in infant mortality. More particularly, this study is concerned with the mothers' age at her first birth. This study hopes to show the importance of the mothers' age at first birth by highlighting the relationship and consequences between mothers' age at first birth and infant mortality in Zimbabwe.

1.2 Problem Statement

Sub-Saharan Africa is a region that suffers from the highest rates of infant mortality across the globe (Kalipeni, 2000). 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 Zambia reaching up to 100 deaths per 1000 live births (Madise et al, 2003)

Zimbabwe's infant mortality rate was at 60 deaths per 1000 live births, according to the ZDHS (2007), which is amongst the highest in the Southern African region and is thus a cause for concern. This includes South Africa and Botswana, which already had decreased infant mortality of 51 and 55 deaths per 1000 live births respectively, in the late 1990's (Kalipeni, 2000).

The study of infant mortality is important in any given society as infant mortality is recognised as a general health indicator of a population (Reidpath and Allotey, 2003). Studies have shown that infant mortality has a high correlation with other social issues and negative health outcomes (Schell et al, 2007). 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 (Gortmaker and Wise, 1997) thus it is important that infant mortality be a focal point of any society to ensure that the infant mortality levels are kept low.

The high rates of infant mortality in Sub-Saharan Africa and particularly Zimbabwe then indicate that the general health of the people, in particular women, is poor and needs to be addressed effectively. Reducing mortality is central to the fourth Millennium Development Goal and is still a major challenge (Schell et al, 2007) and current rates indicate that many African countries including Zimbabwe will fail to meet the targets set by the Millennium Development Goals.

An additional issue in the Sub-Saharan African region is adolescent childbearing. This has been a pressing issue in many countries in recent years (Reynolds et al, 2006) including Zimbabwe. Zimbabwe's adolescent fertility rate was 99 births per 1000 women between the period of 2005 and 2006 (Zimbabwe Demographic and Health Survey, 2007). This figure is alarming due to the known consequences of adolescent childbearing such as increased risk of mortality, which has particularly been linked to childbearing at a young age (15-19) in comparison to older mothers (Le Grand and Mbacke, 1993). Young mother's age has been linked to increased risk of low birth weight infants and even infant mortality (Phipps et al,

2002). Zimbabwe has unacceptably high infant mortality rates and concerning adolescent childbearing levels. This study isolates the important determinants of infant mortality and in particular determines the relationship between mother's age at first birth and infant mortality in Zimbabwe.

1.3 Research Question

Is there an association between mothers' age at first birth and infant mortality in Zimbabwe?

1.4 Research Objectives

1.4.1 General Objective:

- To examine the association between mothers' age at first birth and infant mortality in Zimbabwe.

1.4.2 Specific Objectives:

- To examine the levels and patterns of infant mortality in Zimbabwe;
- To examine the relationship between mothers' age at first birth and infant mortality in relation to other socio-economic determinants.

1.5 Justification

Sub-Saharan Africa has the highest rates of infant mortality worldwide (Kalipeni, 2000). Southern Africa in particular, is a region of concern and Zimbabwe is no different. Zimbabwe has the third highest infant mortality rate in Southern Africa of 60 deaths per 1000 live births (Zimbabwe Demographic and Health Survey, 2007). This rate indicates that there's a need to identify the determinants of mortality and increase the chances of reaching the proposed targets of the MDG. Moreover, the high rate of mortality emphasises the need to isolate the socio-economic and demographic determinants of infant mortality in the country.

Identifying these determinants will increase existing knowledge about infant mortality in the country. This will be useful in the process of influencing and developing policy and intervention methods to deal with the issue of infant mortality in Zimbabwe such as family planning.

According to the ZDHS (2007), the adolescent fertility rate was at an alarming rate of 14% and 21% of adolescents had experienced childbearing by the age of 20. It is important, therefore, to study mother's age at first birth as being an important factor in the study of infant mortality in Zimbabwe.

Mother's age at first birth has been identified as an influential factor in infant mortality in Zimbabwe (Kembo and Van Ginneken, 2009) but although this is so, it has not been assessed as a main predictor of infant mortality, thus the need to study further the relationship between mother's age at first birth and infant mortality in the context of Zimbabwe. By identifying the mothers' age at first birth, it hopes to determine the birth outcomes a mother experiences in relation to her age. In this way the study hopes to increase awareness of the influence mothers' age at first birth has on infant outcomes.

More significantly, studying infant mortality and its determinants in Zimbabwe will assist in reaching the fourth MDG to reduce mortality by two thirds by the year 2015. This is due to the fact that successfully identifying the determinants of infant mortality allows for effective policy development which can combat this issue in Zimbabwe. Zimbabwe is still behind in meeting the MDG targets, thus studies specifically focused on infant mortality are essential.

The study will be beneficial to both women's health and infant survival in Sub-Saharan Africa as it will increase knowledge about the importance of bearing children at the right ages and the consequence of having children too young. It will also help shape future development programmes in Zimbabwe, such as adolescent reproductive health care with the aim of preventing early childbearing in and around the country by highlighting the need of contraceptive use in younger women in order to delay childbearing and decrease infant mortality within the country.

Furthermore, the ultimate goal of the National Population Policy of Zimbabwe is to achieve higher standards of living for its people (National economic planning committee of Zimbabwe, 1998); as infant mortality is understood to be a reflection of the standard of living in society it is important that it is an area of focus to meet the goal of the Zimbabwe National Population Policy.

1.6 Definition of Key Terms

1.6.1 Mothers Age At First Birth -, the age of the women at the period of their first birth

In this study mother's age at first birth will be further broken down into two main categories:

Young Age- young age is the age at which the mother experiences childbearing if she is 18years of age and less, this is also referred to this study as adolescents

Older Age- this refers to the age of the women at childbearing if they are above the age of 18, also referred to in this study as adults

1.6.2 Infant Mortality- infant mortality is the probability of the infant dying between birth and their first birthday, deaths of infants at 12 months and younger.

1.6.3 Adolescents- for the purpose of this study adolescent will be referring to women between the age of 15 and 18

1.6.4 Adults- for the purpose of this study adult will be understood as women who are above the age of 18

Chapter 2: Literature Review and Conceptual Framework

2.1 Literature Review

2.1.1 Infant Mortality

Infant mortality has been used extensively in research as a key indicator of population health in past years (Reidpath and Allotey, 2003). This is can be understood through the widespread research which has determined that an infant's wellbeing is heavily dependent on the socio-economic conditions of the environment, more than any other age group (Madise et al, 2001). Infants have a special vulnerability to poverty and substandard living conditions, therefore infant mortality acts as a social mirror as it reflects the social inequalities which are in existence in any society (Gortmaker and Wise, 1997).As a result, even though under-five mortality and mother's age at first birth can also be used as indicators or measures of social health, infant mortality in this study is used since it is understood as an the most significant indicator of socio-economic conditions in any given society.

2.1.2 Infant Mortality in Sub-Saharan Africa

Infant mortality is believed to have immense variation in and amongst nations (Frey and Field, 2000), with less developed nations indicating the highest rates of infant mortality worldwide (Kalipeni, 2000). In previous years the infant mortality rate in Sub-Saharan Africa showed a declining trend. This trend slowly came to a halt and was eventually reversed, which is evident in the more recent infant mortality rates that indicate that infant mortality is on the rise (Schell et al, 2007). Sub-Saharan Africa is a region of vast concern and although infant mortality has in previous years indicated a decreasing trend, from 151 to 96 deaths per 1000 live births from 1960 to 1990; the infant mortality rates of recent years are still regarded to be at an unacceptably high rate by world standards (Kalipeni, 2000).

The rate of infant mortality has been highlighted as an area of concern in society and was addressed through the implementation of the United Nations Millennium Development Goals. The fourth MDG in particular, addresses the issue of reducing mortality worldwide by up to two thirds in 2015 (Sachs and Mc Arthur, 2005) .Thus determinants of infant mortality need to be known and examined in order to undertake the goal to decrease mortality in the coming years. Furthermore, policies need to be implemented to ensure that proposed programmes and initiatives are directed at decreasing mortality to ensure that the targets of the Millennium Development Goals in Sub-Saharan Africa are met.

Previous studies have been heavily focused on the wealth index as the main determinant of infant mortality in Sub-Saharan Africa (Hamer et al, 2003). Schell and others (2007) conducted a study in 152 countries with the aim of identifying the determinants of infant mortality; this study similar to others emphasised the importance of wealth as a determinant of infant mortality. Although the findings of this study emphasise wealth distribution as influential in infant mortality, it is not specific to Sub-Saharan Africa, which has shown different trends from other regions of the world. In addition, the study overlooks demographic determinants of infant mortality and fails to include important socio-economic factors such as education, in conducting the study.

Mothers' education as a determinant of infant mortality has also been identified in numerous studies on infant mortality (Frey and Field, 2000). A cross-sectional study of 96 less developed countries was conducted to determine the effect of women's status contributing to infant mortality inclusive, but not exclusive to their education (Boehmer and Williamson, 1996). This study found that there is indeed an identifiable relationship between women's status and infant mortality: with increased status, the women's risk of infant mortality is significantly decreased.

Boehmer and Williamson (1996) studied factors, such as economic, political and educational factors, and included women's autonomy as an influential aspect in infant mortality. Similarly to previous studies, education emerged as a significant determinant although it was better understood in a multi-dimensional model rather than separate to other factors which make up women's status in society.

In a study conducted in Malawi, spatial variation was examined as a major contributor to infant and child mortality. Infant mortality in Malawi in the early 1990's was at an alarming rate of 154 deaths per 1000 live births (Kalipeni, 2003). Thus infant mortality was a major problem there during this period. This study's main interest was the impact the type of residence has on infant mortality in Malawi, and discovered the huge impact that environmental factors have on child survival, with region as the single most important determinant of infant mortality in Malawi (Kalipeni's, 2003). Although this study identified other influential factors, it focused on an aspect of infant mortality that many demographic studies have found to be less influential in the Sub-Saharan African context rather than other determinants, such as demographic factors.

Similarly, Macassa and others (2003) found that in Mozambique whether the mother resided in an urban or rural area had an impact on child survival, with infant mortality in rural Mozambique reported to be 145 deaths per 1000 live births and 125 deaths per 1000 live births in urban Mozambique. Although this study had similar findings to the study in Malawi, it was conducted in a period of conflict and therefore fails to look at residence in relation to other factors and thus could overestimate the relationship between rural and urban residence in relation to infant mortality in Mozambique.

Tanzania, like many African countries, suffers a large amount of unnecessary and preventable infant deaths yearly (Frey and Field, 2000). A study conducted by Mturi and Curtis (1995) attempted to address this issue by isolating the major determinants of infant mortality. They indicated a large decrease from 160 to 115 deaths per 1000 live births in Tanzania in the 1980's.With the use of the 1991-1992 Tanzania DHS, this retrospective study isolated the factors which played a major role in neonatal deaths including birth order, preceding birth intervals, and mother's age at first birth.

