The effect of socio-demographic, socio-economic and environmental factors on under-five mortality in South Africa: analysis of the 1998 South African Demographic Health Survey dataset

By

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DECLARATION

I, Ms. Basetsana Malefi Phetoane declare that this research report is my own original work and that it is based on the analysis of the 1998 South African Demographic and Health Survey data set (SADHS 1998) that I downloaded freely from the ORC MACRO website (http://www.macroint.com). The data set I downloaded has been used for performing data analysis as part of my studies for the degree of Master of Science in Population Studies at the Faculty of Humanities of the University of the Witwatersrand, Johannesburg, South Africa. To the best of my knowledge, this research report has not been submitted before in part or in full for any degree or examination at this or any other University.

Name and Surname: Basetsana Malefi Phetoane Authorized signature: 

Date:17/July/2012

Place: …Pretoria.....

This research report has been submitted for examination with my full approval.

Name and Surname: Basetsana Malefi Phetoane Authorized signature: 

Date:…17…../…July……../2012
Place:……Pretoria……

DEDICATION

I dedicate this work to my father Letlotlo Titus Phetoane, my younger brother Raphetwe Dichabe Phetoane, my son Mika Mehluli Phetoane, and my sister Tshepiso Dineo Rufus.

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ABSTRACT

This study is based on secondary data analysis of the 1998 South African Demographic and Health Survey (SADHS) data set. The aim of the study was to identify socio-demographic, socio-economic and environmental variables that affect the survival of South African children under the age of five years.

Descriptive analyses, frequency tables, Pearson's chi-square tests of association and binary logistic regression analysis were used for data analysis in this study. Mothers who lost an under-five child were predominantly Black and rural. Such mothers were characterized by rural residential areas, relatively large family sizes, relatively poorer socioeconomic status, relatively poorer access to basic health services, relatively more child deliveries at home, and low level of education.

The study showed that 269 of the 5, 066 children in the study died before celebrating their fifth birthday (5.31%). At the 5% level of significance, the survival of under-five children is significantly influenced by 2 of the 11 predictor variables found to be significantly associated in the univariate analysis and therefore included in the logistic regression analysis. These 2 predictor variables were: place of delivery of child [OR=0.97; P=0.000; CI = (0.96, 0.98)], and use of modern contraceptives by the mother [OR=0.73; P=0.002; CI = (0.59, 0.89)]. The study found that *not* using modern contraceptives gives a lower chance on death of a child under 5 as well as delivering at home, in the absence of a trained birth attendant. These findings are unexpected and contrary to what was found in the univariate analysis. No real explanation can be given for these findings and it would be interesting to see if the same results are found with more recent data. In order for the South African National Department of Health to fulfil its United Nations Millennium Development Goals, rural mothers and their under-five children must be provided with improved health as well as socioeconomic services.

Key words: Survival, under-five mortality, socio-demographic characteristics, logistic regression, odds ratio.

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CHAPTER 1: GENERAL INTRODUCTION TO STUDY

1.1.Introduction to study

This study aims to identify factors that affect mortality among South African children under the age of five years. The study is based on a secondary data analysis of the 1998 South African Demographic and Health Survey (SADHS) (South African National Department of Health, 1998).

The study attempts to explore the relationship between various socio-demographic, socio-economic and environmental variables and under-five mortality in South Africa based on SADHS, 1998. According to the annual report issued by the World Health Organization Statistical Information System (2009), there is a statistically significant association between under-five mortality in Sub-Saharan African countries and poor socio-economic status as well as lack of access to basic health services. Under-five mortality is the probability of dying before reaching the age of five years. The scope of the study will cover the following: The 1998 SADHS collected information on the socio-demographic, socio-economic and environmental factors of respondents/households such as the age, educational level, marital status, and occupation of respondents. All these factors have an effect on the level of under-five mortality. Under-five mortality is caused by several direct and indirect factors. The study will concentrate mainly on the indirect factors that affect under-five mortality among South African children. According to Nannan et al. (2012), the direct and indirect causes of under-five mortality are listed in the South African ICD-10 international classification of diseases. According to the authors, indirect causes of under-five mortality are also known as underlying causes of under-five mortality, and are defined as the disease or injury that started the sequence of events leading directly to death, or the circumstances of the accident or violence that produced the fatal injury. In the case of a violent death, the form of external violence or accident is antecedent to the injury entered, although the two events may be almost simultaneous. The direct or immediate cause of under-five mortality is the final disease, injury or complication that directly caused the death of the under-five child. Examples of the most notable direct causes of under-five mortality in Sub-Saharan African countries including South Africa are diarrhoeal diseases, acute respiratory infectious diseases, malaria, hepatitis B, polio, measles and neonatal tetanus. Indirect causes of under-five mortality in most Sub-Saharan African countries are malnutrition, lack of access to clean water, lack of access to basic health services, poverty, poor infrastructure, hunger, low level of education of parents, and low socioeconomic status of parents.

Based on what has been extensively reported in the relevant literature, this study makes the assumption that there is a correlation between under-five mortality and household headship (United Nations Children's Fund, 2007). As married couples with children have become less common, they have been replaced most often by female headed, mother-only families, and by non-family households including people who live alone. The study will only focus on the mothers of the children. Empirical studies have also shown that household structure is an important determinant of child outcomes. Most of these studies have also focused on the effect of growing up in a single-parent or a female-headed household. Studies conducted by the United Nations Development Progamme (2009) in a

number of Sub-Saharan African countries as well as in Bangladesh and Southern India have shown that children living in extended households and meagre resources are nutritionally disadvantaged in comparison with children living in nuclear families. A report by the United Nations Programme on HIV and AIDS (UNAIDS, 2009) has found that South African children under the age of five years who are born into poor, rural households in which the parents have poor access to basic health and education services are quite vulnerable to premature death.

1.2 Background of study

According to the South African Millennium Development Goals Country Report issued by Statistics South Africa (2010), South Africa is one of those countries that are determined to meet the 2015 goals that are applicable to under-five children and their mothers. Disparities in child deaths are pronounced both between and within countries, and the survival rates for children of mothers with at least a secondary education are twice as high as those for children with less educated mothers. At the same time, children living in the wealthiest 20 per cent of households are twice as likely to survive as those in the poorest 20 per cent of households. In order to address these disparities, and to reach the most disadvantaged group, is the greatest challenge. This goal is supposed to be achieved in 2015 by South Africa. For this reason, the reduction of under-five mortality is one of the top priorities of the South African National Department of Health (2010). Because most children depend largely on their families to meet their basic human needs, programs aimed at reducing under-five mortality could be improved by the availability of better information on the home environment where children are at risk of unfavourable health outcomes. According to the Millennium Development Goals Report the under-five mortality of South Africa in the year 2011 is equal to 104 per thousand live births. South Africa is committed to reduce the current under-five mortality rate by two thirds by the year 2015.

1.3 Problem statement

Reducing mortality and especially under-five mortality in Sub-Saharan African countries is one of the eight Millennium Development Goals (MDGs) of the year 2015. However, a review of the relevant literature shows that most sub-Saharan African countries have, in recent years, seen reversals in under-five mortality trends, and that this failure is attributed to the HIV epidemic as well as other socio-environmental characteristics including poverty. According to McKerrow and Mulaudzi (2010), under-five mortality in South Africa has increased from 61 to 70.9 per thousand live births between 1998 and 2007. The country's under-five mortality rate is presently estimated to be 104 per 1000 live births (Statistics South Africa, 2010). As many as 75, 000 children die in South Africa every year before they turn five. Of these, about 22, 000 die within their first month. The main cause of death is HIV and AIDS. Other leading factors are pregnancy and childbirth complications, newborn and childhood illness and malnutrition (United Nations Children's Fund, 2011).

As a signatory country to the MDG treaty, the South African Government has committed itself to meet the MDG goals of 2015 by reducing the current under-five mortality rate of 104 per thousand live births by two-thirds by the year 2015 (World Health Organization, 2012). Although South Africa is doing its best to meet its MDG goals of 2015, it has faced criticism for falling behind in terms of making the necessary resources available to the National Department of Health and its provincial offices. According to these critiques, the country must achieve a yearly rate of 15 percent reduction to meet the goal by the year 2015. But under-five mortality rates have actually increased since 1990, making South Africa one of 12 countries in which under-five mortality rates have grown (Keyser, 2008).

1.4 Justification of study

Given the current concern over the increasing level of child mortality, especially among the black and coloured population groups, a better understanding of the factors affecting under-five mortality has become increasingly important. Hence, this study will focus on the impact of socio-demographic, socio-economic and environmental characteristics on under-five mortality in 1998 in South Africa. The key benefits of the study are the following:

- The study does not identify key factors responsible for under-five mortality, but rather key factors that are associated with under-five mortality based on a scientifically well designed and nationally representative database.
- The study indicates the general areas for policies and programmes by multiple sectors such as education, health and service delivery and water and sanitation.

1.5 Scope and limitations

The 1998 SADHS dataset is characterized by limitations such as low response rate and missing data (Phillips, 1999). Examples of missing data are the mother's failure to recall the birth weight of her child, and the exact date of her first pregnancy. These could have influenced the results. It is also right to note that these data were not conceived with the current research in mind hence the variables included might not be ideal for answering the objectives.

1.6 Objectives of study

1.6.1 General objective

The aim of this study is to establish the relationship between socio-demographic, socio-economic and environmental factors on under-five mortality in 1998 in South Africa.

1.6.2 Specific objectives

The specific objectives of study are the following:

1. To describe the socio-demographic, socio-economic and environmental characteristics of women included in the South African Demographic and Health Survey (SAHDS) 1998.

2. To analyse the relationship between the socio-demographic, socio-economic and environmental characteristics and under-five mortality in 1998 in South Africa.

3. To identify the most important factors (socio-demographic, socio-economic and environmental) that influenced under-five mortality in 1998 in South Africa.

1.7 Definition of concepts

Under-five mortality: This is the probability a child (life birth) dying between birth and the age of five.

Socio-demographic characteristics: characteristics like age, ethnicity, marital status, residential area, birth interval, desire for last child by mother, and contraceptive use by mother.

