FACTORS INFLUENCING CHILD MORTALITY IN SOMALIA

BY

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DECLARATION

This project is my original work and to the best of my knowledge, has not been presented for a degree award in any university.

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This project is submitted for the award of a Master of Science Degree in population studies with our approval as university supervisors:

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DEDICATION

I dedicate this work to my dear wife Wavinya, sons: Ken Mweu and Kevin Mumo and daughter Joy Mwende for their encouragement and for giving me time to pursue this degree. To my dear mother, Sarah - your words and extreme commitment give me the strength to achieve my goals. To my brothers David, Paul, Jeremiah, Joseph and only sister Dorcas, thank you for being there for me.

Above all, every perfect gift is God given - to Him alone be all the glory.

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ABSTRACT

This study focuses on determinants of child mortality in Somalia. It specifically examines the effect of household's environmental, socio-economic and bio-demographic characteristics on child mortality in Somalia. The study variables analyzed included households' wealth status, type and region of residence, mother's education level, mothers' age, source of drinking water, type of toilet facility, children ever born, current marital status of the mother and sex of the child.

The study was conceptualized using the Mosley and Chen framework on child mortality. The study used data drawn from the Somali 2006 Multiple Indicator Cluster Survey (MICS). The national survey was designed to provide estimates on a large number of indicators on the situation of children and women at the national level, for urban and rural areas, and for the three regions: Somaliland, Punt land and Central and southern Somalia.

Descriptive statistics and Cox regression analysis were the main methods of analysis used in this study. Cox proportional hazard regression results revealed that a household's socio-economic and environmental characteristics in addition to bio-demographic variables have significant impact on child mortality in Somalia. Lower risk of child death was experienced among children born in Somaliland as compared to those from the other regions, children born from rural households as compared to those bom from urban residences and among children born in wealthier families. In addition, overcrowding at the household was found to increase the risk of death among children. Furthermore, the risk of child death was higher among boys and among children born to mothers who were currently not in marriage unions.

Policies aimed at achieving reduced child mortality in Somalia should be directed at improving the household's socio-economic and environmental status.. In addition efforts to strengthen national reconciliation and comprehensive sustainable peace should be prioritized.

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CHAPTER ONE

INTRODUCTION AND PROBLEM STATEMENT

1.1 Introduction

Infant and Child mortality have been used as measures of children's well-being for many years (Hill et all, 1996). Sen (1998) in a study on mortality as an Indicator of Economic Success and Failure, stated that mortality and its converse indicator, longevity or life expectancy, are among the most important measures of well-being and development in poor countries.

High mortality among children remains a serious public health concern in many developing countries. Nearly 99% of the 10.9 million children under the age of five years who died in 2000 were from developing countries which amounted to at least 29000 deaths per day (UNICEF 2005). Approximately ten million infants and children under five years of age die each year, with large variations in under-five mortality rates, across regions and countries (Espo, 2002).

The Millennium Development Goal (MDG) number 4 calls for a reduction of child mortality by two thirds, between 1990 and 2015. The reduction in child mortality globally has been a development success story, as rates have been halved over the last few decades. However, the high number of children under five years of age dying each year in developing countries is shocking, particularly compared to the dramatic progress with reducing mortality rates in recent years in the rest of the world. Child mortality has received renewed attention as a part of the United Nation's Millennium Development Goals (Mutunga 2004).

Substantial reductions in child mortality occurred in low income and middle-income countries in the late 20th century, but more than 10 million children younger than 5 years still die every year. With the decline in child mortality globally it has become clear that the right life-saving interventions are proving effective in reducing the number of child deaths (Robert E Black, Saul S Morris, Jennifer Bryce, 2003).

A strategy to reduce child mortality rates needs to consider both the specific causes that threaten children's lives as well as the functioning of health systems as a whole. Challenges to accelerate progress include economic decline, conflict and inequality, persistent poverty in some parts of the world, the HIV and AIDS epidemic, and lack of progress in reducing the number of deaths of newborn babies.

The characteristics of armed conflicts — violence, poverty, food insecurity, destruction of health and other vital infrastructure, internal population displacements and the breakdown of family units — enhance conditions for mortality and morbidity with infants and children under five years being particularly vulnerable (World Bank 2005). In Luanda, Akoto and Tabutin (1989) found that child mortality has increased since independence (1975) with the war and the considerable deterioration in general living conditions until 1980. The mortality rate among children 0 to 2 years of age rose by nearly 20% in 5 years.

Nearly two decades after the collapse of the government, Somalia continues to be a country without a unified central government lacking basic health services and access to safe water for a great proportion of the population. Somalia under 5 mortality rates of 225 per 1000 is ranked among the highest in the world after Sierra Leone with 270 deaths per 1,000 births, Angola with 260 deaths, followed by Afghanistan with 257 deaths per 1000 live births among others (Robert E Black, Saul S Morris, Jennifer Bryce, 2003).

Several decades of research on child mortality have yielded many hypotheses and extensive empirical findings about the factors influencing child deaths. Many studies have found the circumstances of birth and child characteristics to be important for survival (Guo and Rodriguez, 1992; Curtis et al. 1993). Gender has also been found to be a significant factor, with boys doing better in settings where they are preferred (Das Gupta, 1990), and girls doing better otherwise.

Although enormous literature exists on child mortality, evidence on why child mortality rates remain high in many sub-Saharan African countries despite action plans and interventions made is still scanty (Mutunga, 2007). While other areas of the world have experienced declining rates of childhood mortality over the last years, Sub Saharan Africa still maintains relatively high rates. It has been noted that 18 of the 20 countries across the world with the highest childhood mortality rates were in sub-Saharan Africa (UN, 1995 c.f Omariba 2005).

1.2 Problem Statement

Although infant and child mortality rates have declined globally, the pace of progress has been uneven across regions and countries with the worst in sub-Saharan Africa where accelerated improvements are needed most urgently.

With an under-five mortality rate of 225 per 1000 live births ranked 7th among the highest in the world, Somalia is in a significantly worse situation than other developing countries in sub Saharan Africa including Ethiopia with under 5 mortality rates at 174 per 1000 live births and Kenya at 120 per 1000 live births (Robert E Black, Saul S Morris, Jennifer Bryce, 2003). Despite numerous interventions and action plans by the UN and other humanitarian organizations, the level of child mortality in Somalia is still high and the determinants influencing child deaths remain un-researched.

According to UNICEF (1999), causes of infant and child mortality are multi-factorial, especially in developing countries, where there are great variations between social, economic and demographical groups of people even inside one country. In the case of Somalia, due to lack of a centralized government and subsequent absence of national Demographic Health Surveys, few studies have been done in demographic phenomena of fertility, mortality and migration and hence the need to use the available MICs 2006 data to study the influence of the various socioeconomic, household's environmental and bio-demographic factors on child mortality.

1.3 Key Research Questions

1. What are the socio-economic determinants of child mortality in Somalia?
2. What are the household's environmental determinants of child mortality in Somalia?
3. What are the bio-demographic determinants of child mortality in Somalia?

1.4 Objectives of the study

The general objective of this study was to establish the determinants of child mortality in Somalia. The specific objectives of the study were;

- To establish the effects of socio-economic factors on child mortality in Somalia
- To examine the effects of environmental factors on child mortality in Somalia
- To determine the effects of bio-demographic factors on child mortality in Somalia

1.5 Justification of the Study

The identification of determinants of child mortality is a crucial step in planning and implementation of interventions. In Somalia there are no documented studies on determinants of child mortality which is essential before appropriate public health interventions can be developed and implemented. In addition, the information on mortality differentials will be of particular use to the agencies providing health services because the population subgroups at high risk of child mortality are identified.

This study aimed at exploring the factors influencing child mortality in Somalia which would further guide on the accelerated child survival strategies towards achievement of millennium development goal of reducing child mortality by two-thirds by 2015.

1.6 Scope and limitations

The scope of this study is limited to exploring the influence of identified socioeconomic, households' environmental and bio-demographic factors on child mortality as guided by literature. The study is focused on child mortality hence the probability of dying between exact ages one and five.

According to Jacoby and Wang, 2003, studies on DHS that uses same retrospective data collection techniques as MICs, show evidence of downward bias in reporting child deaths, that is, the longer the recall period, the more likely the possibility of the respondents to misreport the case. However, this study considered cases within the five years preceding the survey to reduce the recall period.

This study reviewed some of the data quality issues and observed potential errors due to misreporting of the age at death which could have distorted age pattern of mortality, selective omission of childhood death and age heaping that could have resulted to shifting of deaths or births from one age group to another. From the review, digit preference of 0 and 5 for the ages of the children and the mothers was observed and specially pronounced at ages 20, 25, 30, 35 and 40 however the preference was not limited to ages ending by 0 and 5 only but also other digits including 2, 4 and 8 therefore the impact on this digit preference for ages ending with 0 and 5 is minimal.

In addition, a review of the data for systematic omission of reporting of child deaths revealed that the cumulative percentage of the dead children was a smooth gradual increase over the age groups of the mothers consistent with the fact that children of older mothers had longer exposure to risk of death as compared to the children of young mothers. Furthermore a review of the sex ratio of male (MCEB) to female children ever born (FCEB) was found to be within the acceptable limit to raise any concerns about the quality of the data.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviewed the literature on determinants of child mortality. The chapter endeavored to identity the socio-economic, bio-demographic and household's environmental factors that determine child mortality. In addition the conceptual and the operational framework used in the study were also defined.

2.2 Determinants of child mortality

There is a relatively large literature that focuses on the determinants of child mortality (Wolpin, 1997) with numerous studies having established that socioeconomic, households environmental and bio-demographic factors as important determinants of child mortality.

According to Kembo, 2009 on a study about determinants of infant and child mortality in Zimbabwe, determinants of child mortality were different in relative importance from those of infant mortality. High parity (birth order of 6+), short preceding birth intervals (intervals less than or equal to 18 months) and multiple births predisposed children to a higher risk of mortality during infancy while socioeconomic variables do not have a distinct impact on infant mortality. Socio economic factors were found to be dominant predictors of child mortality. Living in rural areas increases the risks of child mortality by 26% relative to living in urban areas.

The relative importance of socioeconomic and demographic factors influencing child mortality varies with the level of socioeconomic development of the nation. Some studies have observed that in a traditional society, demographic factors affect infant mortality more than socioeconomic factors. In the early stages of development,

demographic factors are replaced by socioeconomic factors and in the later stages the effect of demographic factors becomes very small (Santosh Jatrana, 1999).
A standard Weibull survival models study by Omariba on Determinants of Infant and Child Mortality in Kenya showed that bio-demographic factors are more important in explaining infant mortality, while socioeconomic, socio-cultural and hygienic factors are more important in explaining child mortality.

Studies by Jada (1992), Okumbe (1996), Wanjohi (1996) and Omariba (1993) measured the effect of socio-economic, environmental and demographic covariates on child mortality with the findings showing that demographic, socio-economic and environmental factors (type of toilet facility, type of bathing facility, source of drinking water) to be significantly related to infant and child mortality.

A study by Espo (2002) to estimate levels and trends of mortality in Malawi established that the source of drinking water and sanitation facilities are strong predictors of infant and child mortality while Woldemicael (1988) examined the effect of some the environmental and socio-economic factors that determine childhood diarrhoea in Eritrea with study findings showing that the type of floor material, household economic status and place of residence are significant predictors of diarrhoea.

Timaeus and Lush (1995), in a comparative study of rural areas of Ghana, Egypt, Brazil and Thailand, found that children's health is affected by environmental conditions and the economic status of the household while using Egypt data, Hala (2002) assesses the impacts of water and sanitation on child mortality. Results show that access to municipal water decreases the risk and sanitation is found to have a more pronounced impact on mortality than water.

Socioeconomic factors - includes maternal education, type of residence, region of residence and wealth index. Several socio-economic factors have been found to be associated with infant and childhood mortality in the developing countries.

Millard, 1994 observes that socioeconomic status is important for child survival because it determines the amount of resources (such as food, good sanitation, and health care) that are available to infants and children). Evidence from DHS studies have shown that in nearly all sub-Saharan African countries infant mortality in rural areas is much higher than in urban areas. However, among poorer households in urban areas, child mortality can be as high as or higher than rural households (Brockerhoff, 1993; Madise and Diamond, 1995).