This study found that mothers who were less than 20 years of age experienced greater infant mortality, but unlike other studies (Huang, 2008) this study found little evidence with regard to increased risk of infant mortality for mothers over the age of 35 (Mturi and Curtis 1995). This study contradicts the findings of Huang (2008), who particularly focused on older ages of childbearing as being influential in child health outcomes and infant mortality. This indicates that these findings concerning mothers' age vary in different regions, which points to the importance of studying mother's age at first birth in relation to infant mortality in the Zimbabwean context.

The extensive studies that have been conducted illustrate that Sub-Saharan Africa has the highest infant mortality rates in the world (Kalipeni, 2000). The determinants are non-static as they are constantly changing with changing environments. The current high rates of infant mortality in Africa are largely preventable (Frey and Field, 2000) and lowering infant mortality is possible, this is evident within the more developed countries. This underlies the importance for new and up-to-date studies on infant mortality in Sub-Saharan Africa, which identify the main determinants in order to be able to combat this pressing issue. Furthermore, identifying determinants of infant mortality will assist in achieving the fourth Millennium Development Goal to decrease infant mortality in the world by two thirds by the year 2015 (Hamer et al, 2003).

2.1.3 Infant Mortality in Zimbabwe

Infant mortality is a major concern in Zimbabwe, similar to other Sub-Saharan regions. Infant mortality has been a major concern in Zimbabwe for many years, dating back to the period of colonialism where the greatest burden of death fell amongst infants, children and women (Sanders and Davis, 1988). In this period there was a clear distinction between the black and white populations, thus the infant mortality rate was recorded separately according to race. Among the Whites there were 17 deaths per 1000 live births, while the non-White infant mortality rate was 120 deaths per 1000 live births (Sanders and Davis, 1988). This was a cause of concern as the majority of the Zimbabwe population consisting of non-White individuals.

In later years the infant mortality decreased drastically from 120 deaths per 1000 live births, yet it still can be considered to be relatively high and thus still an area of concern within the country. A study done by Kalipeni (2000) found that the infant mortality in Zimbabwe, although lower than some African countries, was still at an alarming figure. According the ZDHS (2007), in the last 14 years, infant mortality in Zimbabwe had shown a steady increase over the years from 40 deaths per 1000 live births 14 years ago, to 60 deaths per 1000 live births between 2005 and 2006. Zimbabwe, similar to many Sub-Saharan African countries has been greatly affected by the HIV/AIDS pandemic, which explains a significant proportion of infant deaths in the country (Kalipeni, 2000).

Feresu and others (2005) assessed the contribution of socio-demographic and reproductive risk factors as contributors to infant mortality in Zimbabwe and found that few studies have been done there concerning peri-natal deaths, which is surprising with the rate of peri-natal mortality being at a relatively high rate. Furthermore, it has a significant contribution in the infant mortality rate within the country. Similar to other studies on infant mortality, including Frisbie (2004), this study found that low birth weight is a contributing factor to infant mortality in Zimbabwe. There are high levels of premature births experienced, leading to infants being born with low birth weight, which consequently increases their risk of infant mortality (Feresu et al, 2005).

A study by Zerai's (1996) regarding infant mortality Zimbabwe examined the influence of socio-economic and demographic factors. With the utilisation of the Zimbabwe 1988 Demographic and Health Survey, a multilevel framework was used to determine the rate of infant survival within the country (Zerai, 1996). This study employed the Cox regression

multilevel analysis and concluded that education was an important factor in infant mortality in Zimbabwe. Similar to a study in Nigeria (Adjetunji's, 1995), which concluded that the relationship with education was not static and differed to the inverse relationship other studies spoke of, this study found the usual trend in education. Education was found to have greater significance on infant mortality rates at a community level rather than at the mother's individual level of education. This study used the Zimbabwe Demographic and Health Survey of 1988, thus it is important that up-to-date research is completed to determine whether this relationship still exists in Zimbabwe more than 20 years later, and more importantly, whether the relationship remains unchanged over the years.

Kembo and Van Ginneken (2009) conducted a study in Zimbabwe with the objective of determining the impact of maternal, socio-economic and sanitation variables on infant and child mortality using the Zimbabwe Demographic and Health Survey 2005 - 2006. This study found that maternal factors had a significant influence on infant mortality; birth order of 6 and above shows a significant increase in mortality and that high birth order increases infant mortality by up to 2.75 more times in comparison to low birth order (Kembo and Van Ginneken, 2009). This figure is higher than that reported in the Zimbabwe Demographic and Health Survey 2005-2006, which recorded high birth order of 4 or more children increasing risk of infant mortality (Zimbabwe Demographic and Health Survey, 2007). Birth intervals and multiple births were also highlighted as significant in this study, alongside low mother's age at first birth, which increases the risk of infant mortality by up to 15% (Kembo and Van Ginneken, 2009). Some findings in this study deviate from previous studies of determinants of infant mortality thus there is a still a need to conduct a study in Zimbabwe to highlight these maternal determinants of infant mortality.

With these two studies having some contradicting findings it is important that the main determinants of infant mortality in Zimbabwe are studied further and in greater detail.

Similar to several Sub-Saharan African countries, Zimbabwe has been devastated by the HIV/AIDS pandemic. In the period of 2005 to 2006, 18% of the adult population had HIV, which specifically peaked in women between 30 and 35 years, while the peak in HIV prevalence in men was between the ages of 40 to 44 years (Zimbabwe Demographic and Health Survey, 2007). In developing countries most HIV transmission to children occurs through the practice of breastfeeding, and it has been found that mother to child transmission can be reduced by up to 50% through the undertaking of a short course ARV therapy (Zijenah et al, 2004). This is of grave concern considering that 30% of pregnant women aged 15-19 in

Zimbabwe were reported to be HIV positive (Blume, 2006). Thus HIV can be seen to have a great impact on infant health in Zimbabwe. Zijenah and others (2004) found that this can be attributed to, amongst other things; the increased risk of low birth weight in HIV infected infants, which in turn increases the risk of mortality.

This is particularly important in the understanding of the next theme of this paper: mother's age at first birth. Adolescents are understood to engage in risky sexual behaviours thus increasing the risk of infection and thus increasing risk of infant mortality (Phipps et al, 2002).

2.1.4 Mothers Age at first birth

Various determinants of infant mortality have been discovered over the years. Existing research concerning infant mortality has determined that mothers' age is an influential factor in infant mortality (Canning et al, 2010). The issue of infant mortality is important on both health and social grounds. The ages of concern have been isolated to young mothers and older mothers due to a number of biological, behavioural and socio-economic characteristics of the mothers, which have an influence on infant survival (Phipps et al, 2002). Studies have largely explained young mothers to be those less than 18 years, and older mothers as those who are 35 years and above (Rutstein, 2000). Specifically, young mother's age at first birth is seen to increase risk of complications and studies have shown an inverse relationship between young mother's age at first birth and infant mortality (Olausson et al, 1999).

Universally, adolescents bear 14 million children a year, with the 90% of these births occurring in the developing world (Reynolds et al, 2006). In the developing world Sub-Saharan Africa stands out as a region of high adolescent childbearing with 85% of women bearing children before the age of 24 (Canning et al, 2010). Adolescent childbearing is a phenomenon with enormous ramifications on a personal, societal and global level (Singh, 1998). Children born to young mothers suffer from increased disadvantaged health outcomes in comparison to children born to mothers who delay childbearing; this includes premature births and low birth weight infants (Phipps, et al, 2002). This can be attributed to biological factors such as the fact that young mothers bodies are not fully developed, which includes their pelvic bones and their birth canals (Reynolds et al, 2006).

Previous studies including Reynolds (2006) and others found that adolescent mothers experience infant mortality exclusively as a result of biological factors, Phipps and others (2002) found that holding the biological factors constant, adolescent mothers usually have

behaviours which further increase the risk of infant mortality. Adolescents experience up to three-fold higher rates of infant mortality, which can be associated with negligent behaviours that they usually possess, including the inability to care for children after birth, inadequate feeding, lack of hygiene and not seeking medical attention when necessary (Reynolds et al, 2006). Adolescents can prevent high risk of infant mortality if they seek prenatal health care, and be able to identify the need to seek help for complications such as haemorrhaging and infections without delay (Reynolds et al, 2006).

As mentioned earlier, Sub-Saharan Africa has the highest levels of adolescent's childbearing with most regions ranging between 120 and 160 births per 1000 women (Singh, 1998). In Zimbabwe the issue of a young mother's age at first birth is a cause for concern similar to other Southern African countries. In the 15 to 19 year old age group, specific fertility rate was recorded to be 99 births per 1000 women and the mean age of childbearing within the country was 18.2 years (Zimbabwe Demographic and Health Survey, 2007).This is a cause for concern and needs to be addressed effectively.

Le Grand and Mbacke (1993) studied adolescent pregnancy outcomes in urban Sahel in correspondence with other studies. This study found that physiological and behavioural factors of young mothers contribute to their poor infant health outcomes, including mortality. Amongst the biological factors already established, Le Grand and Mbacke (1993) found that young mothers, as a result of lack of physical development, often suffer fatalities as the foetus does not develop adequately due to not attaining the adequate amount of nutrients, as the mother and the foetus are fighting for any nutrients the body receives.

Children born to adolescents in urban Sahel, experience 50% more mortality than children born to mothers over 20. This is can be understood through the inadequate health care that young mothers receive (Le Grand and Mbacke, 1993), which is substantiated by a study conducted in 21 countries in Sub-Saharan Africa. This study found that childbearing at a young age is usually unwanted and as a result, very few antenatal and prenatal visits are undertaken by the mothers. (Magadi et al, 2007) .The study in urban Sahel makes great contribution to the understanding of the risks of young mother's age at first birth yet fails to look in depth into the risk of bearing children outside the age bracket of 20-34, in other words it fails to address the issue of older mothers aged 35 and above.

A study by Huang (2008) identifies mother's age at first birth as an influence with particular focus on older mothers. It was found that mothers older than 35 years of age also have

biological factors contributing to negative child health outcomes, including chronic diseases and gestational diabetes, to mention a few (Huang, 2008). This study indicates that there is much research that still needs to be conducted, focused not only on young mother's age at first birth but also the socio-economic and demographic effects of childbearing at older ages.

Mothers' age at first birth is an important determinant to examine as many studies fail look at it in depth in their studies, although they do mention that it is indeed an important factor in infant mortality. Mothers' age at first birth is often imbalanced; with most studies focusing on the young age even though some studies (Huang, 2008) have made known that older age also have fatal consequences to child health and infant mortality.

The extensive studies done in other countries with regard to infant mortality and mothers' age at first birth indicate the importance of this relationship, and thus the need to examine the relationship within Zimbabwe. This study will use the variable mothers' age at first birth to analyse how bearing children at different age groups impacts on infant mortality in Zimbabwe.

2.2 Theoretical and Conceptual framework

This study will be based on the Mosley and Chen model (1984), which is an analytical framework for the study of child survival in developing countries. This model integrates the social and biological factors that have an influence on infant and child mortality and provides a means of measuring morbidity and mortality in developing countries (Mosley and Chen, 1984).

Based on the biological factors the Mosley and Chen analytical model (1984) has developed proximate variables which impact on infant and child survival; this model of socio-economic determinants has identified maternal factors as being influential in child survival (Mosley and Chen, 1984). Each of these factors has an independent and coexisting influence on infant and child mortality.