Socio-economic characteristics: characteristics like education, employment, ownership of assets (eg household has radio; household has TV; household has refrigerator; household has car).

Environmental characteristics: characteristics like drinking water, toilet, place of delivery child.

1.8 Organisation of study

The study is presented in seven chapters. Chapter one and two are introductory and literature review chapters, while chapter three is methodology. Chapter four deals with the background characteristics of the study population whilst chapter five deals with bivariate associations between the background characteristics and the survival status of children under the age of five. Chapter six presents the results of the binary logistic regression. Chapter seven presents the discussion of results including the major findings of the study covering limitations, recommendations and conclusion.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction to literature review

In this section, a review of the relevant literature will be given. The review will be consistent with the research questions the study aims to answer. As this study constitutes a postgraduate level research exercise, one of the key purposes of the review is to provide a succinct summary and critique of the key findings that have been published over the past several years about factors that affect under-five mortality among South African children (Atkins and Murphy, 1993). This literature review will also present a brief discussion of a theoretical framework that will be used for making a meaningful contribution to the body of science in this area of research.

2.1.1 Levels and trends in infant mortality in South Africa

There is an overwhelming consensus on the differentials in Infant Mortality Rate (IMR) among various population groups in South Africa. The 1998 SADHS estimated that in 1996 the IMR (per 1000 live births) for Africans was 47, 38 for coloured people, 19 for Indians, and 11 for white people. The estimates by Yach (1994) are very similar to this pattern with 51 for Africans, 38 for coloured people, 7 for white people and 8 for Asians (Heaton & Amoateng, 2007).

According to the 1998 SADHS, there are also striking differences in mortality rates by population group, with infant and under-five mortality rates for Africans that are two and half times that of coloured infants and four times higher than for white infants. In order to achieve higher levels of child health and reduce child mortality, it is clearly necessary that governments have better information on the home environments in which children are most at risk of adverse health outcomes (SADHS, 1998).

2.1.2 Levels and trends in under-five mortality in South Africa

Between 1993 and 1998, under-five mortality increased by about a third. Based on results obtained from the analysis of the South African Demographic and Health Survey of 1998 (South African National Department of Health, 1998), the observed under-five mortality rates (not corrected for omission of deaths) were 59 per thousand live births during the period 1993 to mid 1998. Using the under-five estimates from the 1998 South African Demographic and Health Survey as a bench mark, a reduction by two-thirds implies that South Africa's under-five mortality is expected to be about 20 per thousand live births or less by the year 2015 if South Africa is to meet the internationally set target. Due to lack of recent data from the Demographic and Health Survey, current levels of under-five mortality rates based on the 2001 census (Statistics South Africa, 2001) and 2007 Community survey (Statistics South Africa, 2007) indicate under-five mortality of 104 per thousand live births in 2007 and 97 per thousand live births in 2001.

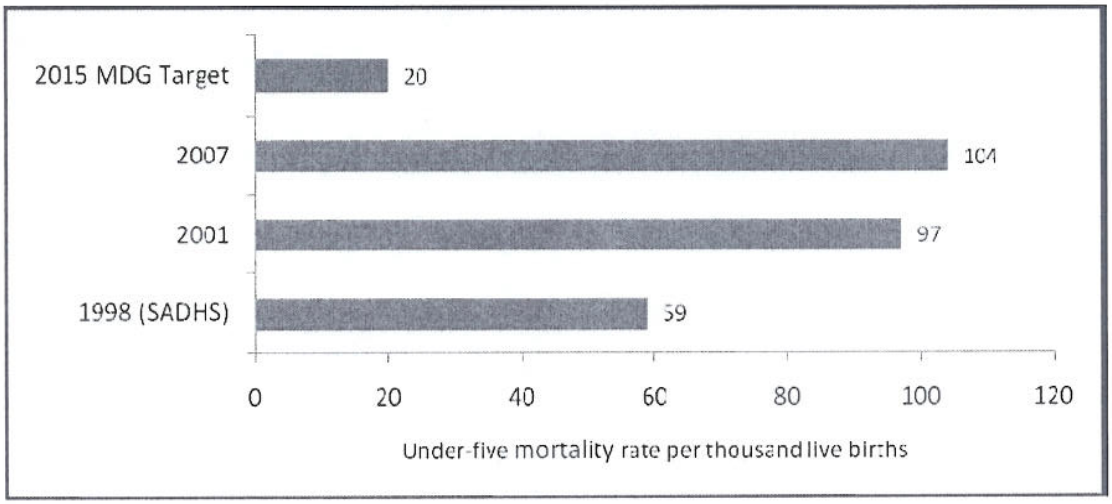

Figure 2.1.2.1: Under-five mortality rates for South Africa

Source: The 1998 South Africa Demographic and Health Survey, 2001 census, 2007 Community Survey, South Africa

The current level of under-five mortality in South Africa is far higher than the international set target for South Africa which is 20 per thousand live births in the Millennium Development Goals Country Report of 2010 (Statistics South Africa, 2010). According to Dorrington, Timaeus, et al (2004), under-five mortality rates for South African children in 1993 and 2003 were 59 and 58 per thousand live births respectively. Also mortality estimates produced by Statistics South Africa (2010) based on the Census conducted in 2001 and the Community Survey of 2007 both suggest no change in mortality figures for the period under review.

2.2 Socio-demographic, socio-economic and environmental factors

2.2.1 Socio-demographic factors

It is established that socio-demographic factors of the mother influence childhood mortality, but limited data on this is available for South Africa.

Hassan (1997) and Kickbusch (2011) have found that mortality and morbidity rates are higher in rural and economically disadvantaged areas than in urban and economically well-off areas. The method of analysis that was used in this study was the cross tabulation and the regression analysis based on the 1993 UN data. This study was mainly conducted to examine the covariates of infant and under-five mortality in 1993. According to the SADHS (1998), it is stated that mortality is consistently higher in non-urban than urban areas. This is also true of African rural residents compared to their urban counterparts.

According to the study on the Levels and trends of under-five mortality in South Africa, 1977 – 1998 (Nannan, et al, 2006), there was a positive and significant relationship

between the total number of pregnancies a woman has had, the total number of her children, the number of members in the household, and under-five mortality.

According to the 1998 SADHS the relationship between age of mother at birth and under-five mortality shows the U-shape with women younger than twenty (20) years old having slightly higher infant and under-five mortality rates than women between age 20 and 40 years of age. However children born to women over the age of forty experience an increased mortality rates (South African National Department of Health, 1998).

In the South African context, researchers such as Dorrington, Timaeus, Moultrie and Nannan (2004) and Worku (2011) have shown that there is a statistically significant association between ethnicity and under-five mortality in which Black and Coloured mothers and their children are more vulnerable to mortality and morbidity in comparison with White and Indian mothers. Based on the analysis of the 2003 SADHS data set, the study by Worku (2011) has found that under-five mortality is higher among black, rural, uneducated and poor South African mothers. The same pattern exists in other Sub-Saharan African countries. Mustafa and Odimegwu (2003) have found that poor, uneducated and rural mothers and their children are more vulnerable to mortality and morbidity based on the analysis of the Kenyan Demographic and Health Survey data set of 2003. The study by Kyei (2011) has found that children belonging to parents who are married and live together have relatively better survival chances in comparison with children who are brought up with only one parent or caretaker.

2.2.2 Socio-economic factors

Various researchers such as Folake (2012), United Nations Children's Fund (UNICEF, 2009), Okafor (2010), Hazel, et al (2010), and Jamieson et al (2011) have found statistically significant associations between low socio-economic status of parents and under-five mortality and morbidity in Sub-Saharan Africa, Australia and Asia. According to UNICEF (2009), there is a significant association between low socio-economic status of the mother and under-five mortality and infant mortality in all Sub-Saharan African countries including South Africa. The research work done by Folake (2012) has shown that poor socio-economic conditions and poverty are indirect causes of under-five mortality and morbidity in all parts of the world. This is because the survival of the newborn is significantly influenced by socio-economic factors that affect the mother's capacity to provide adequate care and health services to the child (Okafor, 2010). The key factors that have been identified as being influential for the survival of children in South Africa are: place of residence, marital status, occupation, level of income, level of education, and employment status. In general, findings reported about South African mothers and their under-five children are fairly similar to those reported about those from other Sub-Saharan African countries.

The study by Argeseanu (2003) has shown that the most significant predictors of child mortality in South Africa are characteristics of the mother, especially her birth history, marital status and education. The study has found that households with toilets, either flush toilets or pit latrines, have significantly lower odds of child deaths from any cause.

Based on the study conducted by Dorrington, Timaeus, Moultrie and Nannan (2004), under-five mortality fell from 73 per thousand live births in 1986 to 57 per thousand live births in 1992, and then ranged between 40 and 95 per thousand live births in 1996. According to Index MUNDI (2011), infant mortality rate for South Africa in 2011 was estimated at 43.2 deaths per thousand live births. For males, the figure was equal to 47.19 deaths per thousand live births. For females, the figure was equal to 39.14 deaths per thousand live births.

Based on a secondary data analysis of the 2003 Kenyan Demographic and Health Survey Data set, Mustafa and Odimegwu (2003) have shown that the infant mortality rate of Kenya was equal to 79.6 per thousand live births in 2003. The authors have found that improving the socioeconomic status of the mother has the potential for reducing infant and under-five mortality rates. According to the authors, the provision of health education to mothers on maternal health education and utilization of modern family planning methods has the potential for reducing infant and under-five mortality in Kenya. According to Kyei (2011), the under five mortality of South African children is affected significantly by socioeconomic factors such as the level of education of both parents, marital status of the mother as well as her occupation, the loss of older children previously, and the duration of breastfeeding.