Advances in female education may represent a potent and cost effective means of reducing child mortality (Caldwell, 1979; preston, 1978). Studies have indicated that educated mothers are less likely to experience childhood deaths because they are thought to have better understanding and appreciation for health related matters. In addition, educated mothers have been found to be less submissive to norms and practices that adversely affect the health and welfare of their children (Gyimah, 2002). Higher levels of educational attainment are generally associated with lower mortality rates, since education exposes mothers to information about better nutrition, use of contraceptives to space births, and knowledge about childhood illnesses and treatment (Mutunga, 2007).

In a study on the link between parent's education and child mortality on the Tigrai region of Northern Ethiopia, Kiros and Hogan (2001) pointed out that although limited information exists on mechanisms by which parental education might improve child survival, social scientists have speculated that higher levels of education leads to increased income which in turn decreases malnutrition. Studies have also pointed out that educated mothers are more likely to implement simple health promoting practices such as increased cleanliness or using health services.The "pathways" by which maternal education enhances child survival are interwoven with decisions and actions that mothers take in health situations as their educational qualifications improve (Caldwell, J.C. and Caldwell, P., 1988)

Several researchers have associated the high rate of child mortality with poverty, Cutright, and Adams (1984), Hobcraft et al (1984), Dasgupta (1993) and Sen (1995). Childhood mortality statistics illustrate the tremendous gap between developed and less developed countries. In the poor countries, the rate of death up to and including 5 year old is between 20-30 percent, while in the rich countries it is below 3 percent, Mosley (1984). In developed countries, at least 97 percent of the children should reach the fifth year of life.

Household's income has significant effect on children survival prospects. Higher mortality rates are experienced in low income households as opposed to their affluent counterparts. Several researchers have associated the high rate of child mortality with poverty, Cutright, and Adams (1984), Hobcraft et al (1984), Dasgupta (1993) and Sen (1995). Casterline et al. (1989) scrutinizes the effects of income on infant and early childhood mortality at the household level in Egypt. They also incorporate socioeconomic and demographic variables in their logistic regression equation, where this type of model does not account for censored data. The main conclusion of Casterline et al. concerning income was household income does not affect survival through infancy but the effects are pronounced during early childhood.

Differentials by urban/rural residence have commonly been observed, with urban areas having more advantages and therefore better child survival prospects (Mutunga, 2007). Studies on urban-rural mortality differentials in Sub-Saharan Africa show that overall mortality, and infant and child mortality in particular, is generally lower in urban than in rural areas (Akoto and Tabutin, 1989). Various factors account for this, including the high concentration of salaried workers (who generally have higher incomes) in urban centers, better education in urban areas, the concentration of public infrastructure in urban areas that provides sanitation services, including water supply, household waste and excreta removal and disinfection, and hospital infrastructure, with health conditions that are more favorable in urban than in rural areas. When observed, excess mortality in urban

areas is often attributed to natural conditions in the physical environment, to seasonal and climatic conditions in particular, and the precariousness of living conditions in urban areas, caused mainly by the economic crisis.

Although the positive impact of urban residence on the mortality of children under five years of age continued in some countries, such as Burkina Faso, this advantage has disappeared entirely in others, such as Cameroon, Togo and Zimbabwe; in Tanzania, the situation has even been reversed in favor of rural areas. A study by Cantrelle (1980) in the middle valley of Senegal (1957) has shown that infant and child mortality rates were lower in rural than in urban areas. In the Central African Republic (1959-60), child mortality rates were the same in urban and rural areas.

In Tanzania (1998), contrary to expectations, urban residence is associated with a higher risk of infant mortality. The risk of enfant death among urban children was 50% higher than among rural children. This may be a reflection of either the deterioration living conditions in urban settings as compared to rural areas, or the rapid improvement in socioeconomic conditions in rural areas as compared to urban areas (Eliwo Akoto and Basile O. Tambashe, 1998).

Over the past ten years, in Somaliland , the degree of peace and stability obtained and the presence of viable administration have allowed a large number of UN agencies, international NGOs and local partners to work in a coordinated manner on both humanitarian and development programmes. Likewise, the region is moving towards political, economic and social recovery and reconstruction. The region of Puntland (Northeast) has also achieved a certain degree of economic recovery and relative stability, which have also provided an environment allowing the unhindered delivery of humanitarian relief. Despite the existence of a central government, most parts of Central South Somalia continue to experience sporadic armed conflict, widespread human rights abuses, endemic humanitarian needs, minimal access to social services, cycles of drought and flooding, dispute and limited economic recovery (UNDP MDG report for Somalia, 2007).

Maternal Factors; These determine certain risks of death for children, some of which are: age of the mother and sex of the child. As concerns the demographic variables, the patterns of mortality by maternal age is typically U-shaped. Children born to both relatively old and young women have higher mortality rates than others. As for the child's gender, it is widely believed that male mortality is higher due to biological disadvantages (Mutunga, 2007). 1. t fj f ra I"

The Mosley-Chen model situates reproductive patterns under the proximate category of maternal factors which include maternal age, parity, and duration of inter-birth interval components. It is important to bear in mind, however, that reproductive patterns as such should not be considered as the immediate mechanism and/or cause of death, in the sense that a specific disease or a combination of diseases are thought of and often recorded as such on a death certificate. Instead they are proximate determinants in the sense that they are associated directly with particular conditions that may lead to child morbidity, impaired intrauterine growth, poor postnatal growth, and subsequently to child death. It has been demonstrated that children are exposed to much higher levels of mortality when children are born to very young or to older mothers, and when children are weaned early in the postpartum period (Cantrelle and Leridon, 1971; Wolfers and Scrimshaw, 1975; Clark, 1981; Rutstein, 1983; Da Vanzo et al.,1984; Hobcraft et al„ 1985; Palloni and Millman, 1986; Hobcraft, 1987; Pebley and Stupp, 1987; Palloni et al., 1994; United Nations, 1994).

Environmental factors - On household's environmental characteristics, source of drinking water supply, type of toilet facility, type of cooking fuel and overcrowding have been found have significant influence on child mortality risk. According to the MDG report (2007) an estimated 1.6 billion people will need access to improved sanitation over the period 2005-2015 to meet the MDG target.

Environmental risk factors account for about one-fifth of the total burden of disease in low income countries according to recent estimates (World Bank, 2001). WHO

(2002) reports that among the 10 identified leading mortality risks in high-mortality developing countries, unsafe water, sanitation and hygiene ranked second, while indoor smoke from solid fuels ranked fourth. About 3% of these deaths (1.7 million) are attributable to environmental risk factors and child deaths account for about 90% of the total.

Wang (2003) used the Ethiopia 2000 DHS to examine the environmental determinants of child mortality. Running three hazard models to examine three age specific mortality rates: neonatal, infant and under five by access to basic environmental services. Results showed that there is strong statistical association between child mortality and poor environmental conditions. It has been argued that water supply and sanitation in Egypt have a considerable effect on child mortality. Although child mortality differentials with respect to water supply and sanitation in many developing countries suggests that access to piped water and toilet facility may improve survival chances of children, Ridder and Tunali (1999) could not find any evidence supporting this relation.

Overcrowding has been found to be an influencing factor of child mortality. Richard G & Dean T (1991), conducted a longitudinal study in Machakos Kenya, and the results were that household probability of having a child under five die increases proportionate to the number of other under five children that the mother has. If the number increases 1 through 2 so does the probability of death. The increase was more than proportionate, 60 to 85 percent when the number of children under five increases two to 3. The probability of a child under five dying increased with the number of children under five present in household.

Similarly, Ballard TJ &Neumann CG (1995) in a one year follow-up study of the association between household crowding and acute respiratory infections; found that children with more than 5 siblings living in the household were at increased risk of disease in Kenya. No association was observed on the study when crowding was measured by the number of children sharing a bed.

2.3 Summary of literature review

From the literature reviewed it is clear that child mortality is influenced by household's socio-economic, environmental characteristics and bio-demographic factors.

There is general consensus in the literature that a household's income has a significant effect on the survival prospects of children. Higher mortality rates have been found to exist in low income households as opposed to their affluent counterparts. In addition, living in an urban or rural area has been one of the key variables for differentiating child mortality (Akoto, 1985).

It has also been shown that the mother's level of education is strongly linked to child survival with higher levels of educational attainment generally being associated with lower mortality rates, since education exposes mothers to information about better nutrition, use of contraceptives to space births, and knowledge about childhood illnesses and treatment. Larger differences have been found to exist between the mortality of children of women who have attained secondary education and above and those with primary level of education or less.

On household's environmental characteristics, safe source of drinking water has negative significant effects on children mortality risk. The same holds true for type of toilet facility, which in most cases has been taken to be access to a flush toilet or a ventilated improved pit latrine.

Literature shows that demographic variables, the patterns of child mortality by maternal age are typically U-shaped. Children born to both relatively old and young women have higher mortality rates than others. As for the child's gender, it has been found that male mortality is higher due to biological disadvantages.

After a review of the various empirical literatures, it is evidenced that the following factors are associated with an increase / decrease in child mortality: education level of the mother, type of place of residence, household's wealth index, type of

sanitation facility and the source of drinking water, sex of the child and age of the mother.

Somalia is the poorest country in sub-Saharan Africa, and one of the poorest countries in the world. According to World Bank, Socio- Economic Survey, 2002; Somalia has not appeared in the Human Development global rankings over the past few years due to lack of data and the absence of a central government. The Maternal Mortality Ratio is very high at 1,044 per 100,000 live births. Primary school attendance is only 18 per cent for girls and 21 per cent for boys. A mere 29 per cent of the population is using improved drinking water sources.

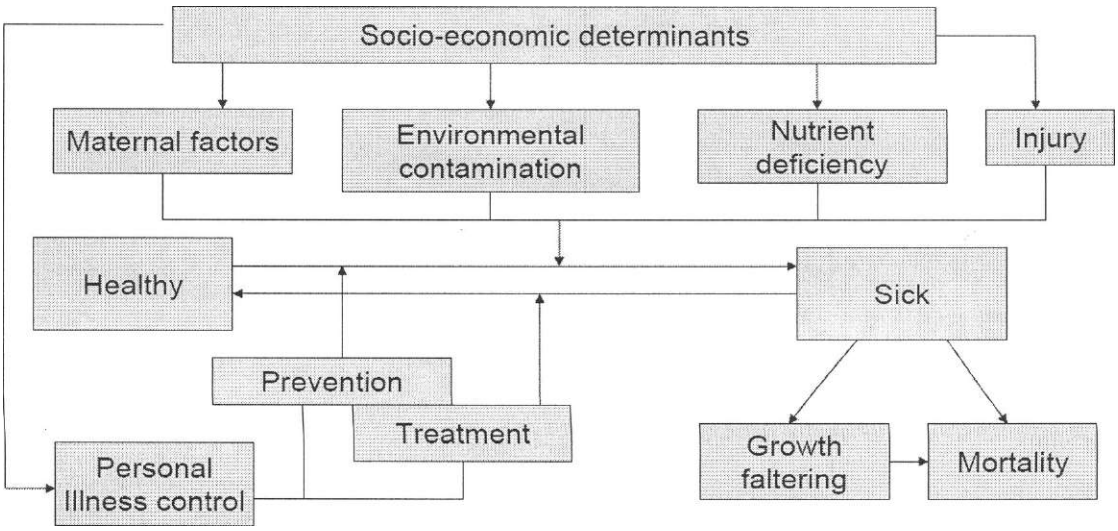
2.4 Conceptual Framework

A useful framework for exploring child mortality is that proposed by Mosley and Chen (1994). Background social, economic, cultural and public policy factors operate through a set of proximate determinants which and only which influence child mortality.

The study was undertaken under the Henry Mosley and Lincoln Chen analytic frame-work which integrates social science research and medical research. The conceptual core of the framework is the idea that all background (socio-economic) variables have to operate through a limited set of proximate determinants that directly influence the risk of disease and the outcome of disease processes.

Demographic research by Mosley and Chen (1984) and by Schultz (1984) made the distinction between variables considered to be exogenous or socio-economic (i.e. cultural, social, economic, community, and regional factors) and endogenous or biomedical factors (i.e. breastfeeding patterns, hygiene, sanitary measures, and nutrition). The effects of the exogenous variables are considered indirect because they operate through the endogenous biomedical factors. Likewise, the bio-medical factors are called intermediate variables or proximate determinants because they constitute the middle step between the exogenous variables and child mortality (Jain, 1988; Mosley and Chen, 1984; Schultz, 1984; UN, 1985).

Mosley & Chen's analytical framework was appropriate since background social, economic, cultural, and health system variables influence a parsimonious but exhaustive set of proximate determinants which in turn directly influence the single outcome variable.