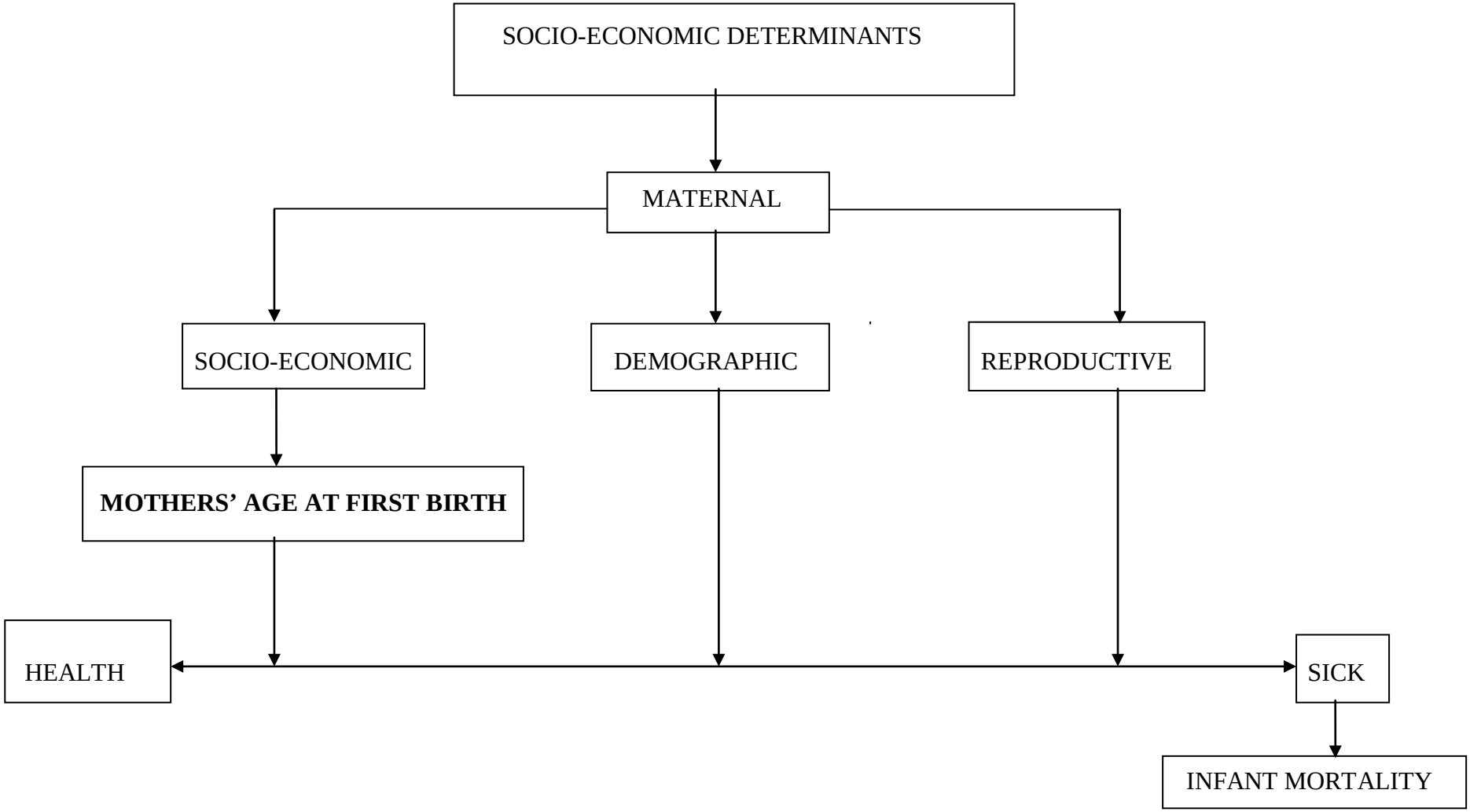
Mothers' age is identified as an important socio-economic factor in this framework in examining the level of infant mortality. This allows for infant mortality to be studied in relation to the mothers' age at first birth in order to identify the relationship between the women's age at childbearing and infant mortality.

Mosley and Chen (1984) also identified important socio-economic, demographic and reproductive factors which are also examined in relation to infant mortality. The study will be analysing an all-women survey, thus all questions will pertain to the mother and therefore the factors in this model can be understood as maternal characteristics of the mother. This study recommends that the age of the mother at her first birth should be highlighted in the Mosley and Chen framework as an influential maternal factor in the study of infant and child morbidity and mortality in developing countries.

2.3 Study Hypotheses

- Ho: There is no significant relationship between mother's age at first birth and infant mortality in Zimbabwe.
- Ha: There is a significant relationship between mother's age at first birth and infant mortality in Zimbabwe.

Figure 1: Conceptual model adapted for the study of mothers' age at first birth and infant mortality in Zimbabwe (Mosley and Chen, 1984)



Chapter 3: Methodology

3.1 Introduction

This chapter will discuss the methodology used in this study.

3.2 Place of Study

Zimbabwe is situated on the eastern side of Southern Africa. It is landlocked, with neighbouring countries including South Africa, Namibia and Zambia (Zimbabwe Demographic and Health Survey, 2007). The population of Zimbabwe has been reported to be 12 million between the period of 2005 and 2006 (Zimbabwe Demographic and Health Survey, 2007). This study is focused particularly on the sample of 4074 women in Zimbabwe, which are the women who had children in the last five years prior to the Zimbabwe Demographic and Health Survey of 2005-2006.

Zimbabwe is faced with a large amount of difficulties in relation to its economy (Clemens and Moss, 2005). The devastated state of the economy is cause for concern as economic growth is necessary for development; furthermore it is necessary to improve various sectors within the country, including the health sector (Clemens and Moss, 2005). The Zimbabwean economy is largely dependent on agriculture (Zimbabwe Demographic and Health Survey, 2007). The damaged agricultural sector resulted in a huge amount of issues within the country and more importantly increased the mortality within Zimbabwe. Clemens and Moss (2005) reported that the economic issue results in more the 3900 infant deaths, in Zimbabwe, per year.

3.3 Data Source

This study is conducted using the Zimbabwe Demographic and Health Survey 2005-2006, specifically the women's individual survey. The ZDHS is a nationally representative survey.

3.4 Study Design

The ZDHS study design is cross-sectional, as it collects information on a sample of the Zimbabwean population at one point in time (Mann, 2003). The survey was conducted between the period of August 2005 to March 2006 by the Central Statistics Office (Zimbabwe Demographic and Health Survey, 2007). The ZDHS collects information on: fertility level, sexual activity, family planning methods, early childhood mortality, and maternal and child health outcomes. It is designed to provide information about population and health indicator estimates for the benefit of the county at both provincial and national levels.

3.4.1 Study Population

The population, which this study particularly focuses on, are the women of reproductive ages (15-49) in Zimbabwe, who had children within the last five years previous to the undertaking of the survey. It includes women who took part in the individual survey of the Zimbabwe Demographic and Health Survey 2005-2006. All women who had children in the past five years were included while the other women were excluded on the grounds that they would fail to contribute to the study. This is attributed to the fact that they would not have given birth to any children in recent years, and are thus irrelevant in this particular study.

3.4.2 Sample Size

The sampling frame of the ZDHS 2005-2006 is developed by the CSO. Ten provinces of Zimbabwe are included in this sample and have been stratified according to the land use, with the exception of Bulawayo and Harare. The sample for this study consists of a total of 8907 women of reproductive age in Zimbabwe (15 to 49) who are permanent residents of households or were visiting the night before the survey was conducted. From the total sample of 8,907 women in the individual survey the sample was further decreased to women who had children in the last five years prior to the undertaking of the survey. This then left 4074 women who fit the criteria of this study.

3.4.3 Questionnaire Design

Similar to the previous Zimbabwe Demographic and Health Survey's this women's questionnaire made use of a calendar to collect information on the reproductive history of women. The issue of infant mortality was dealt with in the section of reproduction and question 220 addressed the issue of childhood deaths.

Variables Used in the Data Analysis

3.5.1 Dependent Variable

The outcome variable in this study is infant mortality.

Infant mortality is defined as the deaths of a child between the period of birth and their first birthday. The variable infant mortality was created using STATA and women who had children in the last five years were the sample. From this sample the variable age at death (imputed in months) was used and all the deaths that were 12 months and less were categorised into infant mortality. This was done for all the children born to the women from the first child up to the 14^{th} child (as this was the highest amount of children that were born to one woman) rather than merely applied to the last child born to women.

In the ZDHS the question of infant mortality was framed as follows: 'Sometimes babies are born and die shortly after birth. Have you ever given birth to a boy or girl who was born alive but later died'? (Zimbabwe Demographic and Health Survey, 2007)

Table 1: Defining the outcome variable, infant mortality.

Dependent variable (outcome variable)	**Answer categories**	**Code**
Infant Mortality	No	0
	Yes	1

3.5.2 Independent Variables

The main independent variable in this study, which is highlighted in the original Mosley and Chen (1984) framework, is mothers' age at first birth.

Mothers' age at first birth, is defined as the age at which the mother experiences her first childbearing. Mothers' age at first birth is further classified into two categories: young mothers (adolescents) and older mothers (adults). Young mothers are mothers who are 18 years of age and less, while older mothers are above the age of 18. Mothers' age has been divided into these categories as previous studies (Kembo and Van Ginneken, 2009 and Rutstein, 2000) have indicated that mothers who are 18 years and less are more likely to experience infant mortality than mothers who delay childbearing well into their early 20's and 30's.

Additional independent variables included in this study are separated into demographic, socio-economic, and reproductive determinants of infant mortality.

There are five demographic factors in this study. Mothers' current age gives the study a snap-shot description of the women and allows for a comparison to be made between the level of infant mortality at their first birth and at their current age. Age is also important as mothers who are too young are said to have increased infant mortality as they are less likely to seek health care services (Mashamba and Robson, 2001). The mean age of the mothers in Zimbabwe is 28. Thus the variable is binary with the mothers' current age divided into mothers younger than 28 and those who are 28 and above.

Marital status indicates the support structure that the women have during and after childbearing. Marital status is separated into two domains for the purpose of this study, which are: women who are not married and those who are married. Studies such as those by Frisbie (2004) found that women who are not married suffer more infant mortality than women in marital unions. The domain 'not married' includes women who have never been married and those who are formerly married and are no longer married due to reasons including: separation, divorce and death of a spouse.

Zimbabwe's ten regions are identified in this study, and women are separated according to which region of Zimbabwe they are currently living in. Region is identified as an important factor as a result of regional differences in health infrastructure and disease prevalence which influence infant mortality rates (Kembo and Ginneken, 2009, Madise, 2003). Furthermore, people in rural areas have been found to have socio-cultural anti biomedical beliefs which impact health care seeking behaviour and in turn have an impact on infant survival (Kalipeni, 2000.) Religion is another important demographic variable as it determines the beliefs and thus behaviours of women, which can have an impact on infant mortality (Omariba et al, 2007). The women of Zimbabwe have a range of religious beliefs and for the purpose of this study they have been grouped into two main domains: Christians, and non-Christians.