According to Shapiro and Gebreselassie (2008), large family sizes in poor households are detrimental to the survival of children born to parents who live under poverty. According to the authors, this fact is true in virtually all Sub-Saharan African countries including South Africa. The authors argue that it is beneficial to educate and empower women in the childbearing age of 15 to 49 years in terms of utilizing modern family planning methods so that they choose to have children for whom they can provide adequately. This assessment is in agreement with what has been reported by the World Health Organization (2012) in which poor socio-economic conditions and large family sizes in poor households have been identified as indirect causes of under-five mortality and morbidity. It follows that improving the socio-economic status of children and their mothers in Sub-Saharan African countries contributes for the alleviation of mortality and morbidity. According to Shapiro and Gebreselassie (2008), fertility rates across 14 Sub-Saharan African countries have shown decrease as a result of improved socioeconomic conditions since the early 1980s. A decrease in fertility rates means there will be fewer children and more resources. The study by Worku (2011) has found that improving the socioeconomic conditions of the mother in South Africa minimizes under-five mortality among South African children. The study has shown that the survival of under-five children in South Africa is significantly influenced by the duration of breastfeeding, the marital status of the mother, and ownership of a flush toilet. According to Ezeh, Mberu, Emina (2009), fertility rates have decreased in countries such as Kenya, Uganda, Tanzania and Zimbabwe over the past several decades due to improved socioeconomic conditions that affect women in the childbearing age. The most notable socioeconomic conditions are level of education and employment status of women. According to Bogaarts (2008), in sub-Saharan African countries, the average pace of decline in fertility is lower around 2000 than in the mid-1990s, and more than half the countries in transition

in this region have stalled. The study by Bogaarts (2008) has shown that children belonging to educated mothers experience lower mortality in comparison with children belonging to uneducated mothers. This finding is consistent with findings reported by Van Raalte, Kunst, et al (2012) in which the significant influence of the mother's level of education on the survival of the child has been verified.

2.2.3 Environmental factors

At the end of the apartheid era 53% of South African children lived in poor households according to the World Bank's definition of poverty, the majority of whom were Black and living in rural areas (National Institute for Economic Policy, 1996). Black children in the 1998 SADHS continued to have poorer living conditions, resources, and survival prospects than others in their first five years of life (South African National Department of Health, 1998). The survey showed that under-five mortality rates more than doubled in cases where the source of drinking water at home was other than piped water. Also, where poor sanitation existed under-five mortality was higher, for example, where flush toilets are in use, under-five mortality was 7.7 per thousand live births in comparison with 34.9 per thousand live births where the proper sanitary practices were in use. This shows that better toilet facilities such as flush toilets are associated with lower infant mortality. This finding is in agreement with the key findings of the research work conducted by Maluleke and Worku (2009).

Provision of health care was also extremely unequal under apartheid era, distributed separately by population group and residential area. The system allocated resources unequally by race, with central cities in 'White areas' featuring sophisticated curative services rivalling those available in developed countries while women living in homeland areas were often forced to travel great distances to visit a clinic providing only basic services (Burgard & Treiman, 2005).

Health services were also not the only infrastructure that was unequally distributed under apartheid; environmental exposure at the household level, particularly the quality of household sanitation, also influences mortality risk. Clean running water and adequate plumbing reduce the likelihood of gastrointestinal diseases that are particularly dangerous for children living in fragile conditions, but toward the end of, and subsequent to the apartheid period, many blacks migrated as families to the cities, setting up squatter communities lacking plumbing and electricity. These communities may not represent an improvement in environmental conditions over the homeland areas and may be worse in some respects. As a result of poor sanitation infrastructures, limited provision of medical services, the concentration of disadvantage among families frequently missing members who migrated for work, and other factors, under-five mortality rates in rural areas of South Africa are very high. Between 1994 and 1996 more than 100, 000 homes, 400 clinics and 4750 health posts were newly built or under construction. Despite all of these positive developments, however, some have argued that because of a poorer economic climate since the end of apartheid and the persistence of the inequalities sustained under that regime, children may actually be worse off than before (Burgard & Treiman, 2005).

A large proportion of households in non-urban areas do not have access to potable water in their dwellings or on their stands. The three provinces that have high proportions of households that have to fetch water from a distance source are Limpopo (62 percent), the Eastern Cape (59 percent) and Kwazulu-Natal (54 percent) (South African National Department of Health, 1998). Since the end of apartheid in 1994, the South African government has made considerable effort to reduce these disparities, including signing the United Nations Convention on the Rights of the Child, establishing the National Programme of Action (NPA) to implement a "call for children" commitment, providing free medical care for pregnant women and children under seven years of age, and establishing a family and children's section within the Ministry of Welfare. A plan introduced by the African National Congress supports health for all South Africans, in the form of expanded primary care-based system funded by economic growth. Despite all these positive developments however some have argued that because of a poorer economic climate since the end of apartheid have required severe budget cuts in historically better served provinces to create parity with the less well-served areas. This has reduced the effectiveness of existing health care institutions (Benetar et al., 1997).

2.3 Theoretical framework of the study

The most comprehensive conceptual framework for this study is the one developed by Mosley and Chen (1984). They came up with 14 proximate determinants, and these determinants were grouped under five categories: maternal factors, environmental contamination, nutrient deficiency, injury and personal illness control. The basic assumption in this model is that the reduction in the chances of child survival depends on socio-economic factors which operate through biological and environmental forces. This framework also tries to classify the mechanisms through which social, behavioural and biological factors interact to bring out differentials in child mortality.

Mosley and Chen (1984) have proposed the above mentioned framework for research on child survival which also shows how the causal linkages can be traced back from death to health status, to a variety of intermediary factors, and finally to a layer of determinants which they place in one category called 'socio-economic'. It has also been stated that even though they have received a great deal of research attention, the socio-economic determinants remain a "black box" to this day (Mosley and Chen, 1984).

As Mosley and Chen pointed out, the social or cultural practices (including religion and population group as some of the explanatory variables) found in each ethnic group do not directly affect child survival status. Hence as part of the socio-economic factors and as discussed before, the following explanatory variables, for example, education of the mother, employment status of the mother, marital status, population group, income of the mother are also the indirect factors that affect child survival. The variables just mentioned fall under the socio-economic determinants as outlined by Mosley and Chen. These socio-economic determinants include individual-level variables such as level of education, birth condition, nutrition status; community level variables such as access to health care; as well as household-level variables such as personal income. As such, the

conceptual framework by Mosley and Chen (1984) has been used in this study in order to explore the relationship between under-five mortality and socioeconomic, demographic and health-related variables that affect under-five mortality. Figure 1, below, shows the theoretical framework developed by Mosley and Chen (1984) in the form of a diagram as presented by Fuentes, Pfütze and Seck (2006).

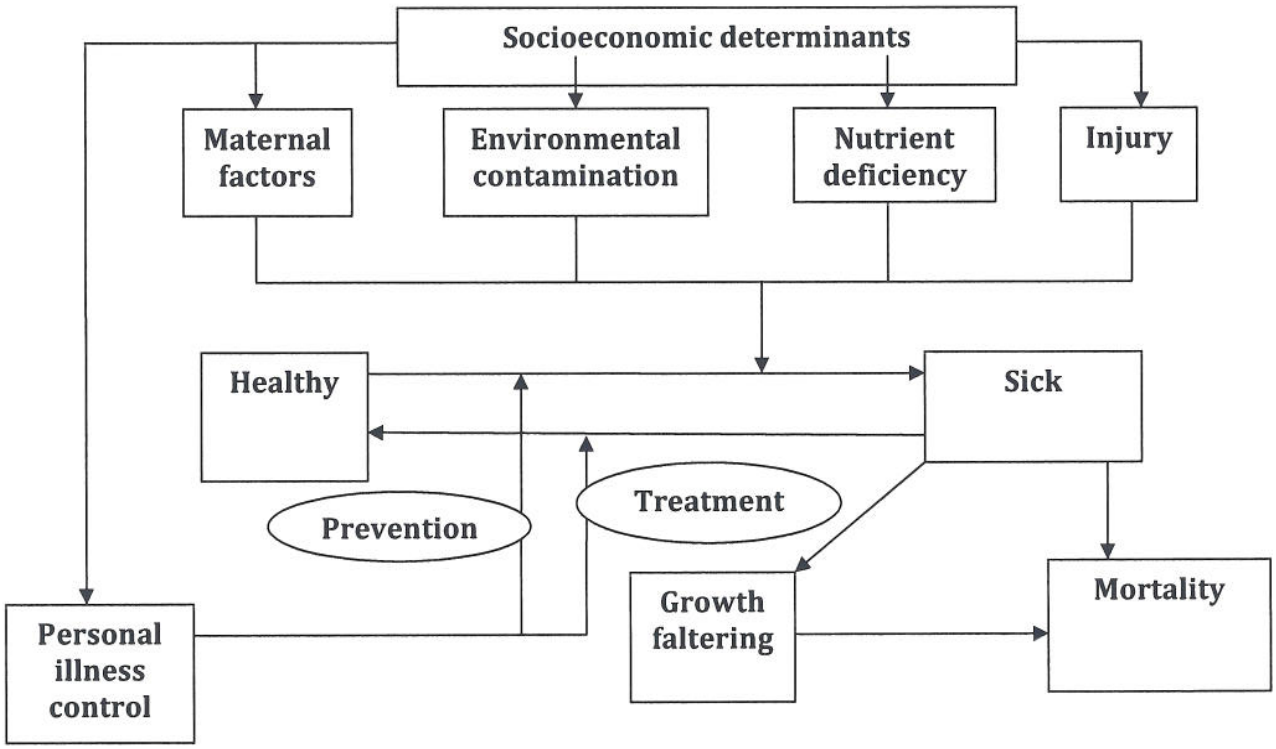

Figure 2.3.1: The Mosely and Chan (1984) theoretical framework

Source: Fuentes, Pfütze and Seck (2006)

2.4 Research hypotheses

The research will test each of the following general and specific hypotheses by using suitable methods of statistical data analysis:

General hypotheses

- The socio-demographic characteristics of the mother have an effect on under-five child mortality.

- The socio-economic characteristics of the mother have an effect on under-five child mortality.
- The environmental factors surrounding the mother have an effect on under-five child mort Under-five mortality is affected by

Specific hypotheses

- Under-five mortality is affected by age of the mother
- Under-five mortality is affected by ethnicity of the mother
- Under-five mortality is affected by current marital status of the mother
- Under-five mortality is affected by residential area of the mother
- Under-five mortality is affected by birth interval
- Under-five mortality is affected by desire for the last child born to the mother
- Under-five mortality is affected by the mother's use of contraceptives
- Under-five mortality is affected by level of education of the mother
- Under-five mortality is affected by the mother's employment status
- Under-five mortality is affected by the mother's wealth status
- Under-five mortality is affected by the source of drinking water at home
- Under-five mortality is affected by the place of delivery of child

The above research hypotheses are all consistent with the general and specific objectives of the study.