Mosley-Chen: Proximate Determinants of Child Health / Child Survival

Extracted from: H. Mosley & L. Chen: Population and Development Review 1984

Mosley and Chen defined five categories of proximate determinants: maternal factors (age, parity, birth interval); environmental contamination (air, food/water/objects, insect vectors); nutrient deficiency (calories, protein, micronutrients); injury (accidental, intentional); and personal illness control (personal preventive measures; medical treatment). Determinants in the first four groups affect the rate at which children move from healthy to sick, whereas factors in the last group influence both this rate (through prevention) and the rate of recovery (through treatment). This list of proximate determinants is intended to be exhaustive, such that child health will change if — and only if — one or more of the determinants change.

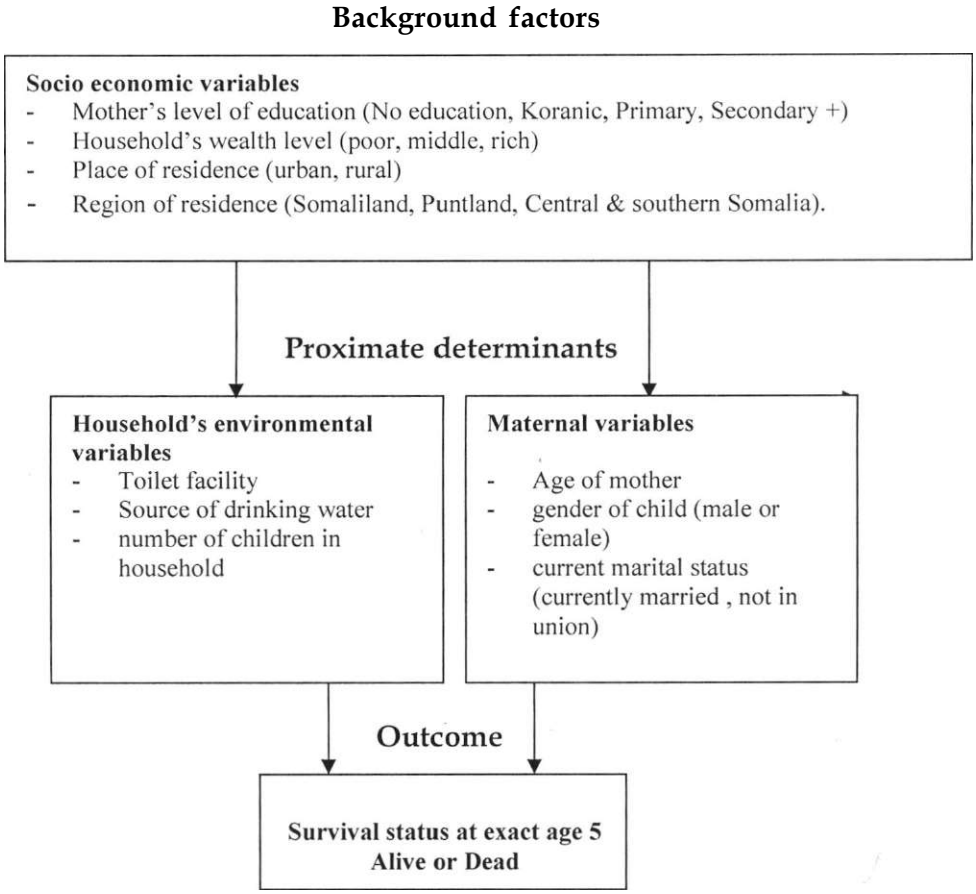
2.5 Conceptual hypotheses

The study tested the influence of environmental factors, bio-demographic factors and socio-economic risk factors on child mortality. This is because the socio-economic factors of type and region of place of residence, household's wealth status and education level of the mother influence child mortality through the proximate determinants and hence in order to investigate the relative importance, the study will control for socio economic risk factors.

The study tested the conceptual hypotheses of that:

1. Socio-economic factors are likely to influence child mortality in Somalia
2. Environmental factors are likely to influence child mortality in Somalia
3. Bio-demographic factors are likely to influence child mortality in Somalia

2.6 Operational Framework



Bio-demographic and environmental factors are the principal determinants of child morbidity and mortality but child morbidity and mortality levels are also affected, promoted and /or modified by socioeconomic factors that prevail in a given society/ household.

2.7 Operational hypotheses

The study then tested the following operational hypotheses:

- That children born in households without access to clean water supply are more likely to die than children born from households with access to clean water
- Children born in households without sanitation facilities are more likely to die than those in households with sanitation facilities
- That children born to mothers with no education are more likely to die compared to children born to mothers with Koranic, primary or secondary and above levels of education
- Children born to mothers in rural areas are more likely to die than those born to mothers in urban areas
- Children born to mothers residing in central southern Somalia region are more likely to die than those bom to mothers residing in Somaliland
- Children born to mothers from poor households' are more likely to die than children born to mothers from rich households
- Children born to mothers under 24 years are more likely to die than children born to mothers above 24 years
- That male children are more likely to die than female children

2.8 Variables and their Measurement

The variables used in the estimations are defined in this section. The choice of these variables is guided by the determinants of child mortality literature.

Dependent Variable

Child mortality is the probability of dying between first birthday and the fifth birthday. The dependent variable in this study is the duration of survival measured iii months. It is conditional to the child surviving to the beginning of the interval. The study focuses on child mortality and hence the dependent variable ranges the period 12- 59 months. The hazard rate, in this case the child mortality rate, is defined as the probability per time unit that a child who has survived to the beginning of the respective interval will fail (die) in that interval (Mutunga, 2004).

Explanatory variables

The explanatory variables are classified into socio-economic, household's environmental and bio-demographic variables.

Socio-economic variables: In this study, maternal education is measured by the level of education of the mother considering the variables (No education, Koranic, Primary and Secondary +). Place of residence variables was categorized as Urban and Rural while region of residence had categories: Somaliland, Puntland and Central / southern Somalia. Housing characteristics and household possessions such as possessions like radio, television, and animal possessions, often reflect the socioeconomic status of households, especially in developing countries where income data are lacking. These variables together or individually were used as proxy for household wealth or socioeconomic status. This is because the type of houses people reside in and their possessions tend to speak to their economic ability or purchasing power. In this study wealth index score (poor, middle, rich) were used as indicators of socioeconomic status.

Bio-demographic variables: In this study the age of the mother was measured in years while the gender of the child will be either male or female. Current marital status variables were categorized as currently married, not in union.

Household's environmental variables were defined based on: Toilet facility, constructed from the mothers' response question on access to a toilet facility (no toilet facility, has toilet facility). The variable measures poor and good sanitation facilities at the households. Number of children in the household measured the level of overcrowding. Source of drinking water is categorized as (piped, wells and springs, surface water and others). In this study, households with access to piped water were regarded to have safe drinking water while other water sources were considered un-protected and unsafe.

Definitions of Concepts

1. Infant mortality (lqO): The probability of dying between birth and the first birthday
2. Child mortality (4ql): The probability of dying between exact ages one and five
3. Under-five mortality (5q0) is the probability of dying between birth and the fifth birthday

CHAPTER THREE

DATA AND METHODOLOGY

3.1 Introduction

This chapter presents the description of the source of data used in the study and the analytical methods utilized to reach on the conclusions on the factors influencing child mortality in Somalia. Data quality issues are also highlighted.

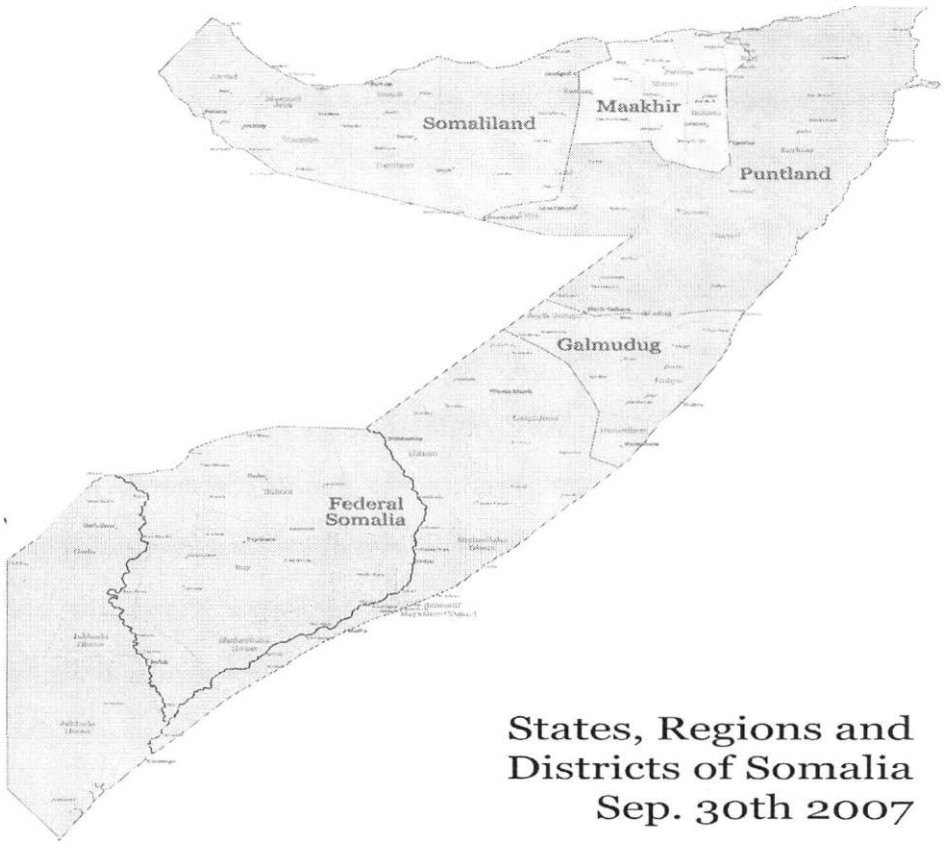
3.2 Source of Data

The principal source of data for the study is the 2006 Multiple Indicator Cluster Survey (MICS 3) for Somalia. Somalia MICS 2006 was conducted by UNICEF following MICS1 (1995) and MICS2 (1999) and was designed to provide a credible dataset at the national level in order to assess the situation of children in Somalia at the mid-decade.

This study uses data from the 5969 households, from where a total 6764 women in the reproductive age group (age 15-49) were interviewed. In addition, 6373 children under age five were listed in the household questionnaire. The survey design provided data disaggregated at the level of regions; Somaliland, Puntland and the Central/ Southern Somalia.

The sample for the Somali 2006 Multiple Indicator Cluster Survey (MICS) was designed to provide estimates on a large number of indicators on the situation of children and women at the national level, for urban and rural areas, and for the three regions: Somaliland, punt land and Central and southern Somalia were identified as the main sampling domains and the sample was then selected in four stages. Within each zone districts were selected with probability proportional to size; in total 57 districts were selected. Within the selected districts a number of permanent and temporary settlements were randomly selected also using probability proportional to size sampling. In each of the 250 clusters 24 households were selected for interview generating a total sample size of 6000 households, sufficient to provide

estimates of 5 percent accuracy. The sample was stratified by urban and non-urban and is not self-weighting.



Three questionnaires were used in the survey. In addition to a household questionnaire which was used to collect information on all household members, the household, and the dwelling, questionnaires were administered in each household to women aged 15-49 - mothers or caretakers of under 5 children were identified in each household, and these persons were interviewed on children under 5.

Of the 6000 households selected for the sample 5969 were successfully interviewed for a household response rate of 99.5 percent. In the interviewed households, 7277 women (age 15-49) were identified. Of these, 6764 were successfully interviewed, yielding a response rate of 93 percent. In addition, 6373 children under age five were listed in the household questionnaire.

3.3 Data Quality

This section discusses data quality issues and how they are addressed in this study. The study uses a retrospective birth history which is susceptible to several possible data collection errors. First, only surviving women age 15-49 were interviewed; therefore, no data are available for children of women who had died. The resulting mortality estimates would be biased if the child mortality of surviving and non-surviving women differs substantially.

Secondly, like DHS data, Multiple Indicator Cluster Survey data can suffer from misreporting; for example a child who died at a very young age might not be reported. Several DHS studies show evidence of downward bias in reporting child deaths (Jacoby and Wang, 2003), that is, the longer the recall period, the more likely the possibility of the respondents to misreport the case.