The total number of people in the household has been identified as important in this study, as the greater the amount of people in the house, the less resources available for the healthy development of the infant. This variable is categorised into less than 6 people living in the household and 6 or more individuals living in the household, which is the average amount of people living in the Zimbabwean households.

There are four socio-economic variables included in this study including the main independent variable mothers' age at first birth. The second is the highest education level of the women, which indicates the level of education that Zimbabwean women had achieved. Education increases the ability for women to make use of government and private health resources (Kembo and Van Ginneken, 2009), which is important in the study of infant mortality. This variable is divided into four categories: no education, primary, secondary, and higher education.

The variable type of residence indicates whether the women live in the rural or urban areas of Zimbabwe and is used in this study to distinguish the extent to which difference in urban and rural areas contribute to infant mortality. The variable working currently indicates the employment status of the women, whether they were currently employed or unemployed at the time of the survey. Studies such as Frey and Field (2000) suggest that access to employment decreases the chances of the mother experiencing infant mortality.

The third category of variables is the reproductive characteristics of the Zimbabwean women. Birth intervals is used in this study as a way of identifying the risk of infant mortality of Zimbabwean women as studies including Mturi and Curtis (1995) have found that women who have short birth intervals have increased chances of infant mortality. Unlike women with longer birth intervals, they have decreased risk of infant mortality. As a result of the mean birth intervals in Zimbabwe being 49 months, short birth intervals are identified in this study as less than 49 months while longer birth intervals are 49 months and above.

Lastly the total number of children has been categorised according to the mean number of children per women in Zimbabwe, and is thus divided into women with less than 3 children and women with more than 3 children. This variable represents the women's parity and has been used in this study since parity has been identified in past studies as an important factor in infant mortality (Omariba et al, 2007). Multiple births are strongly negatively associated with infant survival (Kembo and Van Ginneken, 2009).

Table 2: The definitions of variables from the 2005-2006 ZHDS used in the study

Independent variables	
Demographic variables	**Current age of mother**
	<28 years
	28years+
	Marital status
	Not married
	married
	Region
	Harare
	Manicaland
	Mashonaland Central
	Mashonaland East
	Mashonaland West
	Matebeleland North
	Matebeleland South
	Midlands
	Masvingo
	Bulawayo
	Religion
	Christian
	Non Christian
	Total number of people in the household
	<6
	6+
Socio-economic variables	**Age at first birth**
	<19 years
	19 years+
	Highest education level
	No education
	Primary
	Secondary
	Higher
	Type of residence
	Urban

	Rural
	Working currently
	No
	Yes
Reproductive Health variables	**Birth intervals**
	<49months
	49 months+
	Total number of children ever born
	<3
	3+

3.6 Ethical Considerations

The ZDHS does not capture information using the respondent's names but rather uses a variable named CASEID. CASEID allows for individuals to be identified while remaining anonymous thus the personal information of the respondents is kept private**.**

3.7 Data Management

The data used is from the Zimbabwe Demographic and Health Survey 2005-2006 which was available and downloaded from the DHS website. The statistical software STATA was used to conduct the analysis of the quantitative data, version 9 of this program was used.

The appropriate variables from the women's questionnaire were identified and used in the running of tests. A total of 4074 women of reproductive ages (15-49) from this survey were relevant for this study as they had experienced childbearing in the last five years prior to the survey.

3.8 Data Analysis

This study conducted an analysis on the appropriate variables at four levels. The first level is univariate analysis, followed by bivariate analysis, multivariate analysis and lastly stepwise analysis. These four levels of analysis are discussed at length in the following paragraphs.

3.8.1 Univariate Analysis

The univariate analysis is conducted for the purpose of attaining the background characteristics of the women in Zimbabwe in relation to the appropriate variables. Tabulation of each independent variable resulted in an output of frequencies and percentages of the characteristics of the women in Zimbabwe. This is a method of summarising the variables used in the study. The independent variables are further categorised into demographic, socio-economic and reproductive factors and this information is then constructed into a frequency table.

3.8.2 Bivariate Analysis

The bivariate analysis is the second level of analysis which is undertaken in this study. This is performed on each independent demographic, socio-economic and reproductive variable against the dependent variable: infant mortality. This then indicates the extent to which each of the independent variables is associated with the outcome infant mortality in Zimbabwe. Binary Logistic regression test is run, which reports the odds ratios, indicating the nature of the association between each independent and dependent variable, whether it is a positive or negative association. Furthermore, the logistic regression output includes p-values and confidence intervals. Logistic regression method is used as the model outcomes includes each independent variable

The model for the bivariate logistic regression is: $Y= B_0 +B_1X_1+E$ (Bender and Grouven, 1997).

Y= Dependent/Outcome variable
B_o= Intercept
B_1= Regression Coefficient
X_1= Independent Variable
E=Error

3.8.3 Multivariate Analysis

The third stage of the analysis is the running of the multivariate logistic regression test. At this point all the independent demographic, socio-economic and reproductive variables are looked at together in relation to the dependent variable, infant mortality. This is done to determine the extent of which all the variables have an impact on infant mortality dependent

on each other's presence. More specifically, the study focuses on the extent to which mothers' age at first birth has an impact on infant mortality when other variables are present. This method tests for confounding. The logistic regression test reports odds ratios, which explain the nature of the relationship between each independent variable and the dependent variable in the presence of the other independent variables. Both the bivariate and multivariate logistic regression tests are run at 5% significance levels and the p-values and confidence intervals are analysed for statistical significance for each independent variable.

The model of the multivariate logistic regression is: $Y= B_0+ B_1X_1+B_2X_2+B_3X_3.....+E$ (Bender and Grouven, 1997)

Y= Dependent/Outcome variable

B_o= Intercept

$B_{(1/2/3/....)}$ = Regression Coefficient

$X_{(1/2/3/....)}$ = Independent Variable

E=Error

Stepwise logistic regression was then applied to the multivariate analysis. This involves running all the demographic, socio-economic and reproductive variables which were significant in the multivariable analysis model together. The backward selection method was undertaken, which includes all the variables and the insignificant ones are then dropped by the model. This is done to see whether these variables are still significant when they are run together.

The model of the stepwise regression is: $Y= B_0+ B_1X_1+B_2X_2+B_3X_3.....+E$

Y= Dependent/Outcome variable

Bo= Intercept

$B_{(1/2/3/...)}$ = Regression Coefficient

$X_{(1/2/3...)}$ = Independent Variable

E=Error

(Bender and Grouven, 1997)

Chapter 4: Results

4.1 Univariate Analysis

The univariate analysis made use of the women's survey from the Zimbabwe Demographic and Health Survey 2005-2006. The outcome variable infant mortality was run, as well as each of the independent demographic, socio-economic and maternal variables, to produce the following results.

Table 3: Frequency and percentage distributions of Zimbabwean women who had at least one child in the last five years, according to selected characteristics, 2005 - 2006 Zimbabwe Demographic and Health Survey

	Characteristic	Frequency	Percentage
Dependent variable	**Infant mortality**		
(Outcome variable)	No	3,565	87.51
	Yes	509	12.49
	Total	4,074	100
Independent variables			
Demographic variables	**Current age of mother**		
	<28years	2,246	55.13
	28years+	1,828	44.87
	Total	4,074	100
	Marital status		
	Not married	740	18.16
	Married	3,334	81.84
	Total	4,074	100
	Region		
	Manicaland	508	12.47
	Mashonaland Central	426	10.46
	Mashonaland East	308	7.56
	Mashonaland West	390	9.57
	Matebeleland North	336	8.25
	Matebeleland South	274	6.73
	Midlands	566	13.89
	Masvingo	501	12.30

	Harare	521	12.79
	Bulawayo	244	5.99
	Total	4,074	100
	Religion		
	Christian	3,489	85.64
	Non Christian	585	14.17
	Total	4,074	100
	Total number of people in the household		
	<6	2,119	52.01
	6+	1,955	47.99
	Total	4,074	100
Socio-economic variables	**Age at first birth**		
	<19years	1,808	44.38
	19years+	2,266	55.62
	Total	4,074	100
	Highest education level		
	No education	159	3.90
	Primary	1,489	36.55
	Secondary	2,322	57.00
	Higher	104	2.55
	Total	4,074	100
	Type of residence		
	Urban	1,136	27.88
	Rural	2,938	72.12
	Total	4,074	100
	Working currently		
	No	2,559	62.84
	Yes	1,513	37.16
	Total	4,072	100
Reproductive Health variables	**Birth intervals**		
	<49months	1,722	42.27
	49months+	2,352	57.73
	Total	4,074	100

	Total number of children ever born		
	<3	2.235	54.86
	3+	1.839	45.14
	Total	4,074	100

Table 3 is a summary of the univariate analysis, which portrays the characteristics of the women in Zimbabwe. The table indicates that there are a total number of 4074 women in Zimbabwe who had children in the last five years and from these women a total of 509 of them experienced infant mortality. Thus 12% of women experienced infant mortality in Zimbabwe in the 5 year period prior to and including the year which the survey was conducted. This can be further understood as 120 of every 1000 women in Zimbabwe experienced infant mortality.

The demographic characteristic current age of the mother indicates that the mean age of women in Zimbabwe is 28. The majority of the women are less than 28 years of age (55%) while 45% are 28 years and older. Table 3 indicates that a significant amount of women (82%) are currently married while the minority (18%) are not married. The majority of the women live in the midlands (14%), the capital Harare (13%) and Manicaland (12%). Bulawayo has the smallest number of women at 6%.

It is evident that Zimbabwe is a country of rich religious beliefs. The table shows that a significant number of women in Zimbabwe are Christians (86%), while a small amount is non-Christians (14%). Households of less than 6 people are slightly more common in Zimbabwe (52%) while households with 6 or more people are slightly less at 48%.

For the socio-economic variables the majority of women reported bearing children over the age of 18, but the difference between those who experienced childbirth at 18 years and less and women who were older than 18 is not significant at 44% and 56% respectively as a result of the insignificant p-values.

As seen in the table, 4% of the Zimbabwean women have no education at all, but this is small percentage in comparison to the amount of educated women. A total of 37% of women have received primary education and a significantly large percentage of women have reached secondary education (57%). Although a small percentage of 3% have received higher education it is evident that most of the women in Zimbabwe between the ages of 15 and 49 who have had a child in the last five years have received some level of education.

The working status of women in Zimbabwe appears to be low with 63% of the women reporting that they are unemployed, while a dismal 37% of women reported that they were currently employed. Zimbabwe is a country which has both urban and rural areas. The overwhelming majority of women live in rural Zimbabwe and this can be seen in Table 3 where 72% of the women live in rural areas while 28% of them reported living in urban areas of Zimbabwe.

With regard to the reproductive characteristics of the women, the results indicate that 58% of the women have longer birth intervals while 42% of Zimbabwean women have short birth intervals. Furthermore the results show that 55% of the women have less than three children while 45% of women in Zimbabwe have more than 3 children.

Table 4 indicates the levels of infant mortality among Zimbabwean women, according to their demographic, socio-economic, and reproductive characteristics. This table is specific to women who experienced infant mortality in the last five years as appose to including all the women who had children in the last five years as done in Table 3.