CHAPTER 3: METHODOLOGY

3.1 Introduction

This study is a secondary data analysis of the South African Demographic and Health Survey of the year 1998 (South African National Department of Health, 1998). The data set is a nationally representative cross-sectional survey designed to provide information on various demographic, maternal, child, and adult health indicators in South Africa. Data was collected by interviewing a representative random sample of 17, 500 individuals living in 12, 247 households in the nine provinces of South Africa. Permission to use the data was obtained from ORC MACRO, the agency which provided technical support for the survey through the MEASURES DHS Project. The entire raw dataset obtained from SADHS, 1998 is freely available for all interested researchers at the ORC MACRO website address: http://www.macroint.com. The dataset was downloaded from the ORC MACRO website, and analyzed by using techniques that are appropriate for the analysis of complex survey data sets.

3.2 Sampling technique

The 1998 SADHS employed a nationally-representative, two-stage sample that was selected from the 1996 census data. The first stage consisted of selecting census enumeration areas (EAs) with probability proportional to size based on the number of households residing in the EA according to the preliminary census results. Each of the nine provinces was stratified into urban and non-urban groups. A total of 972 primary sampling units were selected for the SADHS (690 in urban areas and 282 in non-urban areas). Fieldwork in three sample points was not implemented and the questionnaires for another three sample points were lost in transit, so the data file contains information for a total of 966 points. A total of 12, 540 households were selected throughout the country. Every second household was selected for the adult health survey, meaning that, in addition to interviewing all women age 15-49, interviewers also interviewed all adults age 15 and over. It was expected that the sample would yield interviews with approximately 12,000 women age 15-49 and 13,500 adults. In total, approximately 17,500 people were interviewed.

3.3 Definitions of variables of study

3.3.1 Outcome Variable

The study population for this analysis includes children whose ages are between zero and five years preceding the 1998 SADHS. These children were the outcomes of singleton deliveries that may or may not have survived the childhood period. With the exclusion of non-singleton live births, the study population comprised 5, 066 singleton live-births. The issue of multiple births is beyond the scope of this particular study.

The loss of at least one child under the age of five years was used as an outcome or dependent variable of study. In the 1998 SADHS, data was gathered from a total of 5,

066 children out of which 269 were dead before the age of five years. The remaining 4, 797 children were alive at the end of the survey. All in all, there were 11, 735 women in the childbearing age of 15 to 49 years included in this study. In this study, the outcome variable of study is an indicator of the loss of at least one under-five child. As such, it is a dichotomous variable (yes, no). For each of the 269 children who died before the age of five, their duration of survival was measured by using the variable "age of child at death in months". A check showed that this variable is derived from the information pertaining to the age of the deceased child in month(s). The original responses in the data for this variable fell between zero months to more than 120 months. For the purpose of this study, only deaths that occurred before the age of 5 were considered. The resulting variable is then renamed as "child loss" with the answer options 'no' when no child has died under the age of 5 and 'yes' when a child had died under the age of 5.

3.3.2 Explanatory Variables

For the purpose of this study the explanatory variables were clustered in three groups: socio-demographic characteristics, socio-economic characteristics and environmental characteristics.
(a) Socio-demographic characteristics: Current age of mother; Ethnicity of mother; Current marital status of mother; Residential area of mother; Birth interval; Desire for last child by mother; Contraceptive use by mother.

(b) Socio-economic characteristics: Highest level of education of mother; Mother currently working; Household has radio; Household has TV; Household has refrigerator; Household has car.
(c) Environmental characteristics: Source of drinking water at home; Type of toilet facility at home; Place of delivery of child.

3.4 Data analysis

As part of this study, the SAHDS 1998 data set was analysed at three levels: univariate, bivariate and multivariate level analyses. Univariate data analyses were used for providing a summary of the socio-demographic, socio-economic and environmental characteristics of mothers and children under the age of five years. Bivariate analysis was done in order to identify which characteristics were independently related to under-five under-five mortality based on Pearson's chi-square tests of associations (Dawson and Trapp, 2004). Finally, multivariate data analysis was conducted by using binary logistic regression analysis (Hosmer and Lemeshow, 2002). Odds ratios estimated from logistic regression analysis were used as an epidemiological measure of effect. A binary logistic regression model was used because the dependent variable of study was dichotomous (yes, no). A significance level of 5% was used for all analyses. Data analysis was conducted in the statistical package STATA version 12 (STATA Corporation, 2011).

CHAPTER 4: CHARACTERISTICS OF RESPONDENTS

This chapter describes the under-five mortality and the socio-demographic, socio-economic and environmental characteristics of the 5, 066 women included in the SAHDS 1998.

4.1 Under-five mortality

Out of the 5, 066 children in SADHS 1998, 269 children under the age of five years were dead. As such, the proportion of children who were dead before the age of five years was equal to 5.06%. The proportion of children who stayed alive until the age of five years was equal to 94.94%. As such, the under-five mortality in this study was roughly equal to 5%. Analysis of the complete 1998 SADHS data set showed that the under-five mortality rate was approximately equal to 59 per thousand live births. Infant mortality rate was approximately equal to 45 per thousand live births. Under-five mortality rate was approximately equal to 15 per thousand live births. Maternal mortality ratio was equal to 150 per 100, 000 births. The total fertility rate was equal to 2.9 children per woman.

4.2 Socio-demographic characteristics

Current age of mother:
The average age of mothers who took part in the survey was equal to 44.84 years. A 95% confidence interval for the true average age of mothers who took part in the study is given by 44.04 to 45.64 years. The following 4 age categories were created for performing cross-tab and multivariate analysis: 1) 15 to 19 years; 2) 20 to 29 years; 3) 30 to 39 years; 4) 40 to 49 years. Table 4.2.1 below provides a summary for the current age of mothers based on the 4 age categories created for data analysis:

Table 4.2.1: Categories for the current age of mothers

Age category	Frequency	Percentage	Cumulative percentage
15 to 19 years	352	6.95%	6.95%
20 to 29 years	2, 523	49.80%	56.75%
30 to 39 years	1, 785	35.23%	91.99%
40 to 49 years	406	8.01%	100.00%
Total	5, 066	100.00%	

Ethnicity of mother:
The proportion of respondents who are black/African is 83.12%. This is followed by coloureds (8.92%), and then by whites (5.01%), and by Asians or Indians (2.27%), and finally by others (0.68%). Figure 4.2.1 below gives a graphical depiction of the results.

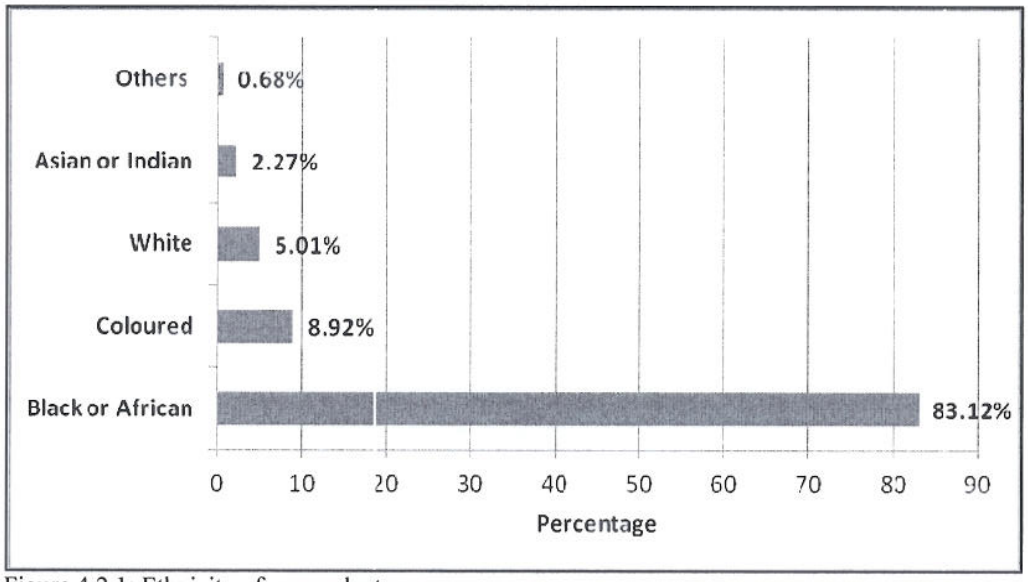

Figure 4.2.1: Ethnicity of respondents

Current marital status of mother:
The proportion of married mothers is 43.04% (Table 4.2). This is followed by unmarried mothers (36.09%). The lowest percentage is for that of divorced mothers (1.32%).

Table 4.2.2: Current marital status of respondents

Current marital status of respondent	Frequency	Percentage
Never married	1871	36.09
Married	2229	43.04
Living together	594	13.60
Widowed	98	1.74
Divorced	65	1.52
Not living together	209	4.01
Total	5066	100.00

Residential area of mother:
The proportion of rural respondents is 50.51%. The proportion of urban respondents is 49.49%.

Birth interval:
The majority of South African under-five children (80.82%) were born in birth intervals of 4 years or more.

Desire for last child by mother:
The proportion of respondents who wanted to have their last child then is 42.80%. The proportion of respondents who wanted no more children is 19.49%. Figure 4.2.2 below gives a graphical depiction of the results for the desire for last child by mother.