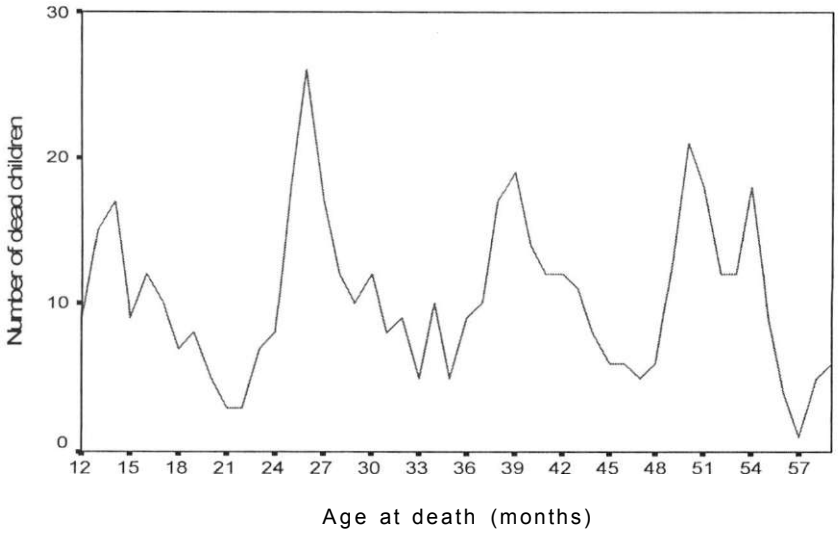
The quality of mortality estimates calculated from retrospective birth histories depends upon the completeness with which births and deaths are reported and recorded. Potentially the most serious data quality problem is the selective omission of the birth histories of those who did not survive, which can lead to underestimation of mortality rates.

Other potential problems include displacement of birth dates, which may cause a distortion of mortality trends, and misreporting of the age at death, which may distort the age pattern of mortality. When selective omission of childhood death occurs, it is usually most severe for deaths in early infancy. Furthermore age heaping could result to the shifting of deaths or births from one age group to another. Some of the quality issues considered by this study are misreporting of age at death for children, age heaping, misreporting of age by mothers and misreporting of child deaths.

3.3.1 Misreporting Age at Death

Misreporting of age at death biases age pattern estimates of mortality if the net result is the transference of deaths between age segments for which the rates are calculated; for example, child mortality may be overestimated relative to infant mortality if children who died in the first year of life are reported as having died at age one or older. Of particular concern is the rounding of reported ages at death so that some deaths which actually occur in late infancy are reported as deaths at one year of age. This type of misreporting would tend to underestimate infant mortality rates and overestimate child mortality rates. The data reveals digit preference on the age at death of children as shown on Figure 3.1

Figure 3.1 Distribution of reported child deaths by age (12- 59 months).



3.3.2 Age Heaping Errors

Heaping of the age at death on certain digits is a problem that is inherent in most retrospective surveys. In this study, the extent of age heaping is assessed by examining the percentage distribution of all living children by current age and by reviewing the distribution of the mother's ages in single years.

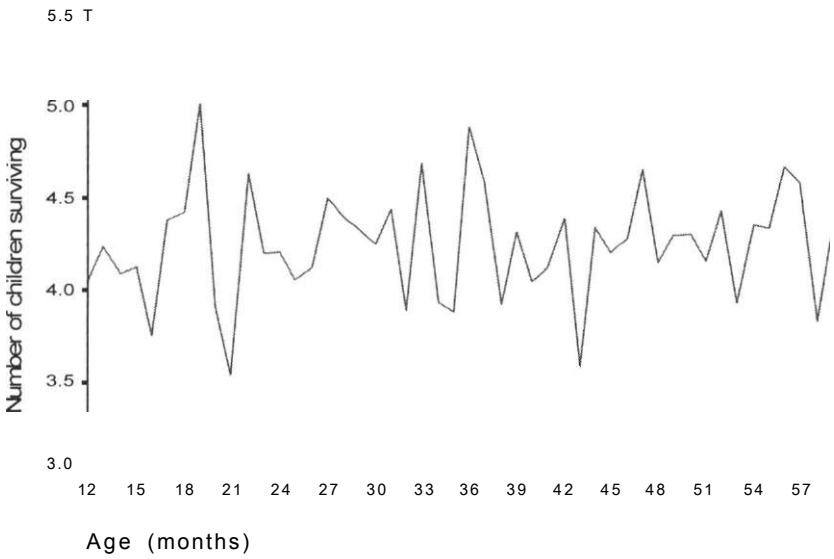
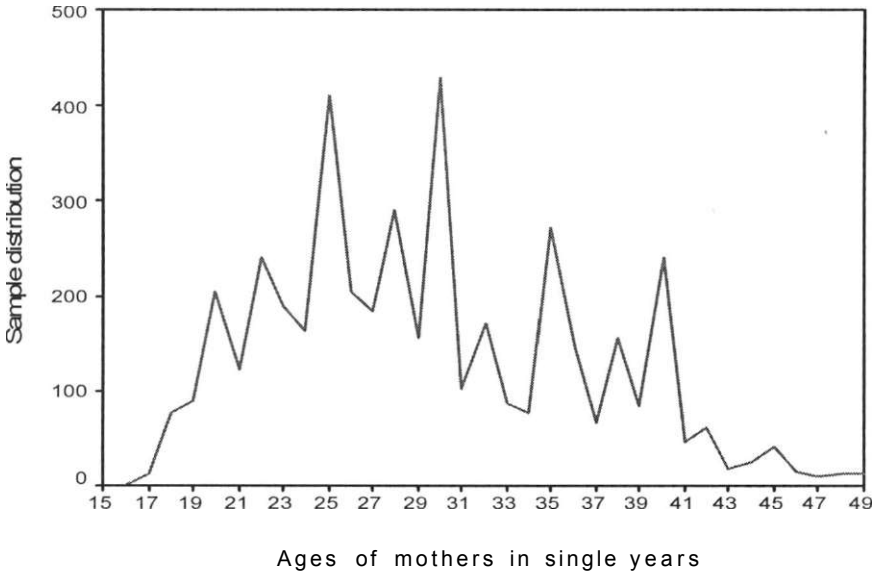


Figure 3.2 Distribution of living children by single years

Figure 3.2 reveals digit preference of ages ending with 0 and 5 while Figure 3.3 below shows the distribution of the ages of the mother's to the sampled population. From the results, digit preference of 0 and 5 and is specially pronounced at ages 20, 25, 30, 35 and 40 however the preference is not limited to ages ending by 0 and 5 only but also other digits including 2, 4 and 8 therefore the impact on this digit preference for ages ending with 0 and 5 is minimal.

Figure 3.3 Distribution of the ages of the sampled mother's in single years



The above observed problem of heaping in particular ages can be partly reduced by grouping women in five-year age groups.

Figure 3.3 shows the distribution of the mothers aged 15-49 by 5 year age groups. Women age 25-29 comprise the greatest percentage of the sample. This percentage declines steadily across age groups until age 45-49. The graph indicates an increasing number of mothers amongst the 15 - 29 years, the highest number a being recorded among the 25- 29 years

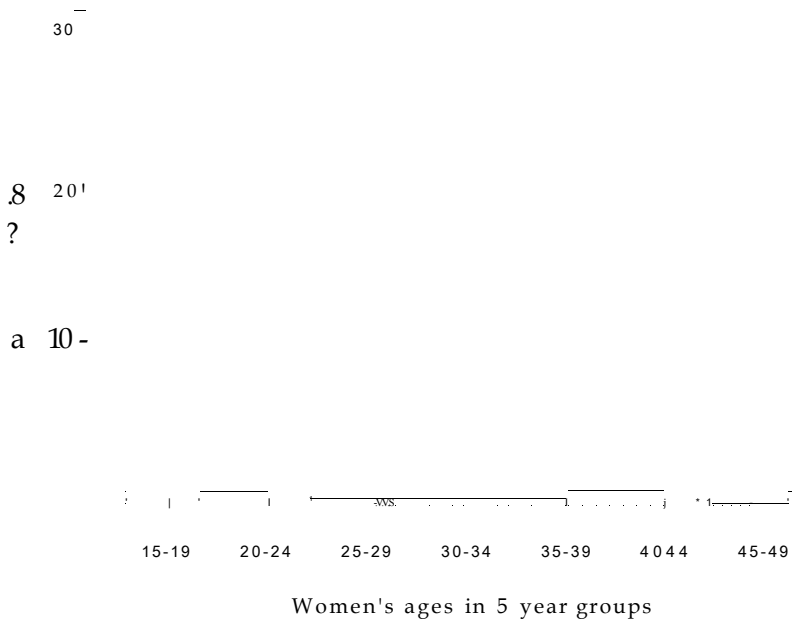


Figure 3.4 Distribution of sampled women in 5 year age groups.

3.3.3 Sex ratios at birth among children ever born and children living

An acceptable sex ratio of male (MCEB) to female children ever born (FCEB) usually falls between 1.02 and 1.07. Ideally, these sex ratios should not vary systematically with age. Studies made in countries where birth registration is fairly complete have shown that the sex ratio at birth is remarkably constant and that its usual value is around 1.05 males per female. In populations originating in Africa south of the Sahara, this value appears to be closer to 1.03(Manual X). Sex ratios falling outside this interval may indicate errors in sampling or under-reporting of births of one sex.

Table 3.1 below shows the analysis of the sex ratios for the sample of children born to the various ages of women in the study. The overall sex ratio for CEB in the data

set used here is 1.07 found to be within the acceptable limit to raise any concerns about the quality of the data.

Table 3.1 Sex ratios at birth among children ever born

Women's age	Total Children	Male	Female	Sex ratio
15-19	181	92	89	1.0337
20-24	924	448	476	0.9412
25-29	1243	649	594	1.0926
30-34	869	462	407	1.1351
35-39	726	374	352	1.0625
40-44	392	219	173	1.2659
45-49	94	50	44	1.1364

Ages of children	Total Children	Male	Female	Sex ratio
12-23 months	983	531	452	1.1748
24-35 months	1111	562	549	1.0237
36-47 months	1176	621	555	1.1189
48-59 months	1159	580	579	1.0017
	4429	2294	2135	1.0797

3.3.4 Misreporting of child deaths

Underreporting of the child deaths is always a concern when collecting birth histories of women. The women may not wish to report such sad events, and interviewers may fail to record some of these events for the five-year period preceding the survey in order to avoid asking questions contained in the maternal and child health sections of the questionnaire.

Figure 3.5 below shows the mean and cumulative percentages of dead children amongst the respective mother's age groups. The mean (percentage proportion) of the dead children changes proportionately with age of mother to correspond to the

number of births by the respective ages of the mothers. The cumulative percentage of the dead children shows a smooth gradual increase over the age groups of the mothers consistent with the fact that children of older mothers have had longer exposure to risk of death as compared to the children of young mothers.