Table 4: Frequency and percentage distribution of Zimbabwean women who experienced infant mortality in the past five years, according to selected characteristics, 2005-2006 Zimbabwe Demographic and Health Survey

	Characteristic	Frequency	Percentage
Dependent variable	**Infant mortality**		
(Outcome variable)	No	3,565	87.51
	Yes	509	12.49
	Total	4,074	100
Independent variables			
Demographic variables	**Current age of mother**		
	<28years	209	41.06
	28years+	300	58.94
	Total	509	100
	Marital status		
	Not married	103	20.24
	Married	406	79.76
	Total	509	100
	Region		
	Manicaland	82	16.11
	Mashonaland Central	54	10.61
	Mashonaland East	33	6.48
	Mashonaland West	59	11.59
	Matebeleland North	46	9.04
	Matebeleland South	28	5.50

	Midlands	83	16.31
	Masvingo	67	13.16
	Harare	42	8.25
	Bulawayo	15	2.95
	Total	509	100
	Religion		
	Christian	421	82.71
	Non Christian	88	17.29
	Total	509	100
	Total number of people in the household		
	<6	257	50.49
	6+	252	49.51
	Total	509	100
Socio-economic variables	**Age at first birth**		
	<19years	277	54.42
	19years+	232	45.58
	Total	509	100
	Highest education level		
	No education	40	7.86
	Primary	221	43.42
	Secondary	239	46.95
	Higher	9	1.77
	Total	509	100
	Type of residence		
	Urban	96	18.86
	Rural	413	81.14
	Total	509	100
	Working currently		
	No	303	59.53

	Yes	206	40.47
	Total	509	100
Reproductive Health variables	**Birth intervals**		
	<49months	325	63.85
	49months+	184	36.15
	Total	509	100
	Total number of children ever born		
	<3	135	26.52
	3+	374	73.48
	Total	509	100

Table 4 specifies the levels of infant mortality as it presents the characteristics of the women of Zimbabwe who have experienced infant mortality indicating the levels and patterns of infant mortality within Zimbabwe in relation to the mother's characteristics.

For the demographic variables, women whose current age is 28 years and more experienced greater infant mortality at 59%.The married women experienced significantly higher infant mortality as 80% of the women who had infant mortalities in the past years are married. The region least impacted by infant mortality is Bulawayo, 3% of these women experienced infant mortality, while women in the manicaland and the midlands experienced the greatest infant mortality at 16%. Christian women experienced the highest mortality with 83% of deaths occurring to these women. The indicator number of people in the household shows little difference in infant mortality amongst women who reside in small or large households.

The socio-economic variables indicate 54% of women who are 18 years old and less experienced infant mortality. It is evident that 47% of infant mortalities occurred to women who had secondary education while only 2% of women with higher education experienced infant mortality. The majority of mothers who experienced infant mortality are from rural Zimbabwe (81%). Furthermore women who are not employed have the highest rates of infant mortality, 60% of the infant deaths fall upon these women.

With regard to the reproductive characteristics of the women it is evident that the majority of women who experienced infant mortality had less than 49 months births spacing intervals (64%).The total number of children variable indicates that 73% of women who experienced infant mortality had more than 3children.

4.2 Bivariate Analysis

The bivariate analysis was undertaken in order to investigate the relationship between the demographic, socio-economic, and reproductive characteristics of the women in relation to the outcome variable: infant mortality. The independent variables are run against infant mortality independently.

Table 5: Unadjusted odds ratios, p-values and confidence intervals from the binary logistic regression to identify the association between selected characteristics of women and infant mortality in Zimbabwe 2005-2006

Dependent variable	Infant mortality	OR	P-value	Confidence Interval
Demographic variables	**Current age of mother**			
	<28years	1.00	1.00	1.00
	28years+	1.91*	0.00	1.58-2.31
	Marital Status			
	Not married	1.00	1.00	1.00
	Married	0.86	0.19	0.68-1.08
	Region			
	Harare	1.00	1.00	1.00
	Manicaland	2.19*	0.00	1.48-3.26
	Mashonaland Central	1.66*	0.02	1.08-2.53
	Mashonaland East	1.37	0.20	0.85-2.21
	Mashonaland West	2.03*	0.00	1.34-3.09
	Matebeleland North	1.81*	0.01	1.16-2.82
	Matebeleland South	1.29	0.31	0.79-2.15
	Midlands	1.96*	0.00	1.32-2.9
	Masvingo	1.76*	0.01	1.17-2.64
	Bulawayo	0.75	0.35	0.41-1.38
	Religion			
	Christian	1.00	1.00	1.00
	Non Christian	1.29*	0.04	1.01-1.65
	Total number of people in the household			
	<6	1.00	1.00	1.00
	6+	1.07	0.46	0.89-1.29

Socio-economic variables	**Age at first birth**			
	<19years	1.59*	0.00	1.32-1.91
	19years+	1.00	1.00	1.00
	Highest education level			
	No education	1.00	1.00	1.00
	Primary	0.52*	0.00	0.35-076
	Secondary	0.34*	0.00	0.23-0.50
	Higher	0.28*	0.00	0.13-0.61
	Type of residence			
	Urban	1.00	1.00	1.00
	Rural	1.77*	0.00	1.40-2.24
	Working currently			
	No	1.00	1.00	1.00
	Yes	1.17	0.09	0.97-1.42
Reproductive Health variables	**Birth intervals**			
	<49months	1.00	1.00	1.00
	49months+	0.36*	0.00	0.3-0.44
	Total number of children			
	<3	1.00	1.00	1.00
	3+	3.97*	0.00	3.23-4.88

1=Reference Category,*p<0.05 denotes significance as tests were run at a 95% significance level

The demographic variables indicate that women that are more than 28 years of age have significantly increased odds of experiencing infant mortality (1.91) than women who are less than 28 years of age.

It is important to note that in every region, with the exception of Bulawayo, women have increased odds of experiencing infant mortality in comparison to the women in Harare, the capital of Zimbabwe. The religion variable in Table 5 indicates that women in Zimbabwe who are non-Christians experience 29% increased chances of infant mortality in comparison to women who are Christians.

For the socio-economic characteristic mothers' age of the first birth, it is apparent that in comparison to women who are above 18 years, women who are 18 years and less experience 59% more infant mortality. It can be said that a woman who is 18 years and less experiences significantly higher infant mortality than those of older ages.

With regards to the characteristic education it is apparent that in comparison to mothers who are uneducated women with primary education are less likely to experience infant mortality by 48%. Women who have reached secondary education are 66% less likely to experience infant mortality and women who have reached higher education are 72% less likely to experience infant mortality than women who have no education in Zimbabwe.

The odds of women in rural areas experiencing infant mortality are 1.77. This figure indicates that there is a 77% increased risk of infant mortality for women in rural Zimbabwe in comparison to their urban counterparts.

With regards to the reproductive characteristics, Table 5 shows results that women who have longer birth intervals (greater than 49 months) have decreased odds of infant mortality of up to 64 % in comparison to women who have short birth intervals (less than 49 months). Thus short birth intervals have a negative impact on infant mortality in Zimbabwe. With regards to the number of children ever born, which represents the parity order of the women. Women who had 3 or more children experience almost 4 times more infant mortality than women who had less than 3 children with the odds of 3.97.

4.3 Multivariate Analysis

Table 6 indicates the multivariate logistic regression tests with all the independent socio-economic, demographic and reproductive variables run against infant mortality simultaneously. The output has odds ratios, p-values and confidence intervals, which indicate the nature of the relationship of all the independent variables and whether the relationship is of statistical significance.

Table 6: Adjusted odds ratios p-values and confidence intervals from multivariate logistic regression examining the likelihood of infant mortality of women in Zimbabwe 2005-2006, according to the specified characteristics.

Dependent variable	**Infant mortality**			
Independent variables		**OR**	**P-value**	**Confidence Interval**
Demographic variables	**Mothers current age**			
	<28years	1.00	1.00	1.00
	28years+	0.96	0.79	0.75 -1.25
	Marital status			
	Not married	1.00	1.00	1.00
	Married	0.60*	0.00	0.47-0.78
	Region			
	Harare	1.00	1.00	1.00
	Manicaland	1.50	0.16	0.86-2.47
	Mashonaland Central	1.05	0.87	0.59-1.84
	Mashonaland East	1.02	0.95	0.56-1.84
	Mashonaland West	1.34	0.28	0.79-2.27
	Matebeleland North	1.15	0.63	0.65-2.05
	Matebeleland South	0.69	0.24	0.37-1.29
	Midlands	1.24	0.42	0.74-2.08
	Masvingo	1.18	0.54	0.69-2.04
	Bulawayo	0.68	0.23	0.37-1.27
	Religion			
	Christian	1.00	1.00	1.00
	Non Christian	1.08	0.60	0.82 -1.41
	Total number of people in the			

	household			
	<6	1.00	1.00	1.00
	6+	0.79*	0.03	0.65 -0.98
Socio-economic variables	**Age at first birth**			
	<19years	1.31*	0.01	1.06-1.62
	19years+	1.00	1.00	1.00
	Highest education level			
	No education	1.00	1.00	1.00
	Primary	0.63*	0.03	0.42-0.95
	Secondary	0.64*	0.04	0.41-0.98
	Higher	0.64	0.31	0.28-1.49
	Working currently			
	No	1.00	1.00	1.00
	Yes	1.15	0.21	0.93-1.42
	Type of residence			
	Urban	1.00	1.00	1.00
	Rural	1.00	0.99	0 .69- 1.46
Reproductive Health variables	**Birth intervals**			
	<49months	1.00	1.00	1.00
	49months+	0.49*	0.00	0.39-0.61
	Total number of children ever born			
	<3	1.00	1.00	1.00
	3+	3.29*	0.00	2.49-4.35

1=Reference Category,*p<0.05 denotes significance as the tests were run at a 95% significance level

Multivariate logistic regression was run in this study in order to identify the importance of all the variables in relation to infant mortality, in relation to one another. The significant variables will be analysed further. It is important to note that some variables which were significant in the bivariate analysis are insignificant in this model, these are: place of residence, region, religion and mothers current age. Others that were not significant in the bivariate analysis are of significance in this model these include: marital status and the total number of people in the household.

The odds of women who are married experiencing infant mortality are 0.60. This indicates that women who are married experience 40% less infant mortality than women who are not married. It is evident that women who live in households of 6 and more have less chance of experiencing infant mortality with the odds of 0.79 indicating a 21% decrease in infant mortality.

In the multivariate analysis the age at first birth variable indicates that women who have children at 18 years and younger have increased odds of infant mortality in comparison to women who are above the age of 18 (1.31). This indicates that they have 31% more infant mortality in comparison to women who delay child bearing. The odds have decreased in comparison to the bivariate analysis.

The odds of infant mortality for education have decreased in this model. Women who have primary education have odds of 0.63 of experiencing infant mortality in comparison to women with no education, thus they have 37% less chance infant mortality than women who have no education. Women with secondary education have slightly decreased odds of 0.64, which implies that women with secondary education experience 36% less infant mortality in comparison to non-educated mothers in Zimbabwe. The odds of women with higher education in comparison to women who have no education are 0.64, which also indicates that with higher education there is 36% decreased odds of infant mortality in comparison to non-educated mothers but the odds of women with higher education are insignificant due to the insignificant p-value.