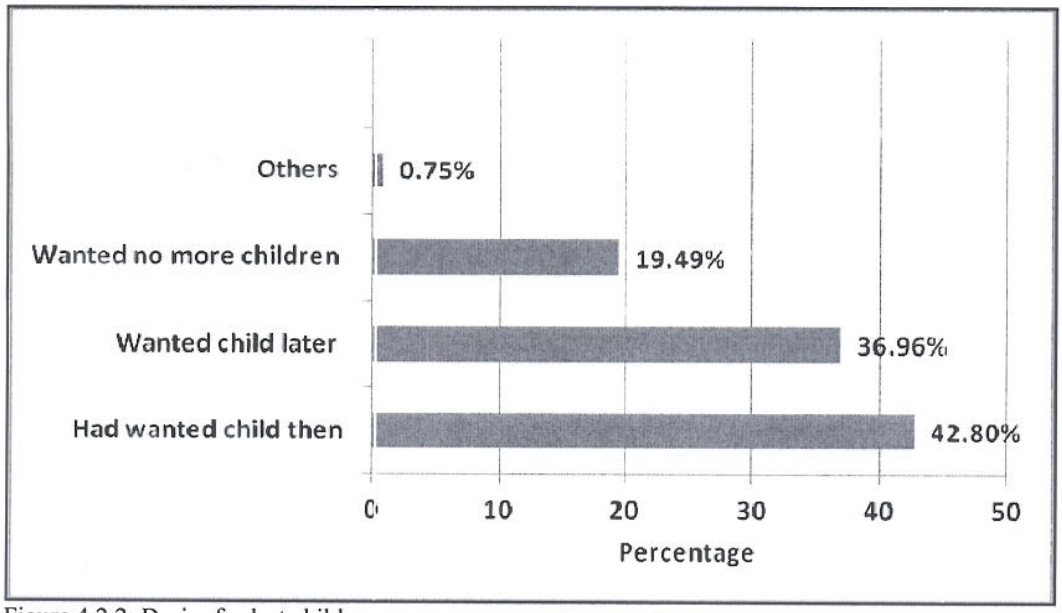

Figure 4.2.2: Desire for last child

Contraceptive use by mother:
Table 4.2.3 shows that the proportion of respondents who use at least one modern contraceptive method is 62.09%. The proportion of respondents who do not use modern contraceptives at the moment, but intend to do so in future is 24.74%. The proportion of respondents who do not intend to use modern contraceptives is 11.94%. The lowest proportion of respondents is those who currently use traditional methods (1.24%).

Table 4.2.3: Contraceptive use by respondents

Contraceptive use and intention to use	**Frequency**	**Percentage**
Using modern contraceptive currently	3103	62.09
Using traditional methods currently	51	1.24
Non-user at present, but intends to use contraceptives in future	1356	24.74
Does not intend to use contraceptives at all	556	11.94
Total	5066	100.00

4.3 Socio-economic characteristics

Highest level of education of mother:
The proportion of mothers with college level education is 6.72%. The proportion of mothers with secondary level education is 56.08%. The proportion of mothers with primary level education is 28.12%. The proportion of mothers with no education is 9.08%. Figure 4.3.1, below, gives a graphical depiction of the results.

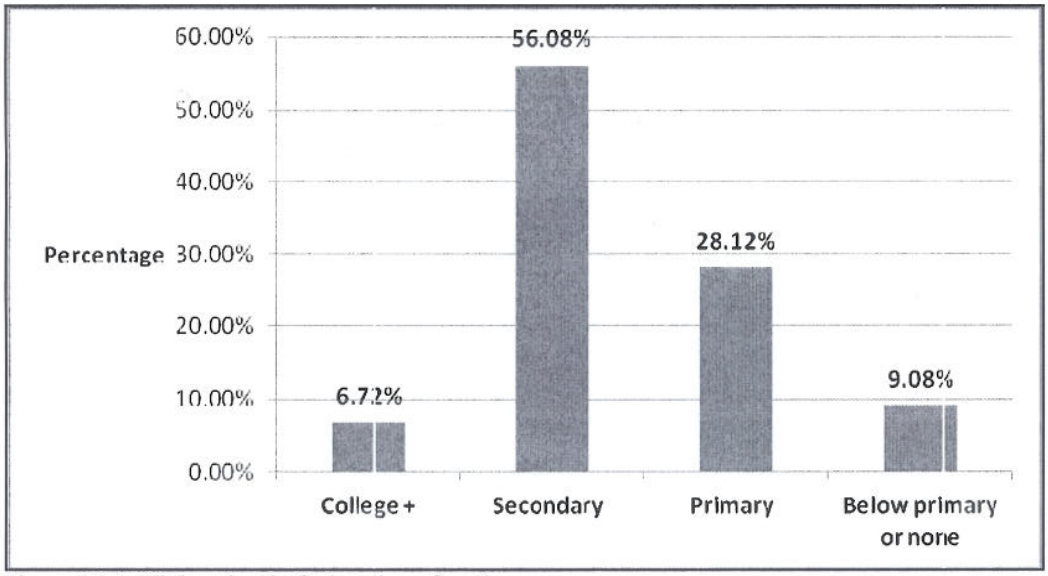

Figure 4.3.1: Highest level of education of mothers

Mother currently working:
The proportion of mothers who are employed is 26.31%. The proportion of mothers who are not employed is as high as 72.35%. This shows that almost three-quarters of all mothers depend on others for livelihood.

Household has radio:
The proportion of households with a radio is 76.65%. The proportion of households without a radio is 22.71%.

Household has television:
The proportion of households with a television set at home is 51.77%. The proportion of households without a television set at home is 47.53%.

Household has refrigerator:
The proportion of households with at least one refrigerator is 42.49%. The proportion of households without refrigerator is 56.73%.

Household has car:
The proportion of households with a car is 19.59%. The proportion of households without a car is 79.97%.

4.4 Environmental characteristics

Source of drinking water at home:
More than half of the people in the survey (52.80%) had access to piped water either at home (29.97%) or at the site where they lived (22.83%). The proportion of respondents who relied on dams, rivers, streams or spring water was less than a quarter (17.19%). The proportion of mothers who have access to public tap water is equal to 22.21%. The proportion of mothers who use bottled water at the household level is less than 0.01%.

Type of toilet facility at home:
The proportion of respondents who use pit latrine is 36.66%. This is followed by respondents who use their own flush toilets (36.33%). The proportion of respondents who use the bush or open field as toilet is 16.73%. The proportion of respondents who have no toilet and therefore use bucket latrines is 4.71%. The proportion of respondents who use other/unknown forms of toilets is 1.54%. Figure 4.4.1 below gives a graphical depiction of the results.

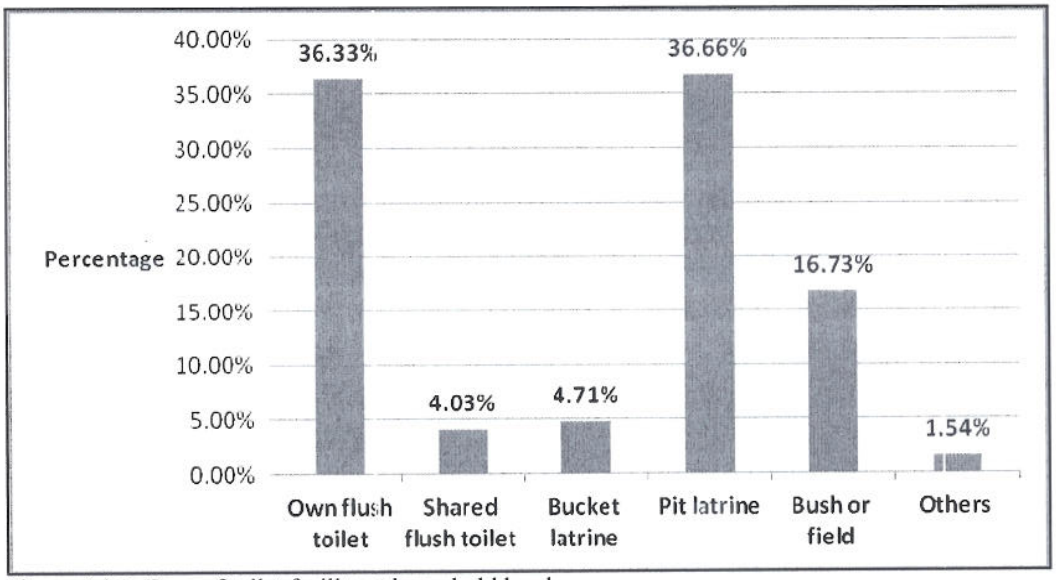

Figure 4.4.1: Type of toilet facility at household level

Place of delivery of child:
It can be seen from Table 4.4.1 below that 67.75% of children were delivered at government hospitals. This is followed by deliveries at home (14.29%), and private hospitals (8.38%) and specialized clinics (6.65%).

Table 4.4.1: Place of delivery of child

Place of delivery of child	**Frequency**	**Percentage**
At home	849	14.29
Government hospitals	3447	67.75
Specialized clinics	293	6.65
Private hospitals	347	8.38
Others	130	2.93
Total	5066	100.00

CHAPTER 5: RESULTS FROM TESTS OF ASSOCIATION

This chapter presents results of data analysis obtained from Pearson's chi-square tests of associations between the socio-demographic, socio-economic and environmental characteristics and the survival status of children under the age of five years. Each test of association is performed at the 5% level of significance. At the 5% level of significance, an association between two variables is said to be significant if the P-value falls below 0.05. Otherwise, the association is said to be insignificant. The sample size of study in the 1998 SADHS data set is fairly large. As such, all expected cell frequencies are well above 5, thereby showing that the P-values obtained from the tests are all valid.

5.1 Socio-demographic characteristics

Current age of mother:
It can be seen from Table 5 that at the 5% level of significance, there is no significant association between the current age of mother and the survival status of the child.

Table 5.1.1: Pearson's chi-square test of association between current age of mother and the survival status of child

Current age of mother	**Survival status of child**		
	Dead	Alive	**Total**
15 to 19	23 (6.5%)	329 (93.5%)	352
20 to 29	140 (5.5%)	2383 (94.5%)	2523
30 to 39	80 (4.5%)	1705 (95.5%)	1785
40 to 49	26 (6.4%)	380 (93.6%)	406
Total	269	4797	5066

P = 0.1107; Chi-square value = 8.3643

Ethnicity of mother:
Table 5.1.2 shows that at the 5% level of significance, there is no significant association between the ethnicity of the mother and the survival status of the child.