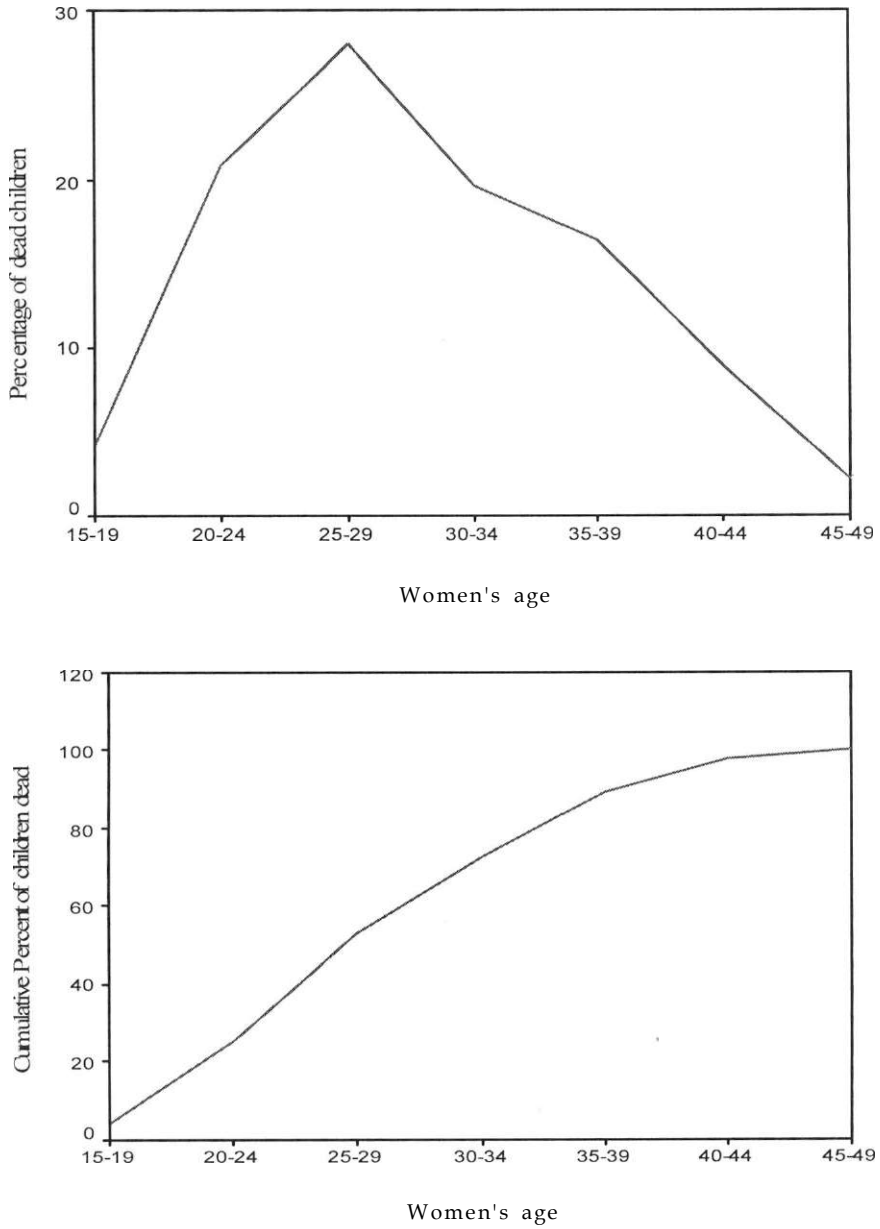


Figure 3.5 1 Mean and cumulative percentages dead children

3.3.5 Completeness of Data and Treatment of missing cases

This study employed the Case Deletion (CD) method also known as complete case analysis. Case Deletion procedure was less hazardous for it involved minimal loss of sample size and there is no structure or pattern to the missing data.

3.4 Methods of data analysis

In this section, methods of data analysis used in this study; descriptive statistics and Cox regression methods are discussed.

3.4.1 Descriptive statistics

Frequencies were used to analyze the characteristics and distribution of the study population by background variables of study. In addition cross tabulations were generated to show association between different study variables and child mortality.

3.4.2 The Cox Proportional Hazard Model

Cox regression (proportional hazard regression) is a method for investigating the effect of several variables on the time a specified event takes to happen. In this case where the outcome was child's survival status, this is known as Cox regression for survival analysis. The method does not assume any particular survival model however it is semi-parametric because it assumes that the effects of the predictor variables upon survival are constant over time and are additive on one scale. The hazards ratio associated with a predictor variable is given by the exponent of its coefficient. The aim was to estimate the hazard ratio of the probability of a child dying within the next day after surviving for t days, as a result of environmental factors, bio-demographic or socio-economic factors. In the context of child mortality, the hazard rate is often referred to as the mortality rate (Ridder and Tunali, 1999). The mortality rate at age t can be interpreted as the intensity at which a child dies at this age, given that the child survived until age t. We focus on children who are born alive and model their mortality probabilities from age one until the age of five.

The coefficients in the multivariate model were interpreted as the effects of a given variable on the odds of dying. The coefficients were exponentiated and interpreted as odds ratios. For categorical variables, odds ratios greater than one represent a higher risk while those less than one represent a lower risk of dying

The Cox regression model was defined as follows

h z(t) = ho (t) x exp {(31 Zl + [32 Z2 + (33 Z3+... (3 m Z m }

Where: i are the index subjects (in this case the children)

- *h (t)* denotes the resultant hazard (defined as the probability per time unit that a case that has survived to the beginning of the respective interval will fail in that interval), given the values of the m covariates for the respective cases (Zl,. . . . Zm) and the respective survival time, t
- ho (t) is some baseline hazard at time t common to all observations, it is the hazard for the respective individual (child) when all the independent variables are equal to zero
- *16(i)* represents the associated coefficients for the respective cases (Zl, Zm)

The model makes no assumptions about the form of h (t) (non-parametric part) of the model but assumes a parametric form of the effects of the predictors on the hazard.

The explanatory variables are classified into three groups: household's socioeconomic, environmental, and bio-demographic. The choice of these variables was guided by the determinants of child mortality literature.

To test the study hypotheses, four models were fitted and analyzed. The first model consisted of socio economic variables: place of residence - urban, rural and region of residence - Somaliland, Central / southern part, maternal education and household's wealth level. Model II was fitted for household's environmental variables - presence of toilet facility, source of drinking water and number of

children in the household controlling for socio economic variables. A third model was fitted for bio-demographic variables of age of mother, current marital status of the mother and sex of the child controlling for socioeconomic variables. A final model was fitted for all the variables: socioeconomic, household's environmental variables and *bio-demographic factors* to *test then net effect on child* mortality.

CHAPTER FOUR

DIFFERENTIALS OF CHILD MORTALITY IN SOMALIA

4.1 Introduction

This chapter discusses the characteristics of the study population by socio-economic, household environmental and bio-demographic factors. In addition, the chapter discusses differentials of child mortality in Somalia by various background and other study variables.

4.2 Background characteristics of study population

Table 4.1 below shows the distribution of the study population by the various background characteristics. Of the 4429 children sampled over 11% died before attaining their fifth birthday while about 89% survived up to their fifth birthday.

The findings showed that, about 63% of the children were born to mothers who resided in the rural areas, while 37% were from mothers residing in urban areas. More than half of the sampled children lived in the southern and central region of Somalia, about 20% in Somaliland whereas about 25 % lived in Puntland. Furthermore, the study showed that 38 % of the sampled children were from poor households, 43% among the medium level and only close to one fifth of the sampled children were among the rich households. In addition, of the sampled children 64% were born to mothers with no education, 17 % were born to mothers who had Koranic education, 16 % were born to mothers with primary level while slightly over 3 percent were born to mothers with secondary and above level of education.

Of the sampled children, about 54 % resided in households that had no toilet facility whereas 46 % resided in households with a toilet facility. 23 % of the sampled children were from households that had piped water, 24 % were residing in households using wells and spring water while about 54 % were from households which were using surface water and other sources for drinking water. Of the

sampled population, 37 % resided in households with 3 or less children while nearly 63 percent resided in households with four or more children.

Table 4.1 Background characteristics of the study population

Characteristic	Frequency (n)	% distribution
Survival status		
Dead	499	11.3
Alive	3930	88.7
Type of place of residence		
Urban	1659	37.5
Rural	2770	62.5
Region of residence		
Somaliland	874	19.7
Puntland	1087	24.5
Central & Southern	2468	55.8
Wealth level		
Poorest	1686	38.1
Medium	1892	42.7
Rich	851	19.2
Mother's education level		
None	2829	63.9
Koranic	746	16.8
Primary	709	16.0
Secondary +	145	3.3
Toilet Facility		
No toilet facility	2373	53.6
Has toilet facility	2056	46.4
Source of drinking water		
Piped	1007	22.7
Wells, springs	1050	23.7
Surface water, others	2372	53.6
Children ever born		
<= 3 children	1648	37.2
4 +children	2781	62.8
Mother's age		
15-24 years	1105	24.9
25-34years	2112	47.7
35+	1212	27.4
Marital Status		
Currently married	4112	92.8
Not in union	317	7.2
Sex of child		
Male	2294	51.8
Female	2135	48.2
Total	**4429**	100 %

Furthermore about one quarter of the sampled children were born to mothers aged between 15 to 24 years, nearly half of the sampled children were born to mothers

aged between 25 to 34 years whereas 27 % of the sample were born to mothers aged 35 years and above. About 93 % of the sampled births were to mother's who were at the time of the survey currently married while only 7 % were to mother's who were not in any form of union. Furthermore, slightly above 50 % of the children were boys while 48 % were girls.

4.3 Differentials of child mortality in Somalia

Table 4.2 is a cross tabulation of children by the study covariates. The results show the number of children dead and those alive cross-classified with socio-economic variables, household's environmental and bio-demographic variables.

Study findings from bivariate analysis showed that there was a significant statistical association between region of residence and child mortality. Over 12 % of the children born from central southern Somalia died while 87 % survived up to age five. In Somaliland and Puntland, child deaths were 9 % and 11% of the total children born from these regions respectively. This association was statistically significant at 10 % level.

Study results showed no significant association between type of place of residence, wealth status of the household and mother's level of education with child mortality.

On household's environmental factors, the study found overcrowding to be associated with child mortality. Children from households with 3 or less number of children recorded less number of child deaths compared to households which had 4+ children. While about 13% of the children living in households with 4 or more children died, only 9 % of children died among those born from households with 3 or less number of children. This association was strongly significant at 1 percent level.

The study did not establish any statistically significant association between type of toilet facility and source of drinking water with child mortality.

On bio-demographic factors, the study showed that marital status of the mother is statistically associated with child mortality. About 16 % of the children born to mothers who were not in marriage unions died while 11 % of children died from mothers who were currently married. This association between marital status of the mother to and child mortality was significant at 5 % level.

Furthermore the study found that there was a significant association between the sex of the child and mortality. Of the sampled population, over 12 % of the boys died while about 10 % of the girls died. This association was statistically significant at 5 percent level.

Study results did not reveal any statistically significant association between age of the mother and child mortality.

Table 4.2 Proportions of children dead and alive by background characteristics

Characteristic		Dead (%)	Alive (%)	(N)(%)
Type of place of residence				
Urban		185(11.2)	1474(88.8)	1659
Rural		314 (11.3)	2456(88.7)	2770
X^2 = 0.035	df = **1**	sig 0.851		
Region of residence				
Somaliland		77(8.8)	797(91.2)	874
Puntland		114(10.5)	973(89.5)	1087
Central southern		308(12.5)	2160(87.5)	2468
X^2 = 9.569	df = 2	sig 0.08		
Wealth level				
Poorest		197(11.7)	1489(88.3)	1686
Medium		217(11.5)	1675(88.5)	1892
Rich		85(10.0)	766(90.0)	851
X^2 =1.763	df = 2	sig 0.414		
Mother's education level				
None		320(11.3)	2509(88.7)	2829
Koranic		95(12.7)	651(87.3)	746
Primary		69(9.7)	640(90.3)	709
Secondary +		15(10.3)	130(89.7)	145
X^2 =3.407	df = 3	sig 0.333		
Toilet Facility				
No toilet facility		273(11.5)	2100(88.5)	2373
Has toilet facility		226(11.4)	1830(88.6)	2056
X^2 =0.289	df = **1**	sig 0.591		
Source of drinking water				
Piped		123(12.2)	884(87.8)	1007
Wells, springs		114(10.9)	936(89.1)	1050
Surface water, others		262(11.0)	2110(89.0)	2372
X^2 =1.197	df = 2	sig 0.550		
Children ever born				
<= 3 children		152(9.2)	1496(90.8)	1648
4 + number of children		347(12.5)	2434(87.5)	2781
X^2 = 10.961	df = **1**	sig 0.001		
Mother's age				
15-24 years		126(11.4)	979(88.6)	1105
25-34years		246(11.7)	1866(88.3)	2112
35+		127(10.5)	1085(89.5)	1212
X^2 =1.080	df = 2	sig 0.583		
Marital Status				
Currently married		450(10.9)	3662(89.1)	4112
Not in union		49(15.5)	268(84.5)	317
X^2 = 5.998	df = 1	sig 0.014		
Sex of child				
Male		274(11.9)	2020(88.1)	2294
Female		225(10.5)	1910(89.5)	2135
X^2 =2.185	df = 1	sig 0.013		

CHAPTER FIVE

DETERMINANTS OF CHILD MORTALITY IN SOMALIA

5.1 Introduction

This chapter summarizes the results of the analysis of the determinants of child mortality in Somalia.

5.2 Bivariate Analysis

Table 5.2 summarizes the bivariate models of household's socioeconomic, environmental and bio-demographic factors on child mortality. The hazard ratios show the impact of each of the variables on child mortality.

On socio economic factors, the study found that region of residence (Somaliland, Puntland or Southern Somalia) is statistically associated with child mortality. Children born in central and southern Somalia were 42% more likely to die compared to children born from households in Somaliland. This relationship was statistically significant at the 1 percent level.

On household's environmental factors, the variable of children ever born was used as a proxy measure for overcrowding in the household. The study revealed that the number of children ever born in a household was a significant factor influencing child mortality. Children born from households with 4 or more children were 1.4 times more likely to die as compared to children born from households with three or less number of children ever born. This relationship was highly significant at 1 percent level.