In addition, Table 6 illustrates the reproductive factors run in the multivariate model. The characteristic of women birth intervals indicates that women who have children after 49 months and more have decreased odds of infant mortality in comparison to women with short birth intervals (less than 49months) with the odds of 0.49. Thus women who have longer birth intervals have 51% less risk of infant mortality in Zimbabwe. Moreover the variable total number of children shows that women who have more than 3 children have significantly increased odds of 3.29 in comparison to women in Zimbabwe who have less than 3 children.

The stepwise logistic regression model was run in order see if there are comparable differences between the odds of the significant variables in the multivariate analysis where all the variables where run simultaneously, and the odds produced when only the significant variables are run in the model. This model thus tests for confounding by running all the significant variables against the dependent variable simultaneously. This method allows for the confirmation of which variables impact infant mortality in Zimbabawe, when run with other identified significant variables, and to what extent they impact infant mortality.

Table 7: Odds Ratios, p-values and confidence intervals from the stepwise model: including significant variables from the multivariate model, in relation to the risk of infant mortality of Zimbabwean women 2005-2006

Dependent variable	**Infant mortality**		
Independent variables	**OR**	**P- value**	**Confidence intervals**
Age at first birth			
<19	1.33*	0.00	1.09-1.61
19+	1.00	1.00	1.00
Birth intervals			
<48months	1.00	1.00	1.00
48months+	0.49*	0.00	0.40-0.61
Marital status			
Not Married	1.00	1.00	1.00
Married	0.61*	0.00	0.48-0.78
Total number of people in the household			
<6	1.00	1.00	1.00
6+	0.81*	0.04	0.67-0.99
Total number of children ever born			
<3	1.00	1.00	1.00
3+	3.36*	0.00	2.69-4.19

1=Reference Category, *p<0.05 denotes significance as the tests were run using 95% significance level

The backward elimination method used, whereby all the significant variables were included in the model and then removed if they became insignificant. The model removed the variable highest level of education, indicating it is not significant when run solely with the other significant variables.

This left five of the significant variables: mother's age at first birth, birth intervals, marital status, total number of people in the household and the total number of children ever born. The odds for mothers' age at first birth indicate a slight increase to 1.33 in this model in comparison to 1.31 in the multivariate model, thus women who have children during adolescents have 33% increased risk of infant mortality. The odds of the birth interval variable remains unchanged in this model with 51% decreased chances of infant mortality for women with longer birth intervals.

Contrary to the odds of age at first birth, the odds of marital status indicate a slight decrease in this model from 0.60 to 0.61, indicating 39% less risk of infant mortality for women who were married in comparison to those who are not married. Similarly, the odds of the total number of people in the household have slightly decreased from 21% in the multivariate model to 19% less chance of infant mortality in this model. These indicate women who have more than 6 people in the household have less chance of infant mortality. This model also indicates that women with more than 3 children were three times more likely to experience infant mortality.

Chapter 5: Discussion

This study was conducted with the main objective to examine the association between mother's age at first birth and infant mortality in Zimbabwe. This study found that 12% of the Zimbabwean women experienced infant mortality between the period of 2005 and 2006. Thus it can be said that 120 out of every 1000 women in Zimbabwe experienced infant mortality during this period.

Mothers' age at first birth is an important socio-economic characteristic, which impacts infant mortality, this can be attributed to the fact that a women's first birth is considered to be a high risk birth in comparison to her subsequent births (Mturi and Curtis, 1995 and Madise, 2003). Furthermore, women who are 18 years of age and less at their first birth are understood to experience negative child health outcomes as well as higher rates of infant mortality (Magadi et al, 2007). The ZDHS (2007) reported the adolescent fertility rate in Zimbabwe to be 99 per 1000 women between 2005 and 2006; this figure is substantially high and is a cause for concern.

In this study, mothers' age at first birth is examined in unadjusted and adjusted models in relation to other demographic, socio-economic and reproductive variables in order to determine its impact on infant mortality. This study used women who are above 18 years as the reference group, since older women are said to have the best infant survival rates as they experience less infant mortality (Canning et al, 2010).

In the unadjusted model the study found that women who have children during adolescence have increased odds of 1.59 of infant mortality. This then indicates that women who have children at a young age have significantly increased chances of infant mortality (59%) in comparison to the women who had their first birth at older ages.

The findings of this study are supported by a wide range of literature including a study by Kembo and Van Ginneken (2009) which looked at mother's age as one of the influential factors in infant mortality in Zimbabwe. These findings of increased mortality for young mothers can be attributed to the fact that in Zimbabwe, young mothers are often asked to leave school or fail to finish school. (Boohene et al, 2001). Low levels of education are related to restrained economic resources and with low levels of employment young mothers are usually unable to afford health care for themselves and their infants thus suffer increased mortality (Ehlers, 2010).

The findings of this study indicate that 44% of women in Zimbabwe experience their first childbearing during adolescence, which is a significantly high percentage. This is supported by the mean age of childbearing which this study found to be 19 years. These findings correspond with a studies by Boohene and others (1991) and Mashamba and Robson (2001), which found that women in Zimbabwe are often sexually active in adolescence yet many of these adolescents fail not seek health care (Mashamba and Robson, 2001). This behaviour increases the risk of infant mortality among young mothers in Zimbabwe.

In the adjusted model it is evident that in comparison to mothers of older ages (above 18years); adolescent mothers undeniably suffer increased odds of infant mortality. The odds indicate the young mothers' experience 31% increased infant mortality. Although the odds decreased when run in relation to other factors as seen in this model, they are still significant and the increased odds of young mothers can still be considered as a cause for concern in the country.

Studies across Africa have also found this relationship with mothers' age and infant mortality to be true, with young mothers isolated as the group which experiences the highest rates of infant mortality (Rutstein, 2000). The study in Kenya by Omariba and others (2007) and a study by Olausson et al (1995) established that young mothers are biologically immaturity increases their risk of complications and infant mortality.

Additionally, the increased rate of infant mortality amongst Zimbabwean adolescents can be attributed to their emotional and psychological immaturity. Young mothers are not ready to take on parental responsibilities and often don't have decision-making powers within their households (Omariba et al, 2007 and Magadi et al, 2007). In addition, adolescents delay reacting to pregnancies and often lack knowledge of the correct health-seeking methods with regard to their pregnancies (Phipps and Blume, 2002).

Young mothers also have significantly different behavioural patterns in comparison to older mothers; they are inexperienced in child care giving and face issues with regards to the feeding of the child and hygiene (Phipps and Blume, 2002; Le Grand and Mbacke, 1993). Other high risk behaviours of adolescent mothers include smoking, alcohol and drug abuse during pregnancy (Oluasson et al, 1999). These behavioural patterns help explain the inverse relationship found to exist between adolescent childbearing and infant mortality in Zimbabwe.

The stepwise model further illustrates the significant impact that adolescent child bearing has on infant mortality in Zimbabwe. This model indicates that in relation to the other significant variables mothers' age at first birth has a slightly increased impact of 33% risk of infant mortality for adolescents. This figure is relatively high in comparison to other studies Omariba and others (2007) found an increased risk of 22% in Kenya while a similar study in Zimbabwe found a 15% increased risk of infant mortality for young mothers in comparison to older mothers (Kembo and Van Ginneken, 2009).Furthermore this model confirms the importance of the reproductive variables: birth spacing and parity as identified in the Mosley and Chen framework (1984) in Zimbabwe.

An interesting finding of this study is that education is an insignificant determinant of infant mortality in Zimbabwe. This finding contradicts studies such as Rutstein (2000), which found that increased maternal education decreased the risk of infant mortality. The study in Kenya (Omariba et al, 2007) found a similar relationship as Rutstein (2000) that mothers with secondary education have 20% less chance of infant mortality compared to mothers' who are not educated. Similarly, studies by Mturi and Curtis (1995) in Tanzania and Kembo and Van Ginneken (2009) in Zimbabwe also found a lack of difference in infant mortality in relation to education levels of the mother. The findings of this study could be due to the fact that many of the mothers were educated, thus education as a comparable variable became insignificant as only 4% of the mothers were uneducated.

This study also indicates findings of decreased mortality amongst women who live in large households. This finding was unexpected as studies have shown greater households act as a determinant of infant mortality as the resources are greatly spread out. The finding of this study is the opposite which could be attributed to the fact larger households means there could be older females who have greater experience in child healthcare.

Parity is the most important characteristic in the in this study as women who have more than 3 children experience 3 times more infant mortality than women who have less than 3 children. Parity is a major contributory factor to infant mortality due to the practice of high fertility amongst Zimbabwe women, due to the importance of child bearing amongst the Ndebele and Shona people of Zimbabwe (Grieser et al, 2003). Women are encouraged to have high fertility as it proves their fecundity which plays a major role in marriage negotiations (Grieser, 2003). This impacts the birth spacing between children and in turn has negative health outcomes on infants.

It can be concluded, therefore, that mother's age at first birth plays a significant role in infant mortality in Zimbabwe, with adolescent childbearing having a negative association with child survival. It is important to note that mothers' age at first birth is an important factor in infant mortality in Zimbabwe but cannot stand alone, that is its influence on infant mortality is seen in relation to other demographic, socio-economic and reproductive characteristics of the mother. These factors are marital status, the number of people in the household parity and birth intervals.

Chapter 6: Conclusions and Recommendations

6.1 Conclusions

This study examined the association between mother's age at first birth and infant mortality and has found that indeed there is an existing association between mother's age at first birth and infant mortality in Zimbabwe. Particularly, the findings indicate that childbearing at older ages (above 18 years) decreases the chance of infant mortality while bearing children during adolescence has significantly greater odds of 33% of infant mortality in Zimbabwe. Furthermore, this study found that there is high rate of adolescent childbearing in Zimbabwe with 44% of women aged 18years and less having experienced childbearing.

As a result of the nature of this study a sample of the population was used. Although this sample is a fragment of the population of the Zimbabwean women who have experienced childbearing in the last five years, it gives a representative picture of the population at the time of the ZDHS 2005-2006 survey. Thus the sample can be understood to be a true reflection of the Zimbabwean women who had given birth in the last five years prior to the survey.

This study is specifically interested in infant mortality from a social health perspective. Infant mortality is a key heath issue in developing countries and has been defined as a population health indicator. The issue of infant mortality is not isolated to Zimbabwe only; rather it has been recognised as a pressing issue in the continent of Africa. The study isolates Zimbabwe as a result of the high infant mortality rates of 60 deaths per 1000 live births (Zimbabwe Demographic and Health Survey, 2007) in comparison to its neighbouring Southern African countries. The focus on infant mortality plays an important role in reducing mortality and reaching the targets set by the UN Millennium Development Goals.

This study was conducted in relation to other demographic, socio-economic and reproductive factors, which have been understood to be associated with infant mortality in developing countries in past research. With regards to the demographic characteristics, the mother's marital status and the number of people in the household had significant influence on infant mortality. Women who are married suffered less infant mortality in comparison to unmarried women, while women who had large households had decreased odds of infant mortality.