Table 5.1.2: Pearson's chi-square test of association between the ethnicity of the mother and the survival status of child

Ethnicity of mother	**Survival status of child**		**Total**
	Dead	Alive	
Black or African	237 (5.8%)	3882 (94.2%)	4119
Coloured	19 (3.2%)	570 (96.8%)	589
White	3 (1.4%)	209 (98.6%)	212
Asian or Indian	3 (2.7%)	107 (97.3%)	110
Others	7 (19.4%)	29 (80.6%)	36
Total	269	4797	5066

P = 0.0715; Chi-square value = 19.8505

Current marital status of mother:
At the 5% level of significance, there is a significant association between the current marital status of mother and the survival status of the child. Those that are married have the lowest percentage of dead children.

Table 5.1.3: Pearson's chi-square test of association between current marital status of mother and the survival status of child

Current marital status of respondent	**Survival status of child**		**Total**
	Dead	Alive	
Never married	107 (5.7%)	1764 (94.3%)	1871
Married	99 (4.4%)	2130 (95.6%)	2229
Living together	36 (6.1%)	558 (93.9%)	594
Widowed	5 (5.1%)	93 (94.9%)	98
Divorced	5 (7.7%)	60 (92.3%)	65
Not living together	17 (8.1%)	192 (91.9%)	209
Total	269	4797	5066

P = 0.0456; Chi-square value = 21.8209

Residential area of mother:

The P-value is equal to 0.0046 < 0.05. This shows that there is a significant association between the loss of an under-five child by the mother and the residential area of the mother at the 5% level of significance. Those whose residential area is urban have the lowest percentage of dead children.

Table 5.1.4: Pearson's chi-square test of association between the residential area of the mother and the survival status of child

Type of place of residence	**Survival status of child**		**Total**
	Dead	Alive	
Urban	89 (4.0%)	2158 (96.0%)	2247
Rural	180 (6.4%)	2639 (93.6%)	2819
Total	269	4797	5066

P = 0.0046; Chi-square value = 13.2982

Birth interval:

Information was gathered from 918 mothers as part of the survey on child spacing. Table 5.1.5 shows that at the 5% level of significance, there is no significant association between child spacing by 4 years or more and the survival status of the child.

Table 5.1.5: Pearson's chi-square test of association between birth intervals and the survival status of child

Birth interval of 4 years or more	**Survival status of child**		**Total**
	Dead	Alive	
No	18 (10.7%)	150 (89.3%)	168
Yes	75 (10.0%)	674 (90.0%)	749
Not known	0 (0%)	1 (100%)	1
Total	93	825	918

P = 0.7038; Chi-square value = 13.2982

Desire for last child by mother:
Table 5.1.6 shows that at the 5% level of significance, there is a highly significant association between desire for last child and the survival status of the child. Those that indicated 'other' have the highest percentage of dead children.

Table 5.1.6: Pearson's chi-square test of association between desire for last child by mother and the survival status of child

Desire for last child	**Survival status of child**		**Total**
	Dead	Alive	
Wanted then	112 (5.2%)	2061 (94.8%)	2173
Wanted later	78 (4.3%)	1755 (95.7%)	1833
Wanted no more child	59 (5.7%)	970 (94.3%)	1029
Others	20 (64.5%)	11 (35.5%)	31
Total	269	4797	5066

P = 0.0000; Chi-square value = 204.0533

Contraceptive use by mother:
Table 5.1.7 shows that at the 5% level of significance, there is a highly significant association between contraceptive use and the survival status of the child. Those that use traditional methods or modern contraceptives have the lowest percentage of dead children.

Table 5.1.7: Pearson's chi-square test of association between contraceptive use and the survival status of child

Contraceptive use	**Survival status of child**		**Total**
	Dead	Alive	
Using modern contraceptives currently	121 (3.9%)	2982 (96.1%)	3103
Using traditional methods currently	1 (2.0%)	50 (98.0%)	51
Non-user at present, but intends to use contraceptives in future	94 (6.9%)	1262 (93.1%)	1356
No intention to use contraceptives at all	53 (9.5%)	503 (90.5%)	556
Total	269	4797	5066

P = 0.0000; Chi-square value = 38.0411

5.2 Socio-economic characteristics

Highest level of education of mother:
The P-value is equal to 0.0248 < 0.05. This shows that there is a significant association between the loss of an under-five child by the mother and the highest level of education at the 5% level of significance. Those that have secondary, college and above education have the lowest percentage of dead children.

Table 5.2.1: Pearson's chi-square test of association between highest level of education of mother and the survival status of child

Highest educational level of mother	**Survival status of child**		**Total**
	Dead	Alive	
Below primary or none	30 (6.9%)	403 (93.1%)	433
Primary	104 (6.9%)	1400 (93.1%)	1504
Secondary	128 (4.5%)	2688 (95.5%)	2816
College or above	7 (2.2%)	306 (97.8%)	313
Total	269	4797	5066

P = 0.0248; Chi-square value = 19.7384

Mother currently working:

Table 5.2.2 shows that at the 5% level of significance, there is no significant association between respondent's current work and survival of the child.

Table 5.2.2: Pearson's chi-square test of association between mother's employment status and the survival status of child

Respondent currently working	**Survival status of child**		**Total**
	Dead	Alive	
No	207 (5.6%)	3509 (94.4%)	3716
Yes	61 (4.6%)	1272 (95.4%)	1333
Not known	1 (5.9%)	16 (94.1%)	17
Total	269	4797	5066

P = 0.81810; Chi-square value = 0.3913

Household has radio:

At the 5% level of significance, there is no significant association between radio ownership at the household level and the survival of the child.

Table 5.2.3: Pearson's chi-square test of association between radio ownership and the survival status of child

Radio ownership at home	**Survival status of child**		**Total**
	Dead	Alive	
No	66 (5.6%)	1110 (94.4%)	1176
Yes	201 (5.2%)	3665 (94.8%)	3866
Not known	2 (8.3%)	22 (91.7%)	24
Total	269	4797	5066

P = 0.9699; Chi-square value = 0.0649

Household has television:

At the 5% level of significance, there is a significant association between television ownership at the household level and the survival status of the child. Those that has television at home have the lowest percentage of dead children.

Table 5.2.4: Pearson's chi-square test of association between television ownership at home and the survival status of child

Television ownership at home	Survival status of child		Total
	Dead	Alive	
No	170 (6.7%)	2357 (93.3%)	2527
Yes	97 (3.9%)	2413 (96.1%)	2510
Not known	2 (6.9%)	27 (93.1%)	29
Total	269	4797	5066

P = 0.0000; Chi-square value = 24.7026

Household has refrigerator:

Table 5.2.5 shows that at the 5% level of significance, there is a significant association between ownership of a refrigerator at home and the survival status of the child. Those that own a refrigerator at home have the lowest percentage of dead children.

Table 5.2.5: Pearson's chi-square test of association between ownership of a refrigerator at home and the survival status of child

Ownership of refrigerator at home	Survival status of child		Total
	Dead	Alive	
No	200 (6.6%)	2809 (93.4%)	3009
Yes	67 (3.3%)	1958 (96.7%)	2025
Not known	2 (6.3%)	30 (93.7%)	32
Total	269	4797	5066

P = 0.0007; Chi-square value = 18.3150

Household has car:

At the 5% level of significance, there is a significant association between car ownership at home and the survival of the child. Those who have a car at home have the lowest percentage of dead children.

Table 5.2.6: Pearson's chi-square test of association between car ownership and the survival status of child

Car ownership at the household level	Survival status of child		Total
	Dead	Alive	
No	241 (5.8%)	3895 (94.2%)	4136
Yes	27 (3.0%)	887 (97.0%)	914
Not known	1 (6.2%)	15 (93.8%)	16
Total	269	4797	5066

P = 0.0242; Chi-square value = 10.7942

5.3 Environmental characteristics

Source of drinking water at home:

The P-value is equal to 0.0000 < 0.05. This shows that there is a significant association between the loss of a child and source of drinking water at the 5% level of significance Those who's source of drinking water is piped or tap water have the lowest percentage of dead children.

Table 5.3.1: Pearson's chi-square test of association between source of drinking water and the survival status of child

Source of drinking water	**Survival status of child**		**Total**
	Dead	Alive	
Indoor piped water	36 (2.6%)	1341 (97.4%)	1377
Outdoor piped water	66 (5.5%)	1124 (94.5%)	1190
Public tap water	47 (4.3%)	1058 (95.7%)	1105
Borehole	15 (9.6%)	141 (90.4%)	156
Dam or river	97 (9.5%)	925 (90.5%)	1022
Rain-water	1 (2.6%)	38 (97.4%)	39
Water carriers	3 (4.8%)	59 (95.2%)	62
Bottled water	0 (0%)	2 (100%)	2
Others	3 (3.6%)	80 (96.4%)	83
Not known	1 (3.3%)	29 (96.7%)	30
Total	269	4797	5066

P = 0.0000; Chi-square value = 65.6125

Type of toilet facility at home:

Table 5.3.2 shows that at the 5% level of significance, there is a significant association between the loss of a child and type of toilet facility at the household level. Those that have a flush toilet at home have the lowest percentage of dead children.

Table 5.3.2: Pearson's chi-square test of association between type of toilet facility and the survival status of child

Type of toilet facility	**Survival status of child**		**Total**
	Dead	Alive	
Own flush toilet	53 (3.2%)	1606 (96.8%)	1659
Shared flush toilet	7 (4.5%)	147 (95.5%)	154
Bucket latrine	18 (5.9%)	289 (94.1%)	307
Pit latrine	101 (5.2%)	1830 (93.8%)	1950
No toilet	86 (9.1%)	864 (90.9%)	950
Others	2 (5.7%)	33 (94.3%)	35
Not known	2 (6.7%)	28 (93.3%)	30
Total	269	4797	5066

P = 0.0000; Chi-square value = 43.6303

Place of delivery of child:

At the 5% level of significance, there is a highly significant association between place of delivery and survival of the child. Those whose place of delivery was in a government/private hospital or clinic or a specialised clinic have the lowest percentage of dead children.