Current marital status of the mother is a significant determinant of child mortality in Somalia. Children born to mothers who were not in marital unions were 40% more likely to experience child deaths compared to children born to mothers who were in marriage. This relationship was statistically significant at the 10 percent level. In addition, the study revealed that boys experienced more deaths than girls. Girls

were 0.8 times less likely to die compared to boys. This association was statistically significant at the 10 percent level.

Bivariate results did not reveal any statistically significant association between child mortality and the type of place of residence, household's wealth level, maternal education, toilet facility, source of drinking water and maternal age.

Table 5.1 Bivariate analysis results of determinants of child mortality

Characteristic	(g)	S.E	exp (P)
Type of place of residence			
Urban (RC)			
Rural	-0.052	0.093	0.949
Region of residence			
Somaliland (RC)			
Puntland	0.212	0.148	1.237
Central & Southern	0.352	0.127	1 422***
Wealth level			
Poorest (RC)			
Medium	0.013	0.098	1.013
Rich	-0.163	0.130	0.850
Mother's education level			
None (RC)			
Koranic	0.089	0.117	1.093
Primary,	-0.146	0.133	0.864
Secondary +	-0.055	0.264	0.946
Toilet Facility			
No toilet facility (RC)			
Has toilet facility	-0.027	0.090	0.974
Source of drinking water			
Piped (RC)			
Wells, springs	-0.157	0.130	0.855
Surface water, others	-0.120	0.109	0.887
Children ever born			
<= 3 children (RC)			
4 +children	0.325	0.097	1.385***
Mother's age			
15-24 years (RC)			
25-34years	0.035	0.110	1.036
35+	-0.107	0.126	0.898
Marital Status			
Currently Married (RC)			
Not in union	0.332	0.151	1.394**
Sex of child			
Male (RC)			
Female	-0.169	0.090	0.845*

Notes: *, **, *** significant at 10 per cent, 5 per cent and 1 per cent respectively, RC = Reference Category

5.3 Multivariate Analysis results

The relationship between covariates and probability of dying of a child between year one and exact age five, were estimated using multivariate proportional hazard

models. The dependent variable (age of the child in months) was run against the covariates censoring all observations (child is alive at the time of the survey). Analysis was done by fitting a series of models estimating the relative risk of a child dying between age one and five. Hazard ratios show the impact of each of the variables on child mortality. The findings are summarized on Table 5.3

Table 5.3 Multivariate analysis results of the determinants of child mortality

Characteristic	Model I	Model II	Model III	Model
Type of residence				
Urban (RC)				
Rural	0.765*	0.826	0.773**	0.858
Region of residence				
Somaliland (RC)				
Puntland	1.252	1.327*	1.213	1.282
Central and Southern region	1.412***	1.470***	1.393**	1.427**
Mother's education level				
None (RC)				
Koranic	1.089	1.093	1.075	1.052
Primary	0.933	0.932	0.931	0.912
Secondary +	1.032	0.950	1.021	0.949
Wealth level				
Poor (RC)				
Medium	0.957	0.960	0.952	0.934
Rich	0.712*	0.670*	0.717*	0.654*
Toilet Facility				
No toilet facility (RC)				
Has toilet facility		0.973		0.996
Source of drinking water				
Piped (RC)				
Wells, springs		0.728		0.719
Surface water, others		0.801		0.779
Children ever born				
<= 3 children (RC)				
4 +children		1.382***		1.684***
Mother's age				
15-24 years (RC)				
25-34years			1.025	0.788*
35+			0.907	0.620**
Marital Status				
Currently married (RC)				
Not in union			1.382**	1.437**
Sex of child				
Male (RC)				
Female			0.848**	0.842**

Notes: *, **, *** significant at 10 per cent, 5 per cent and 1 per cent respectively, RC = Reference Category

Model I presents the results of the influence of household's socio-economic factors on child mortality. Model II presents the results of the influence of household's

environmental factors on child mortality controlling for socioeconomic factors while Model III shows the relative risks of bio-demographic covariates on child mortality controlling for socioeconomic factors. In the overall, Model IV, the Full model incorporates all the variables of the study.

5.4 Discussion of the results

The study examined the association of the risk of child mortality with socio economic, household environmental and bio-demographic factors in Somalia.
Table 5.3 summarizes the results of the four models showing the relative risks of child deaths in Somalia as influenced by various household's socioeconomic, environmental and bio-demographic variables.

Model I indicates the effects of socio economic factors on child mortality. The study showed that children born from rural households were 25 % less likely to die compared to children born from the urban type of residence. This relationship was statistically significant at the 10 percent level. In addition, children born from households in central southern region of Somalia were 41% more likely to die compared to children born from Somaliland. This association was strongly significant at the 1 percent level.

Compared to the bivariate analysis, the relative risk of child deaths due to region of residence was almost at the same level while controlling for the other socio economic variables. The higher risk of death among children born from households in central and southern region as compared to other regions could be explained by the fact that the region has been more devastated by the continued war and conflict compared to the semi-autonomous northern regions of Somaliland and Puntland which have experienced considerable peace and stability. For the last two decades, the state of anarchy in the central and southern Somalia has hampered any meaningful progress in socioeconomic systems development for basic social services including education and health.

On wealth status of the household, the study established that lower mortality was experienced in affluent households as compared to the poor households. This finding was consistent to Mutunga (2007). These households have better housing conditions, better nutrition, have more empowerment hence being able to afford better medical attention and care thus significantly enhancing the survival probability of all their members including the children (Mutunga, 2007). Specifically, model I results showed that children born from the rich households were 30 % less likely to die compared to children born from poor households. This relationship was strongly significant at 10 percent level. Although the bivariate analysis did not establish any statistically significant relationship between household wealth status and child mortality, multivariate results showed that children born from rich households were 30 % less likely to die compared to children born from poor households. This relationship was strongly significant at the 10 percent level.

Unexpectedly, multivariate analysis did not reveal any significant association between mother's level of education and child mortality. This could perhaps be explained by the low literacy levels, socio-cultural factors whereby decisions at the household are mainly made by the husband, the clan and the community. Somalia continues to have one of the lowest literacy rates in the world (World Bank, 2002).
The adult literacy rates vary from 34.9 percent for urban to 10.9 percent for rural and nomadic areas giving an overall rate of 19.2 percent for Somalia. The adult female literacy rate for rural and nomadic areas is as low as 6.7 percent. This partly reflects the lack of educational opportunities after the civil war, particularly in rural and nomadic areas where a large proportion of the school aged population missed out on opportunities for basic education. Though some Koranic schools teach Arabic, many of the students become functionally illiterate later (World Bank, 2002).

Furthermore, gender segregation is deeply rooted in traditional Somali socio-cultural structures and remains a formidable barrier to women's participation in decision-making processes and access to – and control of – resources. Female marginalization is also a result of lack of education and self-reliance, thus the need

for improving women's education is a must. Women's participation in governance and respect for human rights in Somalia fall short of those expressed in internationally recognized instruments.

In model II, on household environmental variables controlling for socioeconomic factors, the study established that children born from households with four or more children were 38% more likely to die compared to those born from households with three or fewer children. This finding was statistically significant at the 1 % level. This finding was consistent with Richard G & Dean T (1991) who established that the household probability of having a child under five die increases proportionate to the number of other under five children that the mother has. Similarly, Ballard TJ & Neumann CG (1995) in a one year follow-up study of the association between household crowding and acute respiratory infections; found that children with more than 5 siblings living in the household were at increased risk of disease in Kenya.
The study did not establish any statistically significant relationship between child deaths with the other household environmental variables considered in the model.

The results in Model III showed higher risk of child mortality among children born to mothers who were not in any marital union. Children born to mothers not in any marriage union experienced 1.4 times higher risk of deaths than children born to mothers who were currently married. This relationship was highly significant at 1 percent level. This study finding was consistent with Linda Waite and Maggie Gallagher (2000) in a study in Australia on why married people are happier, healthier, and better-off financially established that divorce and unmarried childbearing has important negative effects on children's physical health and life expectancy (Doubleday, 2000). A study using the National Health Interview Survey to track changes in children's health after their parents' separation found that divorce increased the incidence of health problems in children by 50 percent. The health advantage of married homes for children remains even after taking into account income and socioeconomic status hence the health gap could not be explained entirely by lower income or reduced access to medical care. Even after

taking economic hardship into account, researchers found adults from non-intact families were 70 percent more likely to have circulatory problems, 56 percent more likely to show signs of mental illness, 27 percent more likely to have chronic aches and pains, and 26 percent more likely to rate their overall health as poor (Doubleday, 2000).

In addition, model III results revealed greater odds of child mortality among boys as compared to girls. Male children (boys) have lower survival prospects than female children As for the child's gender, it is widely believed that male mortality is higher due to biological disadvantages (Mutunga, 2007). Girls were 15 percent less likely to die compared to boys. This relationship was statistically significant at the 10 percent level. According to Maleta, Ashorn and M. Espo, 2002 in a study on male biased mortality among 1-2 year old children in rural Malawi, the consistent mortality gap in early life is believed to reflect inherent biological differences between the sexes, subsequent variation is often attributed to behavioural factors. Therefore, effective child survival programmes may need to address cultural aspects, especially prevailing sex preferences, in areas where over 1 year old boys and girls have unequal death rates.

Studies on urban-rural mortality differentials in Sub-Saharan Africa have shown that overall mortality, and infant and child mortality in particular, is generally lower in urban than in rural areas (Akoto and Tabutin, 1989) The rural-urban differential in child mortality is primarily due to limited access to proper health services by rural residents compared to urban residents and to better sanitary conditions in the urban centres (Brockerhoof, 1990; Farha and Preston, 1982). In models I and III, contrary to some literature, the impact of place of residence on child mortality did not turn out as expected, although the findings were also consistent with a study by Akoto, 1989. Living in an urban or rural area has long been one of the key variables for differentiating child mortality (Akoto, 1985). Although the positive impact of urban residence on the mortality of children under five years of age continued in some countries, such as Burkina Faso, this advantage has disappeared entirely in others,

such as Cameroon, Togo and Zimbabwe; in Tanzania, the situation has even been reversed in favor of rural areas. Estimation results from Cox model showed that children born in rural households were 0.7 times less likely to die compared to children born from urban households. This relationship was strongly significant at 10 percent level.

Child survival advantage associated with urban residence in contemporary developing countries is documented in a large body of demographic literature (Behm and Vallin, 1982; Davis, 1973; Hobcraft et al., 1984). However, in recent years, there has been growing recognition that this urban advantage is misleading and inappropriate as a guide for national health strategies, insofar as it obscures enormous differences in health status and survival chances among and within urban areas of most developing countries (WHO, 1991; Harpham et al., 1991, Brockerhoff, 1995). Using Demographic and Health Survey data from 17 countries, a recent study demonstrates that the child survival prospects of rural-urban migrants are higher than those in their rural origin and lower than those of urban non-migrants (Brockerhoff, 1995).

Although the study did not seek to explain the observed rural-urban differentials on child mortality, plausible reasons for the higher mortality among the urban residences as compared to the rural households could be two fold: one due to the huge populations of Internally Displaced People (IDPs) living in the urban areas with limited access and use of maternal and child health care services and secondly , the general socio economic development between the urban / rural households in not very much differentiated due to close to two decades of conflict in Somalia.

In addition, controlling for all other model variables, full model results revealed some statistically significant relationship between maternal age and child mortality. Bio-demographic and environmental factors are the principal determinants of child morbidity and mortality but child morbidity and mortality levels are also affected, promoted and / or modified by socioeconomic factors that prevail in a given society/

household. Although the bivariate results did not reveal any statistically significant relationship between maternal age and child mortality, the factor became significant while controlling for all other factors.

It is well established that bio-demographic factors of the mother and child influence childhood mortality (Hobcraft, McDonald and Rutstein, 1983). Children born to mothers aged between 25 - 34 years were 22% less likely to die compared to children born to mothers aged 15 - 24 years while children born to mothers aged 35 and above years were 38% less likely to die compared to children born to mothers who were in the age 15 - 24 years. These relationships were statistically significant at 10 percent and 5 percent respectively. This finding was consistent with Jatrana, 1999 that children born to young mothers (<24 years) were at a significantly greater risk of child death. Relatively young mothers may have poor child-care skills, which derives partly from inexperience in child rearing (Suchindran and Adlakha, 1981). Moreover, they may be unable to obtain an adequate share of food and other household resources for their children, since they may have little influence on the allocation of household resources (Ikamari, 1996). The Somalia conflict has also affected the role of women, due to male members of the family dying and mental ill health caused by conflict-related which has forced women to broaden their traditional role of primary family care takers to become breadwinners in an insecure environment and in a society that had not previously recognized such a role for women (World Bank, 2002).