The socio-economic variable of importance is the mothers' age at first birth, which proves to have a significant impact on infant mortality while others including the level of education; working status and type of residence are found to be less influential factors in Zimbabwe. The

reproductive factors of importance are birth intervals and parity order of the women. Women who have short intervals between births had significantly increased infant mortality in comparison to women who had intervals of 49 months and more. Parity order of women in Zimbabwe indicated the expected results; mothers with higher parity order suffered increased chances of infant mortality.

Regarding the research question: is there an association between mothers' age at first birth and infant mortality in Zimbabwe? This study confirmed that there is an association.

This study then concludes that mother's age at first birth is highly associated with infant mortality. Mothers who have their first birth in adolescence suffer higher infant mortality in comparison to women who delay childbearing to ages older than 18 years. Young mothers suffer fatal consequences. This is important on both social and health grounds, and this information needs to be made known to policy makers in Zimbabwe.

6.2 Recommendations

This study identified a significant relationship between maternal characteristics, particularly mothers' age at first birth and infant mortality. Further studies should be conducted to see whether this relationship is existent in relation to the under-five infant mortality in Zimbabwe. The under-five mortality rate is at an astounding 82 deaths per 1000 live births (Zimbabwe Demographic and Health Survey, 2007). This rate is high and is a cause for concern. Although infants have been said to be more vulnerable to their environments, the maternal characteristics of the mother still have a huge impact on the child and its development, which underlines the importance to study the association between mother's age at first birth and under-five mortality in Zimbabwe.

Other important factors isolated in this study include the mother's marital status, the total number of people in the household, birth intervals and parity order. These factors should be looked at in further detail to identify the true extent to which they have on infant mortality and whether they play a direct role or are intermediate factors in the relationship of infant mortality in Zimbabwe.

Zimbabwe is a culturally rich country; it would therefore be beneficial if a study was conducted on infant mortality from the cultural perspective of Zimbabwe. Some African countries have a culture of early marriage. This increases the exposure of young women to sexual activity, therefore increases adolescent childbearing and in turn affects infant mortality rates. Thus identifying significant cultural practices and norms within Zimbabwe stands to be beneficial in the study of infant mortality.

This study identifies adolescent childbearing as relatively high in Zimbabwe thus recommends that greater attention be paid to the reproductive factors of women pertaining to infant mortality. Studies focused on these factors could play a major role in informing policy makers and community initiatives about key issues regarding adolescent reproductive health and behaviours in Zimbabwe.

6.3 Limitations

6.3.1 Missing Data

The dependent variable in this study is 'infant mortality'. The study recorded the infant mortalities at the time of the ZDHS 2005-2006 (August 2005 and March 2006) thus the infants who passed away in 2005 prior to the study and infants who died later in 2006 after the survey was conducted are not accounted for, therefore there is the possibility that the infant mortality calculated may be lower than the infant mortality in reality. Furthermore, young mothers usually under-report early childbearing, which could impact the findings of this study.

6.3.2 Recall bias

The study sample is women who had children in the last five years prior to the study thus the respondents have to recall information of up to five years back, which leaves room for error in reporting the months when the child died.

6.3.3 Definitions of independent variables

The independent variables also pose some limitations. The employment status and marital status of the mother do not necessarily correlate with whether they were employed or married at the time of death of the infant. For the purpose of this study, if the mother is currently employed or currently married the assumption is that they were employed or married during pregnancy and death of the child.

6.3.4 Temporality

Logistic regression cannot determine the causal relationship between an independent variable and the outcome variable, but rather will allow for the describing of the variables associated to infant mortality. This limitation is linked to the cross-sectional study design.

6.3.5 Confounding

Finally, the existence of confounding factors in infant mortality, including the economic crisis, deteriorated health services and particularly the HIV/AIDS epidemic that Zimbabwe is facing could possibly affect the findings of this study. These have a major impact on infant mortality in the country.

Reference List

Adetunji, J.A. (1995). Infant mortality and mother's education in Ondo state, Nigeria: *Social Sciences Medicine* 40 (2): 253-263

Bender, R. Grouven, U. (1997). Ordinal Logistic Regression in Medical Research. *Journal of the Royal College of Physicians of London* 31(5): 546-551

Boohene, E., Tsodzai, J., Hardee-Cleaveland, K., Weir, S., Janowits, B. (1991) Fertility and Contraceptive use Among Young Adults in Harare, Zimbabwe: *Studies in Family Planning*, 22(4): 264-271

Boehmer, U., Willamson, J.B. (1996). The impact of women's status on infant mortality rate: A cross sectional study. *Social Indicators research* 37: 333-360

Blume, R.W. (2006). Youth in sub-Saharan Africa: *Journal of adolescent health*. 4: 230-238

Canning, D., Finlay, J.E., Ozaltin, E. (2010). Association of mother's age at first birth and infant mortality, child anthropometric failure, diarrheal and anaemia in low and middle income countries *BMJ journals* 1(2) 1-26

Clemens, M., Moss, T. (2005) Cost and Causes of the Zimbabwe's Crisis: *Centre of Global development* 1-4

Ehler, V.J., Litt et Phil, D. (2010). Adolescent mother's non utilization of contraceptives in Zimbabwe: *Africa journal of nursing and midwifery* 12(2): 14-26

Feresu, S.A, Harlow, S.D, Weleh, K, Gillespie, B.W. (2005). Incidence of still births and peri-natal mortality and their associated factors among women delivering at Harare maternity hospital, Zimbabwe: *A cross sectional retrospective analysis: BMC pregnancy and childbirth* 5(9): 1471-2393

Frey, R.S, Field, C. (2000). The determinants of infant mortality in the less developed countries: A cross-national test of five theories: *Social indicators research* 52:215-234

Frisbie, W. P. (2004): "Infant Mortality", *Handbook of population* [ed] by Dudley et al 251-282

Gortmaker, S.L, Wise, P.H. (1997). The first injustice: Socioeconomic disparities, health services technology and infant mortality .*Annual Review of Sociology* 23:147-170

Grieser, M. Gittelsohn, J. Shankar, A.V, Koppenhover, T. Legrand, T.K, Marindo, R. Mavhu, W.M, Hill, K.(2001) Reproductive Decision making and the HIV/AIDS Epidemic in Zimbabwe: *Journal of Southern African Studies* 27(2)225-243

Hamer, L. Lensink, R. White, H. (2003) Infant and Child mortality in developing countries; analysing the data for robust determinants: *Journal of development Studies* 40(1): 101-118

Huang, L. Sauve, R. Birkett, N. Fergusson, D. Van Walrauen, C. (2008). Mother's age at first birth and risk of stillbirths: A stystematic review. 178(2): 165-172

Jhamba, T. (1999) Regional Variations in Childhood Mortality in Zimbabwe*: Geographical association* 84(4): 319-330

Kalipeni, E. (1993). Determinants of Infant Mortality in Malawi: A spatial perspective: *Social Sciences and Medicine*. 37(2): 183-198

Kalipeni, E. (2000). Health and disease in Southern Africa: A comparative and vulnerability perspective. *Social Sciences and Medicine* 50: 965-983

Kembo, J., Van Ginneken, J.K. (2009). Determinants of infant and child mortality in Zimbabwe: results of multivariate hazard analysis. *Demographic Research* 21(13): 367-384

Le Grand, T.K, Mbacke, C.S.M. (1993). Teenage Pregnancy and Child Health in Urban Sahel: *Studies in Family Planning*. 24(3): 137-149

Macassa, G. Ghilagober, G. Bernhardt, E. Burstorm, B. (2003) Trends in infant and child mortality in Mozambique during and after a period of conflict. *Royal institute of Public Health* 117: 221–227

Madise, N.J, Banda, E.M, Benaya, K.W. (2003). Infant Mortality in Zimbabwe: Socioeconomic correlates: *Social Biology* 50 (1-2) 148-166

Magadi, M.A, Agwanda, A.O, Obare, F.O. (2007). A comparative analysis of the use of maternal health services between teenagers and older mothers in sub-Saharan Africa: Evidence from demographic health survey. *Social Science and Medicine* 64: 1311-1325

Mann, C.J. (2003). Observational research methods: Research design II: cohort, cross sectional and case control studies. *Emergency medicine journal* 20(1): 54-60

Mashamba, A. Robson, E. (2001).Youth reproductive Health Services in Bulawayo, Zimbabwe: *Health & Place* 8:273–283

Mosley, W.H, Chen, L.C. (1984). An analytical framework for the study of child survival in developing countries: *Population and Development Review* 10:25-45.

Mturi, A.J, Curtis, S.L. (1995). The determinants of Infant and child mortality in Tanzania: *Health policy planning* 10(4) 384-394

Olausson, P.O, Chattingius, S, Haglund, B.(1999) Teenage pregnancies and risk of late foetal death and infant mortality. British *Journal of Obstetrics and Gynaecology* 106: 116-121

Omariba, D.W.R, Beaujot R, Rajulton F. (2007). Determinants of infant and child mortality in Kenya: An analysis controlling for frailty effects. *Population Res Policy Rev* 26:299-321

Phipps, M.G, Blume, J.D, De Manner, S. M. (2002). Young Mother's age at first birth Associated with Increased Risk of Post neonatal Death. *Elsevier Science* 100 (3):481-486

Reidpath, D.D, Allotey, P.(2003). Infant mortality rate as an indicator of population health: Theory and methods Epidemiology Community health 57:344-348

Reynolds, H.W, Wong, E.L, Tucker. (2006). Adolescents use of Maternal and Child Health services in Developing Countries: *International Family Planning Perspectives* 32(1): 6-16

Rutstein, S.O. (2000). Factors associated with trends in infant and child mortality in developing countries during 1990's.*Bulletin of the world health organisation* 78:1256-1270

Sachs, J.D, Mc Arthur, J.W. (2005). The Millennium Project: a plan for meeting the Millennium Development Goals: *Lancet* 365: 347–53

Sanders, D. Davis, R. (1988) Economic adjustment and current trends in child survival the case of Zimbabwe: *Health policy and planning* 3(3)195-204

Schell, C.O, Reilly, M. Rosling, H. Perterson, S. Ekstrom, A.M. (2007) Socio-economic determinants of infant mortality: A worldwide study of 152 low-middle and high income countries. *Journal of public health* 35:228-297

Singh, S. (1998) Adolescent childbearing in developing countries: A global review. *Studies in Family planning* 29(2):117-136

Zerai, A. (1996). Preventive health strategies and infant survival in Zimbabwe: *African Population Studies* 11(1): 29-62.

Zimbabwe Central Statistical Office/ Macro International Inc. (2007). *Zimbabwe Demographic and Health Survey Country Report*. Harare: Central Statistical Office.