Table 5.3.3: Pearson's chi-square test of association between place of delivery of child and the survival status of child

Place of delivery of child	Survival status of the child		Total
	Dead	Alive	
Respondent's home	58 (6.8%)	791 (93.2%)	849
Government hospital	149 (4.3%)	3298 (95.7%)	3447
Private hospital or clinic	7 (2.0%)	340 (98.0%)	347
Specialized clinics	11 (3.8%)	282 (96.2%)	293
Others	44 (33.8%)	86 (66.2%)	130
Total	269	4797	5066

P = 0.0000; Chi-square value =197.7810

Table 5.3.4, below, shows a summary of 15 two-by-two Pearson's chi-square tests of associations that were performed between the survival status of children in SADHS (1998) and 15 key variables that are known to affect the survival of children under the age of five years in South Africa. Individual frequency tables are presented for each of these 15 variables above. Odds ratios are used as an epidemiological measure of effect in cases where the strength of association between an exposure (factors that affect under-five mortality) and outcome variable (survival of child) is investigated. Odds ratios that are estimated in two-by-two tests of association are crude estimates in which the strength of association between two factors is estimated by disregarding other factors that could affect the survival of children under the age of five years. Therefore, these are less reliable than adjusted odds ratios that are estimated by using multivariate methods of data analysis such as logistic regression analysis. In this regard, the results shown below in Table 5.3.4 serve as a rough guideline only.
Furthermore, it must be noted that the crude odds ratios presented in Table 5.3.4 are not as reliable as crude odds ratios estimated from logistic regression analysis (Dawson and Trapp, 2004).

More reliable results are presented in Chapter 6 of this thesis. The analysis done there involves several variables that affect the survival of children, and constitutes multivariate analysis. So the results presented in Chapter 6 are more reliable than the results presented in Table 5.3.4 below.

The reference categories shown in Table 5.3.4 below are defined in accordance with a review of the literature. The reference category (r) is that category of the exposure variable that least affects the survival of the child. No estimates are obtained for the reference category. Odds ratios that are estimated for the non-reference categories are interpreted based on the reference categories defined for each variable.

Table 5.3.4: Summary of two-by-two associations with the survival status of children under the age of five years

Characteristic	P-value	Odds Ratio	95% C. I.
Age of mother			

30 years or more (r)		1.00	
Below 30 years	0.7147	0.94	(0.66, 1.33)
Ethnic group of mother			
Non-Black (r)		1.00	
Black	0.0033**	1.75	(1.20, 2.54)
Marital status			
Married (r)		1.00	
Otherwise	0.0145*	1.37	(1.06, 1.77)
Residential area of mother			
Urban (r)		1.00	
Rural	0.0001***	1.65	(1.28, 2.14)
Birth interval			
Less than 4 years (r)		1.00	
4 years or more	0.0000***	2.36	(1.79, 3.12)
Desire for last child by mother			
Yes (r)		1.00	
No	0.6683	1.05	(0.83, 1.35)
Use of modern contraceptives by mother			
Yes (r)		1.00	
No	0.0000***	2.01	(1.57, 2.57)
Highest level of education of mother			
Secondary or above (r)		1.00	
Primary or less	0.0001***	1.65	(1.29, 2.11)
Current employment status of mother			
Employed (r)		1.00	
Not employed	0.1699	1.23	(0.92, 1.64)
Ownership of radio			
Yes (r)		1.00	
No	0.5977	1.07	(0.82, 1.44)
Ownership of TV			
Yes (r)			
No	0.0000***	1.78	(1.38, 2.29)
Ownership of refrigerator			
Yes (r)			
No	0.0000***	2.05	(1.55, 2.71)
Ownership of car			
Yes (r)			
No	0.0005***	1.99	(1.34, 2.96)
Source of drinking water			
Tap water, bottled water, or water on carrier (r)			
Otherwise	0.0000***	2.12	(1.65, 2.74)

Place of delivery of child			
At a health facility (r)			
Otherwise	0.0000***	2.84	(2.19, 3.67)

Note: r denotes the reference category of variable; * denotes significance at the 5% level; ** denotes significance at the 1% level. *** denotes significance at the 0.1% level.

5.4 Summary of key findings from cross-tab analyses

In this chapter, we have seen that the survival of under-five children is significantly influenced by socioeconomic and demographic variables such as ethnicity of the mother, residential status of the mother, birth interval, desire for last child, use of modern contraceptives by the mother, highest level of education of mother, current employment status of the mother, ownership of television, ownership of refrigerator, ownership of car, source of drinking water, and the place of delivery of the child. These findings are consistent with what has been reported in the relevant literature.

CHAPTER 6: RESULTS FROM LOGISTIC REGRESSION ANALYSIS

6.1 Introduction

The crude odds ratios reported in Table 5.3.4 are not as reliable as odds ratios estimated from multivariate analysis (binary logistic regression analysis) in this section of the thesis. In the calculation of crude odds ratios, only the exposure and outcome variable are considered, thereby disregarding other variables that could be important predictors of under-five mortality. By contrast, in binary logistic regression analysis, several variables that are associated with the outcome variable of study are considered for analysis at the same time. This fact explains why odds ratios estimated from binary logistic regression analysis are more reliable than the crude odds ratios reported in Table 5.3.4 (Hosmer and Lemeshow, 2002).

The measure of effect in binary logistic regression analysis is the odds ratio (OR). The outcome variable Y is dichotomous, and has only 2 categories. That is,

$$Y = \begin{cases} 1 & if \ \ child \ is \ dead \\ 0 & otherwise \end{cases}$$

$X_1, X_2, ..., X_k$ are a combination of k discrete and continuous explanatory variables that affect the outcome variable Y.

An estimated regression coefficient is denoted by $\hat{\beta}$. In logistic regression analysis, a regression coefficient is estimated for each explanatory variable included in the model. In general, the binary logistic regression of a dichotomous outcome variable Y on a combination of k discrete and continuous independent variables $X_1, X_2, ..., X_k$ is defined by the following logit function:

$$\log it(p_i) = \ln\left(\frac{p_i}{1-p_i}\right) = \hat{\beta}_0 + \hat{\beta}_1 X_1 + ... + \hat{\beta}_k X_k$$

The odds ratio corresponding to the ith explanatory variable X_i is equal to $\exp(\hat{\beta}_i)$ where $\hat{\beta}_i$ denotes the estimated regression coefficient corresponding to X_i.

6.2 Reference categories of variables

In this study, reference categories of variables are defined as those categories that represent mothers who are least affected by the loss of an under-five child. In logistic regression analysis, it is essential to explicitly state the reference categories of variables

in order to interpret significant odds ratios. Reference categories enable us to quantify the plight of mothers who have lost a child in comparison with mothers who have not lost a child.

Binary logistic regression analysis was performed by using 12 variables of study (one dependent variable and 11 independent variables of study). The survival status of the child was used as a dependent (outcome) variable of study. Eleven independent or predictor variables of study that were highly associated with the survival status of children ($p<0.05$) were used as independent variables of study (See table 5.3.4). Odds ratios were used as an epidemiological measure of effect.

Table 6.2.1: Reference categories of variables used in logistic regression analysis

Variable of study	**Status of variable**
Survival status of child	Dependent variable
Alive (r)	
Dead	
Highest level of education of mother	Independent variable 1
Secondary or above (r)	
Primary or less	
Current marital status of mother	Independent variable 2
Married (r)	
Never married, divorced, widowed, (not) living together	
Source of drinking water at home	Independent variable 3
Piped, tap or bottled water (r)	
Borehole, dam, river, rain, etc	
Toilet facility at home	Independent variable 4
Own flush toilet or shared flush toilet (r)	
Bucket latrine, pit latrine, no toilet, etc	
Television at home	Independent variable 5
Yes (r)	
No	
Refrigerator at home	Independent variable 6
Yes (r)	
No	
Car at home	Independent variable 7
Yes (r)	
No	
Use of contraceptives by mother	Independent variable 8
Yes (r)	
No	
Desire for last child by husband	Independent variable 9
Wanted (r)	
Not wanted	
Place of delivery of child	Independent variable 10
Private, specialist, or public health facility (r)	
At home, others	
Residential area of mother	Independent variable 11
Urban (r)	
Rural	

6.3 Odds ratios estimated from logistic regression

In this study, binary logistic regression analysis was performed on 11 predictor variables that were significantly associated with the loss of an under-five child. Odds ratios estimated from binary logistic regression analysis are shown below in Table 6.2.1.

In this study, the outcome variable of study is the survival of the child (yes, no). The outcome variable of study is dichotomous because it can only have 2 values. The regression of such a dichotomous outcome variable of study on a set of predictor variables that affect the survival of the child can be performed by using binary logistic regression analysis. When this is done odds ratios are used as an epidemiological measure of effect.

At the 5% level of significance, in binary logistic regression analysis, significant predictor variables are characterized by estimated odds ratios that differ from 1 significantly; P-values that are smaller than 0.05, and 95% confidence intervals of true odds ratios that do not contain 1.

At the 5% level of significance, 2 of the 11 predictor variables used for binary logistic regression were significant. These 2 variables are: contraceptive use by the mother, and place of delivery of the child.

Table 6.3.1, below, provides a summary of estimates obtained from binary logistic regression analysis.

Table 6.3.1: Summary of estimates obtained from binary logistic regression analysis

Variable of study	Odds Ratio	P-value	95% C. I.
Current marital status of mother			
Married (r)	1.00		
Never married, divorced, widowed, or not living together	0.76	0.310	(0.45, 1.29)
Place residence of mother			
Urban (r)	1.00		
Rural	1.05	0.851	(0.62, 1.78)
Highest educational level			
Secondary or above (r)	1.00		
Primary or less	1.22	0.458	(0.83, 1.52)
Type of toilet facility			
Own flush toilet or shared flush toilet (r)	1.00		
Bucket latrine, pit latrine, no toilet, etc.	0.99	0.074	(0.97, 1.00)
Source of drinking water at home			
Piped, tap or bottled water (r)	1.00		
Borehole, dam, river, rain, etc	0.99	0.207	(0.98, 1.00)
Television at home			
Yes (r)	1.00		
No	1.30	0.223	(0.85, 2.00)
Refrigerator at home			
Yes (r)	1.00		
No	1.23	0.453	(0.72, 2.11)
Has car			
Yes (r)	1.00		
No	1.37	0.410	(0.65, 2.86)
Contraceptive use by mother			
Yes (r)	1.00		
No	0.73	0.002**	(0.59, 0.89)
Desire for last child by husband			
Yes (r)	1.00		
No	1.05	0.302	(0.96, 1.14)
Place of delivery of child			
Private or public health facility (r)	1.00		

At home, in the absence of a trained birth attendant	0.97	0.000***	(0.96, 0.98)

Key: Significance at * P<0.05; ** P<0.01; *** P<0.001.