Region of residence remained a dominant determinant of child mortality in Somalia irrespective of controlling for all other socioeconomic, environmental and bio demographic factors. Children born from households in central and southern Somalia were 43 percent more likely to experience death compared to children born to Somaliland households. This relationship was strongly significant at the 1 percent level. The characteristics of Somalia conflict—violence, poverty, food insecurity, destruction of health and other vital infrastructure, large population displacements, and the breakdown of family units—ideal conditions for disease and trauma to

proliferate. Children are particularly vulnerable to the consequences of conflicts and poverty. Not only does the effect of conflicts on child health constitute a violation of a fundamental human right, but it also presents serious impediments to creating and sustaining healthy, prosperous and stable societies.

Somaliland considers itself a self-governed state since breaking away from Somalia in 1991. It has been relatively peaceful since 1998 and has built up its institutions quite significantly. Unlike Somaliland and puntland, most parts of Central South Somalia continue to experience sporadic armed conflict, widespread human rights abuses, endemic humanitarian needs, minimal access to social services, cycles of drought and flooding, dispute and limited economic recovery. Child mortality differentials observed between the three regions of the war torn country could be explained by the different levels of conflict experienced in the different regions.

Similarly study results revealed that household's wealth status is associated with child mortality. Children born from rich households were 35 % less likely to die compared to those born from poor households. This relationship was strongly significant at the 10 percent level. In Somalia, health facilities are extremely limited, and clinics set up by communities or private medical services often exclude the poor from access due to fees thereby limiting access by most of the rural and urban populations. A study conducted by the World Health Organization (WHO) in northern Somalia found that only one of ten hospitals functioned adequately (United Nations, 2007).

In addition, model IV results revealed greater odds of child mortality among households with four or more children as compared to households with 3 or fewer children. Children born in overcrowded households were 1.7 times more likely to experience death compared to those from less crowded households. This relationship was statistically significant at 1 % level. The finding is consistent with Richard G & Dean T (1991), that household probability of having a child under five die increases proportionate to the number of other under five children that the mother has.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the summary of the study findings, conclusions and recommendations for policy and further research.

6.2 Summary

This study set out to examine the influence of household's socioeconomic, environmental and bio-demographic characteristics on child mortality in Somalia using survival analysis. The study variables analyzed included type of place and region of residence, mother's level of education, households' wealth status, age of the mother, source of drinking water, toilet facility, children ever born, current marital status of the mother and sex of the child.

The data for the study was extracted from 2006 MICS for Somalia. The study population consisted of a sub-sample of 4429 children comprising 499 child deaths. Data quality was assessed by examining age heaping, checking on the sex ratios and reviewing data for systematic omission of dead children.

Chapter 1 introduced the study by giving the problem statement, key research questions, objectives, justification and scope and limitation; chapter two discussed the literature on determinants of child mortality in developing countries, the conceptual framework, conceptual and operational hypotheses and measurement of variables while chapter three discussed the data, reviewed data quality issues and methods of data analysis and Cox proportional hazard model.

Chapter four discussed the background characteristics of the study population including descriptive statistics and cross-tabulations to establish associations between socio-economic, households' environmental and bio demographic study variables and child mortality.

In chapter five, the effects of socio-economic, households' environment and bio-demographic factors on child mortality were established by fitting four multivariate Cox regression models. Model I included socio economic variables, model II considered the effects of household's environment variables on child mortality while controlling for socio economic variables. Model III tested the influence of bio-demographic variables on child mortality while controlling for socioeconomic variables. Finally a full model was fitted to include all socio-economic, environmental and bio-demographic variables.

Analysis showed that there was a significant relationship between child mortality and type of residence, region of place of residence, number of children in the household, current marital status of the mother, maternal age and sex of the child. Higher child mortality was found among children born in households with more children due to environmental factors. Similarly, higher risks of mortality were associated to children born in urban residences as compared to the rural, children born from central and southern Somalia compared to Somaliland and among the poor as compared to rich households. Children born to mothers who were currently not in marriage and male children were found to experience higher risks of child mortality.

The study did not establish any statistically significant relationship between mother's level of education, toilet facility, source of drinking water and child mortality.

6.3 Conclusions

This study set out to examine the determinants of child deaths among households in Somalia. A Cox proportional regression analysis was undertaken to determine the influence of selected household's socio-economic, environmental characteristics and bio-demographic factors on child mortality. The study achieved its objective by establishing the socioeconomic, enviroximental and bio-demographic determinants of child mortality in Somalia.

The study showed that children born from rural households were less likely to die compared to children born from the urban type of residences. In addition, children born from households in central southern region of Somalia were more likely to die compared to children born from Somaliland and Puntland. The higher risk of death among children born from households in central and southern region as compared to other regions could be explained the increased level of war and conflict in the southern region as compared to the northern regions. The last two decades have been characterized by anarchy in the southern Somalia which has hampered any meaningful progress in socioeconomic systems development for basic social services including education and health.

On wealth status of the household, the study established that lower mortality was experienced in affluent households as compared to the poor households. Wealthier households have better housing conditions, better nutrition, have more empowerment hence being able to afford better medical attention and care thus significantly enhancing the survival probability of all their members including the children.

The study did not reveal any significant association between mother's level of education and child mortality. This could perhaps be explained by the low literacy levels among the Somali population and also by the strong cultural and religious values existing among the Somali communities. Gender segregation is deeply rooted in traditional Somali socio-cultural structures and remains a formidable barrier to women's participation in decision-making processes and access to — and control of — resources.

The study showed higher risk of child mortality among children born to mothers who were not in any marital union as compared to children born to married women. The low child mortality among children born to married women could be explained by their health advantage due to household's income and socioeconomic status which provides for better access to medical care.

The study observed rural-urban differentials on child mortality in Somalia with rural households experiencing less risk of child deaths as compared to urban households. The higher mortality among the urban residences as compared to the rural households could be due to huge populations of Internally Displaced People (IDPs) living in the urban areas with limited access and use of maternal and child health care services in addition to the fact that the socio economic development between the urban / rural households in Somalia is not very much differentiated due to close to two decades of conflict in the country.

The study showed that maternal age is a significant predictor of child mortality in Somalia. Children born to mothers aged between 25 - 34 years were found to be less likely to die compared to children born to mothers aged 15 - 24 years and children born to mothers aged 35 and above years. Relatively young mothers may have poor child-care skills, which derives partly from inexperience in child rearing and partly due to lack of access to adequate share of food and other household resources for their children due to their little influence on the allocation of household resources.

6.3.1 Recommendations

This section discusses the recommendations emanating from the study both for policy and further research. This will be discussed in light to the study findings and conclusions.

6.3.2 Implications for policy

This study indicates that household environment and wealth status have significant impact on child mortality. Therefore there is need to improve on strategies directed to providing better housing including reduction of overcrowding. In addition strategies to improve on the household's wealth status including poverty eradication and socioeconomic development should be strengthened to reduce the risks of death among children. Poverty increases the risk of civil war and insecurity and therefore, poverty reduction efforts are not just desirable, but a necessity for the security of the

all the regions of Somalia. Empirical evidence shows that poor countries are more likely to experience violent conflict, and conflict-affected countries tend to exhibit higher levels of poverty; on average, a negative economic growth shock of five percentage points increases the risk of civil war by about 50% (United Nations, 2007). Efforts to strengthen national reconciliation and comprehensive peace should be prioritized. Policies on gender mainstreaming to empower women and counter the socio-cultural structures that marginalize women's participation in decision-making processes and control of resources should be initiated.

6.3.3 Recommendations for further research

According to available evidence, maternal education plays a major role in determining the level of child mortality with some studies confirming maternal education as the single most significant determinant of child mortality. In view of the lack of significant relationship between maternal education and child mortality in this study, it would be prudent to do further research to determine the underlying reasons including exploring interactions of education with religion and other socio-cultural factors. A qualitative research to study the perception of mothers on the socio-cultural practices that may be responsible for the high child mortality in Somalia is recommended.

Some of the variables including type of toilet facility and source of drinking water reviewed in the literature had no statistical significance on child mortality when tested and without any plausible explanation. Further research in determining the influence of sanitation and source of drinking water on child mortality using MICS 2009 data is recommended.

In addition, it is recommended to do further research to explain the observed urban-rural differentials in child mortality specifically looking at child mortality situation among the urban rich and the huge populations of Internally Displaced People (IDPs) living in the urban areas.

REFERENCES:

Akoto, E. and Tambashe, B. 1989. Socioeconomic Inequalities in Infant and Child Mortality among Urban and Rural Areas in Sub-Saharan Africa.

African Population Studies Union for African Population Studies ISSN: 0850-5780 Vol. 19, Num. 1, 2004, pp. 13-33. Population Studies Center, University of Pennsylvania, Philadelphia, PA 19104, USA Risks, Amenities, and Child Mortality in Rural South Africa.

Ballard, TJ. And Neumann, CG. 1995. The effects of malnutrition, parental literacy and household overcrowding on acute respiratory infections in young Kenyan children. *Trap pediatric* 1995 41:8 - 13.

Becker, S. and R. E. Black 1996. A Model of Child Morbidity, Mortality, and Health Interventions. *Population & Development Review* 22(3): 431-456.

Black, Robert E., Saul S. Morris and Jennifer Bryce. 2003. Where and Why Are 10 Million Children Dying Every Year?. *The Lancet*, vol. 361, no. 9376, 28 June 2003, p. 2230.* www.thelancet.com

Caldwell, J.C. 1979. Education as a factor in mortality decline: An examination of Nigerian data. *Population Studies,* (3):395-414.

Casterline, J. B., E. C. Cooksey *et al.* 1989. Household Income and Child Survival in Egypt. *Demography* 26(1): 15-35.

Cantrelle, P., and H. Leridon.1971. Breastfeeding, mortality in childhood and fertility in a rural zone in Senegal. *Popidation Studies* 25(3): 505-533.

Curtis, S.L., Diamond, I. et al. 1993. Birth Interval and Family Effects on Post-neonatal Mortality in Brazil. *Demography* 30(1): 33-43.

Cox, D.R. 1972. Regression models and life tables, *Journal of Royal StatisticalSociety,* vol.34, pp. 187.

Das Gupta, M. 1990. Death Clustering, Mothers' Education and the Determinants of Child Mortality in Rural Punjab, India.*Popidation Studies* 44: 489-505.

De-Gita S.K.1996. The socio-economic differentials of infant and child mortality in Kenya: Evidence from Kenya Demographic and Health Survey (KDHS) 1993 data.

Eliwo A. and O. Tambashe. 1989. Socioeconomic Inequalities in Infant and Child Mortality among Urban and Rural Areas in Sub-Saharan Africa.

Espo. 2002.1nfant Mortality and its Underlying Determinants in Rural Malawi. Dissertation, University of Tampere medical School, Finland

Gyimah, S. O. 2002. Ethnicity and infant mortality in sub-Saharan Africa: The case of Ghana .*Population Studies Centre Discussion Paper* 02-10, the University of Western Ontario, and London, Ontario.

Gyimah, S. O. 2003. Interaction Effects of Maternal Education and Household Facilities on Childhood Diarrhea in sub-Saharan Africa: The Case of Ghana.

Guo, G. 1993. Use of Sibling Data to Estimate Family Mortality Effects in Guatemala. *Demography* 30(1): 15-32.

Guo, G. and G. Rodriguez.1992. Estimating a Multivariate Proportional Hazard Model for Clustered Data Using the EM Algorithm, With an Application to Child Survival in Guatemala. *Journal of the American Statistical Association,* 87(429): 969-976.

Hala, A. 2002. The effect of water and sanitation on child mortality in Egypt. *Environmental Economics Unit,* Department of Economics, Gothenburg University.

Hobcraft, J.; McDonald, J, and Rutstein, S.0.1984. Socio-economic factors in infant and child mortality: a cross national comparison. *Population Studies*

Hobcraft, J. N., McDonald, J. W. and Rutstein, S. 0.1983. Child spacing effects on infant and child mortality. *Popidation Index,* 49, 5)5-*l)

Hobcraft, J. N., McDonald, J. W. and Rutstein. S. 0.1985.Demographic determinants of infant and early child mortality: Comparative analyses .*Popidation Studies,* 39, 3*3-)5.