Zijenah, L.S, Moulton, L.H, Iliff, P. Nathoo, K, Munjoma, M.W, Kuda Mutasa, K, Malaba, L, Zvandasara, P, Ward, B.J ,Humphrey, J and ZVITAMBO Study Group (2004) Timing of mother to child transmission of HIV and infant mortality in the first six months of life in Harare, Zimbabwe 18(2) 273-280

Appendices:

Annexure A: Univariate table of sample size

births in last five years	Freq.	Percent	Cum.
1	3,007	73.81	73.81
2	969	23.78	97.59
3	91	2.23	99.83
4	6	0.15	99.98
5	1	0.02	100.00
Total	4,074	100.00	

Annexure B: Univariate table of infant mortality

infant_mortality	Freq.	Percent	Cum.
0	3,565	87.51	87.51
1	509	12.49	100.00
Total	4,074	100.00	

Annexure C: Univariate table of mother's age at first birth

```
. summ age_at_first_birth

    Variable |        Obs        Mean    Std. Dev.       Min        Max
-------------+---------------------------------------------------------
age_at_fir~h |       4074    19.34413      3.2395         9         40
```

Annexure D: Bivariate table of region and infant mortality

```
i.region          _Iregion_1-10       (naturally coded; _Iregion_9 omitted)

Logistic regression                               Number of obs   =       4074
                                                  LR chi2(9)      =      34.82
                                                  Prob > chi2     =     0.0001
Log likelihood = -1517.0668                       Pseudo R2       =     0.0113

------------------------------------------------------------------------------
infant_mor~y | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
  _Iregion_1 |   2.195282   .4414633     3.91   0.000     1.480188    3.255847
  _Iregion_2 |    1.65553   .3593068     2.32   0.020     1.081925    2.533244
  _Iregion_3 |   1.368571   .3347734     1.28   0.200     .8473262    2.210468
  _Iregion_4 |   2.032873   .4353743     3.31   0.001     1.336014    3.093211
  _Iregion_5 |   1.809031   .4088755     2.62   0.009     1.161605    2.817305
  _Iregion_6 |   1.298103   .3326705     1.02   0.309     .7855395    2.145113
  _Iregion_7 |   1.959825   .3920423     3.36   0.001     1.324169    2.900622
  _Iregion_8 |   1.760643   .3656323     2.72   0.006     1.171932    2.645088
 _Iregion_10 |    .747035   .2325798    -0.94   0.349      .405817    1.375155
------------------------------------------------------------------------------
```

Annexure E: Bivariate table of place of residence and infant mortality

```
i.place_of_re~e   _Iplace_of__1-2     (naturally coded; _Iplace_of__1 omitted)

Logistic regression                               Number of obs   =       4074
                                                  LR chi2(1)      =      25.23
                                                  Prob > chi2     =     0.0000
Log likelihood = -1521.8611                       Pseudo R2       =     0.0082

------------------------------------------------------------------------------
infant_mor~y | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_Iplace_of~2 |   1.771947   .2111188     4.80   0.000     1.402924    2.238037
------------------------------------------------------------------------------
```

Annexure F: Bivariate table of highest education level and infant mortality

```
i.highe~u_level   _Ihighest_e_0-3     (naturally coded; _Ihighest_e_0 omitted)

Logistic regression                               Number of obs   =       4074
                                                  LR chi2(3)      =      38.34
                                                  Prob > chi2     =     0.0000
Log likelihood = -1515.3053                       Pseudo R2       =     0.0125

------------------------------------------------------------------------------
infant_mor~y | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_Ihighest_~1 |   .5185134   .1020259    -3.34   0.001      .352592    .7625136
_Ihighest_~2 |   .3413466   .0665998    -5.51   0.000     .2328726    .5003486
_Ihighest_~3 |   .2818421   .1109759    -3.22   0.001     .1302697    .6097732
------------------------------------------------------------------------------
```

Annexure G: Bivariate table of mothers' current age and infant mortality

```
i.mothers_cur~e   _Imothers_c_1-2     (naturally coded; _Imothers_c_1 omitted)

Logistic regression                               Number of obs   =       4074
                                                  LR chi2(1)      =      46.32
                                                  Prob > chi2     =     0.0000
Log likelihood =  -1511.317                       Pseudo R2       =     0.0151

------------------------------------------------------------------------------
infant_mor~y | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_Imothers_~2 |   1.913562   .1841737     6.74   0.000     1.584592    2.310829
------------------------------------------------------------------------------
```

Annexure H: Bivariate table of religion and infant mortality

```
Logistic regression                               Number of obs   =       4074
                                                  LR chi2(1)      =       3.88
                                                  Prob > chi2     =     0.0488
Log likelihood = -1532.5345                       Pseudo R2       =     0.0013

------------------------------------------------------------------------------
infant_mor~y | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_Ireligion~3 |   1.290326   .1636068     2.01   0.044     1.006402    1.654351
------------------------------------------------------------------------------
```

Annexure I: Bivariate table of total number of people in the household and infant mortality

```
i.ppl_in_hous~d   _Ippl_in_ho_1-2     (naturally coded; _Ippl_in_ho_1 omitted)

Logistic regression                               Number of obs   =       4074
                                                  LR chi2(1)      =       0.54
                                                  Prob > chi2     =     0.4627
Log likelihood = -1534.2055                       Pseudo R2       =     0.0002

------------------------------------------------------------------------------
infant_mor~y | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_Ippl_in_h~2 |   1.072093   .1016147     0.73   0.463     .8903365    1.290954
------------------------------------------------------------------------------
```

Annexure J: Bivariate table of total number of children ever born and infant mortality

```
Logistic regression                                   Number of obs   =       4074
                                                      LR chi2(1)      =     191.92
                                                      Prob > chi2     =     0.0000
Log likelihood = -1438.5156                           Pseudo R2       =     0.0625

------------------------------------------------------------------------------
infant_mor~y | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_Itotal_no~2 |   3.971179   .4210197    13.01   0.000     3.226087    4.888357
------------------------------------------------------------------------------
```

Annexure K: Bivariate table of infant mothers' age at first birth and infant mortality

```
Logistic regression                                   Number of obs   =       4074
                                                      LR chi2(1)      =      23.59
                                                      Prob > chi2     =     0.0000
Log likelihood = -1522.6782                           Pseudo R2       =     0.0077

------------------------------------------------------------------------------
infant_mor~y | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_Iage_at_f~1 |   1.586235   .1510281     4.85   0.000     1.316204    1.911665
------------------------------------------------------------------------------
```

Annexure L: Bivariate table of marital status and infant mortality

```
i.marital_sta~2   _Imarital_s_0-1     (naturally coded; _Imarital_s_0 omitted)

Logistic regression                                   Number of obs   =       4074
                                                      LR chi2(1)      =       1.64
                                                      Prob > chi2     =     0.2004
Log likelihood = -1533.6553                           Pseudo R2       =     0.0005

------------------------------------------------------------------------------
infant_mor~y | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_Imarital_~1 |   .8575455   .1017671    -1.30   0.195     .6795836     1.08211
------------------------------------------------------------------------------
```

Annexure M: Bivariate table of birth intervals and infant mortality

```
i.birth_spaci~2   _Ibirth_spa_1-2     (naturally coded; _Ibirth_spa_1 omitted)

Logistic regression                                   Number of obs   =       4074
                                                      LR chi2(1)      =     109.83
                                                      Prob > chi2     =     0.0000
Log likelihood =  -1479.561                           Pseudo R2       =     0.0358

------------------------------------------------------------------------------
infant_mor~y | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_Ibirth_sp~2 |   .3648141   .0359092   -10.24   0.000      .300806    .4424424
------------------------------------------------------------------------------
```

Annexure N: Bivariate table of working status and infant mortality

```
i.working_cur~y   _Iworking_c_0-1     (naturally coded; _Iworking_c_0 omitted)

Logistic regression                               Number of obs   =       4072
                                                  LR chi2(1)      =       2.71
                                                  Prob > chi2     =     0.0996
Log likelihood = -1532.8521                       Pseudo R2       =     0.0009

------------------------------------------------------------------------------
infant_mor~y | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_Iworking_~1 |   1.173514   .1135527     1.65   0.098     .9707856    1.418577
------------------------------------------------------------------------------
```

Annexure O: Multivariate table of socio-economic, demographic and reproductive variable against infant mortality

```
Logistic regression                               Number of obs   =       4072
                                                  LR chi2(21)     =     285.49
                                                  Prob > chi2     =     0.0000
Log likelihood = -1391.4647                       Pseudo R2       =     0.0930

------------------------------------------------------------------------------
infant_mor~y | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_Iage_at_f~1 |    1.30888   .1409736     2.50   0.012     1.059792    1.616512
  _Iregion_1 |   1.458611   .3924444     1.40   0.161     .8608365    2.471486
  _Iregion_2 |   1.047421   .3026083     0.16   0.873     .5945691    1.845186
  _Iregion_3 |   1.018633   .3086352     0.06   0.951     .5624871    1.844688
  _Iregion_4 |   1.339672    .361556     1.08   0.279     .7893563    2.273653
  _Iregion_5 |   1.151512   .3398969     0.48   0.633     .6456773    2.053626
  _Iregion_6 |   .6916552   .2187005    -1.17   0.244     .3721695      1.2854
  _Iregion_7 |   1.241964   .3287105     0.82   0.413     .7393015    2.086395
  _Iregion_8 |   1.183278   .3282451     0.61   0.544     .6870062     2.03804
 _Iregion_10 |   .6822414   .2174048    -1.20   0.230     .3653356    1.274043
_Iplace_of~2 |   1.002618   .1929742     0.01   0.989     .6875504    1.462064
_Ihighest_~1 |   .6302049   .1326057    -2.19   0.028     .4172291    .9518947
_Ihighest_~2 |     .63564   .1392175    -2.07   0.039     .4137915    .9764294
_Ihighest_~3 |   .6486712   .2771038    -1.01   0.311     .2808035    1.498466
_Imothers_~2 |   .9661988   .1261228    -0.26   0.792     .7480917    1.247895
_Ireligion~3 |    1.07578   .1498439     0.52   0.600     .8187675    1.413468
_Ippl_in_h~2 |   .7986882   .0818183    -2.19   0.028     .6534005    .9762814
_Itotal_no~2 |   3.289594   .4701435     8.33   0.000     2.485936     4.35306
_Imarital_~1 |   .6038348   .0774106    -3.93   0.000     .4696729    .7763201
_Iworking_~1 |   1.146112   .1243203     1.26   0.209     .9266077    1.417614
_Ibirth_sp~2 |   .4923504   .0527565    -6.61   0.000     .3990856    .6074109
------------------------------------------------------------------------------
```

Annexure P: Stepwise table of significant variables against infant mortality

```
Logistic regression                               Number of obs   =       4074
                                                  LR chi2(5)      =     259.05
                                                  Prob > chi2     =     0.0000
Log likelihood = -1404.9493                       Pseudo R2       =     0.0844

------------------------------------------------------------------------------
infant_mor~y | Odds Ratio   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
_Ibirth_sp~2 |   .4949988   .0517525    -6.73   0.000     .4032835    .6075721
_Imarital_~1 |   .6118512   .0773966    -3.88   0.000      .477499    .7840058
_Ippl_in_h~2 |   .8125874   .0813739    -2.07   0.038     .6677736    .9888055
_Iage_at_f~1 |   1.326241   .1311726     2.85   0.004     1.092531    1.609945
_Itotal_no~2 |   3.364797   .3804081    10.73   0.000     2.696038    4.199443
------------------------------------------------------------------------------
```