6.4 Interpretation of significant odds ratios from binary logistic regression analysis

At the 5% level of significance, 2 of the 11 predictor variables used for binary logistic regression were significant. These 2 variables are: contraceptive use by the mother, and place of delivery of the child.

The odds ratio of the variable contraceptive use by the mother is 0.73. In binary logistic regression analysis, an odds ratio that is less than 1 indicates that exposure has a protective effect. In this case, contrary to what was found in the test of association, it means that *not* using modern contraceptives gives a lower chance on death of a child under 5.

The odds ratio of the variable place of delivery is 0.97. In binary logistic regression analysis, an odds ratio that is less than 1 indicates that exposure has a protective effect. In this case, contrary to what was found in the test of association, it means that delivering at home, in the absence of a trained birth attendant, gives a lower chance on death of a child under 5.

6.5 Key findings in Chapter 6

In this chapter, we have seen that the survival of under-five children is significantly influenced by contraceptive use by the mother, and place of delivery of the child. These findings are more reliable than the results obtained in Chapters 4 and 5.

CHAPTER 7: DISCUSSION OF RESULTS

7.1 Major findings of study

7.1.1. Under five-mortality

Based on results obtained from the analysis of the SADHS (1998) data set, 269 of the 5,066 children included in the study (5.3% or 53 per 1000) died before reaching the age of five years. This figure is not a true under-five mortality rate, as an under-five mortality rate is the number of children who die by the age of five, per thousand live births per year. However, we can still compare our rate with under five mortality rates to see whether it is (not) in the same line. According to the United Nations Children's Fund (2010), the under-five mortality of South Africa is 57 per thousand live births. The corresponding figures for most of the other countries in Sub-Saharan African countries are larger than 57. For example, the figure for Lesotho is 85 and the figure for Zimbabwe is 80. Studies conducted by the World Bank (2009) have shown that under-five mortality figures are relatively higher in countries where poverty and the prevalence of HIV are high. The purpose of this study is to compare 1998 figures with those obtained in 2010. The rationale for such a comparison is to assess the degree to which under-five mortality has changed since the 1998 Demographic and Health Survey was conducted. According to the United Nations Children's Fund (UNICEF, 2011), the under-five mortality rate for South Africa in the year 2011 was equal to 58 per thousand live births. Based on the analysis of the 1998 South African Demographic and Health Survey data set, a crude estimate for the South African under-five mortality rate back in 1998 was roughly equal to 57 per thousand live births. This shows that the under-five mortality rate in South Africa has remained more or less unchanged between the years 1998 and 2011.

7.1.2. Characteristics of respondents

The average age of mothers who took part in the survey was equal to 44.84 years. Furthermore, the study mainly included Black/African mothers (83%). According to Statistics South Africa (2010), this figure is slightly larger than the percentage of Black/African mothers in South Africa (about 80%). Blacks make up 79.5% of the South African population, while white people and coloured people each make up 9.0% and the Indian/Asian population 2.5%.

The proportion of married mothers is 43%, the proportion of mothers living together 14% and those not living together 4%. This shows that 39% of mothers had children, but did not have a formal relationship with their sexual partners. This figure is relatively high in comparison with other countries in Sub-Saharan African countries (UNDP, 2009).

The study has shown that the proportion of rural mothers (50.51%) is more or less the same as the proportion of urban (49.49%). This indicates that half of the population of

mothers in South Africa resides in urban areas. This figure is relatively higher than corresponding figures in other Sub-Saharan African countries (UNDP, 2009).

The study has shown that the majority of South African under-five children (81%) were born in birth intervals of 4 years or more. According to the Union for African Population Studies (2009), this figure shows that birth-spacing is fairly well practiced in South Africa in comparison with other Sub-Saharan African countries.

Only 62% of all women currently use modern contraceptives. According to the World Bank (2009), this is worrying, especially in light of the high number of illegal abortions performed in South Africa.

The study has shown that the percentage of mothers with no education is 9.08%. By Sub-Saharan African standards, this figure is fairly low, and shows that South African mothers are fairly literate. As such, they could listen to useful health-related messages over the radio. They could also benefit from health promotion and education programmes conducted by the South African Department of Health (UNICEF, 2011).

The percentage of mothers who are not employed is quite high (72%). The figure shows that almost three-quarters of women are not employed. Unemployed women depend directly on their sexual partners and relatives for their own livelihood, and for providing care to their children.

The majority of households had a radio (77%), television (52%), while only a minority had a refrigerator (42%) or car (20%). Ownership of radio at home enables members of the family to listen to important health-related messages and news about useful services provided to the community. The World Health Organization (2005) encourages governments in developing nations throughout the world to promote primary health care and disseminate health education messages to rural and urban communities by using the radio as a vital tool. It must be noted that simply listening to health-related messages does not necessarily result in behavioral change. It is important to acknowledge socioeconomic and structural barriers.

Access to television at home enables the family to follow up current news on basic services provided to the community. Ownership of television sets at home is a measure of social status in developing nations such as South Africa. The fact that almost half of the respondents in the study own television sets at home shows that the respondents in the study enjoy a fairly good access to current news and information. Car ownership is a well known indicator of socioeconomic status. Households with cars are better equipped to seek health services to their under-five children in comparison with those who rely on public transport. In general, ownership of valuable household assets is an indicator of a higher SES, and has a positive impact on food security and nutritional status. Likewise, low SES is an important indicator of lack of food security and poor nutritional status at the household level.

The study shows that more than half of the people in the survey (53%) had access to piped water either at home or at the site where they lived. According to Dovi (2007),

South African households have better access to clean and piped water in comparison with other Sub-Saharan African countries. According to the World Bank (2009), access to clean tap water is a key indicator of quality of life. Poor water and sanitation are important risk factors for diarrhoeal diseases from which children die.

About a third of the respondents own flush toilets (36%). According to Winkley, Cubbin and Aim (2006), ownership of flush toilets at home is a reliable indicator of social status. Dovi (2007) suggests that South African households have better access to flush toilets, and that ownership of flush toilet is an indicator of improved socioeconomic status. As such, it can be argued that South Africans enjoy a relatively better status in comparison with Africans living in other sub-Saharan African countries.

The study showed that only 17% of children were not delivered in a health facility (government/private hospital, specialized clinic). The South African National Department of Health (2008) is making a concerted effort to increase the proportion of children delivered at health facilities, or at least in the presence of trained birth attendants as a means of minimizing the risk of death in children under the age of five years.

7.1.3. Association of characteristics with mortality

Results obtained from Pearson's chi-square tests of associations showed that 11 variables were associated with the survival status of children. However, in the logistic regression analysis in which these variables were considered together, only 2 variables were still significantly associated.

It was found that *not* using modern contraceptives gives a lower chance on death of a child under 5 as well as delivering at home, in the absence of a trained birth attendant. These findings are unexpected and contrary to what was found in the univariate analysis. In this particular study, women who did not experience the loss of a child under the age of five years in the 1998 survey were characterized by failure to use modern contraceptives as well as the practice of delivering children at home in the absence of trained birth attendants. Although these findings do not necessarily apply to the general South African population, they do apply to the sample of women who took part in the South African Demographic and Health Survey of 1998. No real explanation can be given for these findings and it would be interesting to see if the same results are found with more recent data.

7.2 Limitations and strengths of study

7.2.1 Limitations of the study

The data set used for analysis is from the South African Demographic and Health Survey of 1998. As such, the data set is a bit old. However, at the time this research was approved by Wits University, the more recent data sets were not available.
Furthermore, an initial selection was made of various that were thought of importance, based on what was found in the literature. However, there may be other variables that might be influencing

under five mortality (both those included in the dataset and other ones) that have not been taken into account.

7.2.2 Strength of the study

National demographic and health survey data sets are quite valuable and informative. As such, the strength of this study is that it is based on a national demographic and health survey that was conducted in all parts of South Africa. The study assesses factors that are known to affect the survival of South African children under the age of five years. The study has identified key factors that are responsible for under-five mortality.

7.3 Conclusions

This study is based on a secondary data analysis of the South African Demographic and Health Survey data set of 1998. The aim of the study was to identify socioeconomic, demographic and health-related variables that affect the survival of South African children under the age of five years. The percentage of children who died before celebrating their fifth birthday was 5.31%. The study found that *not* using modern contraceptives gives a lower chance on death of a child under 5 as well as delivering at home, in the absence of a trained birth attendant. These findings are unexpected and contrary to what was found in the univariate analysis. No real explanation can be given for these findings and it would be interesting to see if the same results are found with more recent data. In order for the South African National Department of Health to fulfil its United Nations Millennium Development Goals, rural mothers and their under-five children must be provided with improved health as well as socioeconomic services.

7.4 Recommendations

It is difficult to give recommendations based on the results of the logistic regression analysis, as the results are unexpected. I would not be wise to promote *not* to use modern contraceptives as well as to promote *not* to deliver a child in either a health care facility or at least with a trained birth attendant. These results first need to be further looked at in the current, but especially other (newer) datasets before any recommendations can be given.

Although the study does not give clear indications for improving the survival chances of children under five, some general recommendations can be made based on the characteristics of the study population:

- Education should be improved so that all mothers at least have primary, but preferably secondary education.
- Community based initiatives should be used among the (rural) population in order to create job opportunities for mothers and empower them economically. The unemployment rate among rural mothers and the gap between the rich and the poor are major problems that must be addressed by the national government.

Young rural mothers leave their children and habitat to go to urban centres in search of jobs and livelihood. This is particularly true of single mothers.

- The availability of piped water, especially at home, should be improved.
- The bucket system of toilets should be discarded. It must be pointed out that although the government has made a commitment to eliminate the bucket system of toilets by 2014, this goal is unlikely to be met in 2014. The task must be pursued with enough vigour, adequate resources and the necessary political commitment.

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