Hill et all,.1996. Child Mortality and Socioeconomic Status in Sub-Saharan Africa.

Hobcraft, J. 1991. Child spacing and child mortality.., *Demographic and Health Surveys World Conference,* Vol. II, Columbia, M.D.:IRD/Macro International.

Ikamari, L. 1996. Factors affecting child survival in Kenya. Unpublished Ph. D Thesis, Demography Program, Research School of Social Sciences, Canberra, The Australian National University.

Jacoby, H. and L. Wang.2003. Environmental Determinants of Child Mortality in Rural China: A Competing Risks Approach. Washington DC: World Bank.

Jatrana, S. 1999. Determinants of Infant Mortality in a Backward Region of North India: Are Socio-economic or Demographic Factors Dominant?.

Jatrana, S. 1999. Determinants and differentials of infant mortality in Mewat region of Haryana State, India.

Jacoby, H. and L. Wang.2003. Environmental Determinants of Child Mortality in Rural China: A Competing Risks Approach. Washington DC: World Bank.

Jada, L.F. 1992. Determinants of levels and differentials of early childhood mortality in Kenya based on Kenya Demographic and Health Survey (KDHS) 1989. MA Thesis, Population Studies and Research Institute, University of Nairobi.

Kembo, J. 2009. Determinants of infant and child mortality in Zimbabwe: Results of multivariate hazard analysis.

Klaauw, van der B. and L. Wang.2003.Child Mortality in Rural India', World Bank Working Paper. Washington DC: World Bank.

Kiragu, E. 2006. A comparative analysis of child mortality in Kenya and Ghana. Unpublished M.A Thesis PSRI University of Nairobi.

KalbfleischJ.D. and Prentice, R.L. 1980. The Statistical Analysis of Failure Time Data. New York: Wiley.

Linda J. Waite and Maggie Gallagher. 2000. The Case for Marriage: Why Married People are Happier, Healthier, and Better-Off Financially. New York: Doubleday: 155-156.

Maleta, P Ashorn, M Espo, T Kulmala. 2002. Male biased mortality among 1-2 year old children in rural Malawi. K Arch Dis Child 2002;87:386-387.

Miller, J., J. Trussell, A.R. Pebley, and B. Vaughan. 1992. Birth spacing and child mortality in Bangladesh and the Philippines.. *Demography,* 29, 305.

Mosley,W & Chen, L. 1984. An analytical framework for the study of child survival in developing countries.*Population and development review supplement* vol 10:25-45.

Mosley, W. II., and S. Becker.1991. Demographic models for child survival and implications for health intervention program. *Health Policy and Planning,* vol.6, No.3, pp. 218-233

Mutunga, Clive.2004. Environmental determinants of child mortality in Kenya. KIPPRA

Mutunga, J. 2007. Environmental Determinants of Child Mortality in Kenya.

Okumbe, J. 1996. Demographic and socio-economic correlates of neonatal mortality in Kenya. MA Thesis, Population Studies and Research Institute, University of Nairobi.

Omariba, W. 2005. Changing childhood mortality conditions in Kenya a Multilevel hazard model analysis. Department of Sociology, Population Studies Centre University of Western Ontario London, Ontario

Omariba, D.W.R. 1993. Socio-economic determinants of child survival in Upper Matasia sub-location, Kajiado district. Kenya' MA Thesis, Population Studies and Research Institute, University of Nairobi, Kenya.

Omariba, Walter., Beaujot, Roderic. and Rajulton, Fernando. Determinants of Infant and Child Mortality in Kenya: An Analysis Controlling for Frailty Effects. Paper presented at the annual meeting of the American Sociological Association, Montreal Convention Center, Montreal, Quebec, Canada, Aug 10, 2006 <Not Available>. 2009-05-24 http://www.allacademic.com/meta/pl 0503 l_index.html

Palloni, A., G. Pinto Aguirre, and S. Lastiri.1994. The effects of breast-feeding and the pace of childbearing on early childhood mortality in Mexico. *Bulletin of the Pan American Health Organization*. 28(2):93-110

Pebley, A.R., and P.W. Stupp.1987. Reproductive patterns and child mortality in Guatemala. *Demography* 24(1): 43-60.

Robert E Black, Saul S Morris, Jennifer Bryce.2003. Where and why are 10 million children dying every year*l.The Lancet,* Volume 361, Issue 9376, Pages 2226 - 2234, 28 June

Richard, G &Dean, T. 1991.Disease and mortality in sub-Saharan Africa. *Oxford University press.*

Ridder G. and Tunali 1.1999.Stratified Partial Likelihood Estimation. *Journal of Econometrics,* 1999.

Rukunga,G. 2004.1ndoor air pollution AMREF, Kenya, Health challenges for children in the world cities, ttp://www.usaid.gov/pubs/cp99/cp99int.htmn accessed June 7, 2007

Sastry, N. 1996. Community Characteristics, Individual and Household Attributes, and Child Survival in Brazil. *Demography,* 33(2): 211-229.

Sastry, N. 1997. Family-level Clustering of Childhood Mortality Risk in Northeast Brazil. *Population Studies* 51: 245-261.

Sen, A. 1998. Mortality as an Indicator of Economic Success and Failure. *Economic Journal,* 108, pp. 1-25.

Schultz, T. 1984. Studying the Impact of Household Economic and Community Variables on Child Mortality. *Population and Development Review* 10: 215-235.

Suchindran, C.M. and Adlakha, A.L. 1981. Infant Mortality and its Effects on Fertility: the experience of Sri Lanka. University of North Carolina, Chapel Hill

Timaeus, I.M. and L. Lush.l995.Intra-urban differentials in child health. *Health Transition Reviexn* 5(2): 163-90, Canberra: Health Transition Centre.

Trussell T. and S. H. Preston, 1982: Estimating the Covariates of Childhood Mortality from Retrospective Reports of Mothers.HeflZf/i *Policy and Education*

Trussell, J. 1975. A Re-Estimation of the Multiplying Factors for the Brass Technique for Determining Childhood Survivorship Rates. *Popidation Studies*

United Nations. 2007.Millennium development goals progress report 2007. *United Nations department of Economics and social Affairs*

UNFPA. 2006. State of world population 2006. A *passage to hope -women and International migration,* UNFPA New York.

UNICEF.1999. The State of the World's Children 1999. New York: UNICEF.

UNICEF. 2000. The State of the World's Children 2000. New York: UNICEF.

United Nations Indirect Techniques for Demographic Estimation Manual X, 1983

UNICEF.2005. "The State of the World's Children 2006: Excluded andlnvisible.New York: UNICEF

UN-HABIT AT,2003. Water and sanitation in the world cities. *Earth scan publication* ltd, London.

Wang, L. 2003. Environmental Determinants of Child Mortality: Empirical Results from the 2000 Ethiopia DHS. Washington DC: World Bank

Wanjohi, K.P. 1996. The influence of environmental factors on infant and child mortality: A study if six districts in Kenya. MA Thesis, Population Studies and Research Institute, University of Nairobi.

Woldemicael, G. 1988. Diarrhoeal morbidity among young children in Eritrea: Environmental and socio-economic determinants. Department of Statistics and Demography, Asmara: University of Asmara

Wolpin, K. 1997. Determinants and consequences of the mortality and health of Infants and children. M. Rosenzweig and O. Stark (eds), 1997 *Handbook of Populatioand Family Economics,* Amsterdam: Elsevier, edition 1, volume 1, number 1.

World Bank. 2001. Health and Environment. *Background paper for the World Bank Environment Strategy,* Washington, D.C

World Bank. 2002. Somalia Social Economic Survey 2002.

World Health organization. 2002.The world health report 2002: Reducing risks, promoting healthy life .Geneva, the World Health Organization.

World Health Organization: Indoor Air Pollution and the Millennium Development Goals, available at http://www.who.int/indoorair/mdg/en/ accessed 22nd May 2007.

World Health Organization, 2003. Global Health: today's challenges. The World Health report 2003."chapter 1. available at http://www.who.int/whr/2003/en/Chapterl-en.pdf. Australia.

APPENDICES

Appendix 1 Multivariate Model 1 Results

Model 1 : Socioeconomic variables						
	B	SE	Wald	df	Sig.	Exp(B)
Rural	-0.268	0.130	4.287	1	0.038	0.765
Somaliland			7.157	2	0.028	
Puntland	0.224	0.149	2.267	1	0.132	1.252
Central South	0.345	0.130	6.985	1	0.008	1.412
None			0.985		0.805	
Koranic	0.085	0.119	0.515	1	0.473	1.089
Primary	-0.070	0.143	0.236	1	0.627	0.933
Secondary +	0.031	0.277	0.013	1	0.910	1.032
Poor			4.027		0.134	
Middle	-0.044	0.116	0.141	1	0.707	0.957
Rich	-0.340	0.190	3.215	1	0.073	0.712

Appendix 2: Multivariate model II Results

Model II : Environmental factors controlling for socioeconomic factors						
	B	SE	Wald	df	Sig.	Exp(B)
Rural	-0.192	0.142	1.814	1	0.178	0.826
Somaliland			8.642	2	0.013	
Puntland	0.283	0.151	3.501	1	0.061	1.327
Central South	0.385	0.131	8.601	1	0.003	1.470
None			1.070		0.784	
Koranic	0.089	0.119	0.558	1	0.455	1.093
Primary	-0.071	0.143	0.244	1	0.621	0.932
Secondary +	-0.051	0.277	0.034	1	0.854	0.950
Poor			5.324		0.070	
Middle	-0.041	0.140	0.085	1	0.770	0.960
Rich	-0.400	0.220	3.316	1	0.069	0.670
Child. = 4 and above	0.323	0.098	10.899	1	0.001	1.382
Has toilet	-0.027	0.151	0.032	1	0.858	0.973
Piped			4.596		0.778	
wells and springs	-0.318	0.151	4.467	1	0.629	0.728
Surface, others	-0.222	0.131	2.890	1	0.757	0.801

Appendix 3: Multivariate model III Results

Model III : Bio-demographic factors controlling for socioeconomic factors						
	B	SE	**Wald**	**df**	**Sig.**	Exp(B)
Rural	-0.257	0.130	3.922	1	0.048	0.773
Somaliland			6.792	2	0.034	
Puntland	0.193	0.150	1.660	1	0.198	1.213
Central South	0.331	0.131	6.417	1	0.011	1.393
None			0.815		0.846	
Koranic	0.072	0.119	0.368	1	0.544	1.075
Primary	-0.072	0.143	0.250	1	0.617	0.931
Secondary +	0.020	0.277	0.005	1	0.942	1.021
Poor			3.742		0.154	
Middle	-0.050	0.117	0.180	1	0.672	0.952
Rich	-0.333	0.190	3.078	1	0.079	0.717
Female	-0.164	0.090	3.314	1	0.069	0.848
15-24 years			1.264		0.532	
25 - 34 years	0.025	0.110	0.050	1	0.824	1.025
35 + years	-0.098	0.127	0.591	1	0.442	0.907
Not in union	0.323	0.151	4.585	1	0.032	1.382

Appendix 4: Multivariate Full model Results

Full model : Socioeconomic, environmental and bio-demographic factors						
	B	SE	Wald	df	Sig.	Exp(B)
Rural	-0.153	0.142	1.155	1	0.282	0.858
Somaliland			7.404	2	0.025	
Puntland	0.248	0.152	2.675	1	0.102	1.282
Central South	0.356	0.132	7.308	1	0.007	1.427
None			0.787		0.852	
Koranic	0.051	0.120	0.182	1	0.670	1.052
Primary	-0.092	0.143	0.411	1	0.521	0.912
Secondary +	-0.052	0.278	0.035	1	0.851	0.949
Poor			5.299		0.071	
Middle	-0.068	0.141	0.236	1	0.627	0.934
Rich	-0.425	0.220	3.717	1	0.054	0.654
Female	-0.172	0.090	3.639	1	0.056	0.842
15-24 years			10.174		0.006	
25 - 34 years	-0.238	0.126	3.567	1	0.059	0.788
35 + years	-0.478	0.151	10.018	1	0.020	0.620
Not in union	0.363	0.152	5.729	1	0.017	1.437
Child. = 4 and above	0.521	0.118	19.555	1	0.000	1.684
Has toilet	-0.005	0.151	0.001	1	0.976	0.996
Piped			5.105		0.778	
wells and springs	-0.330	0.151	4.789	1	0.629	0.719
Surface, others	-0.249	0.131	3.616	1	0.757	0.779