DETERMINANTS OF MORTALITY DIFFERENTIALS IN INFANCY AND CHILDHOOD BY SEX IN KENYA.

BY

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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Otieno G.G. Apiyo (2001)

DEDICATION

This work is dedicated to all women in third world countries, in their daily struggle to attain the very best for their offsprings.

ABSTRACT

The main objective of this study is to find out the determinants of mortality differentials by sex among infants and children in Kenya. The study examines sex differentials in childhood mortality by birth order and also attempts to determine the principal behavioural mechanisms responsible for mortality differentials among boys and girls.

The rationale of the study is that once the determinants of mortality differentials by sex are known then preventing excess mortality among either boys or girls who are exposed to the same environmental conditions becomes easier. The study applied direct estimation methods for child mortality rates using the 1993 Kenya Demographic and Health Survey (KDHS) data. Logistic regression method was used to study the childhood mortality determinants for males and females separately.

There are wide regional variations in immunisation by sex. Higher immunisation coverage was recorded among male children in Western and Rift Valley provinces while in Coast and Central provinces, more female than male children were vaccinated. Girls in Coast province and boys in Central province had higher immunisation drop out rates compared to their counterparts of opposite sex. The analysis further indicates that there were no significant differentials in the duration of breast feeding and nutritional status of boys and girls.

Boys and girls are subjected to the same physical and personal environment given that there are no pronounced differentials by sex in the prevalence of fever and cough, diarrhoea and also cough with short rapid breathing. At the national level, Kenya has no significant differentials in the health care coverage given to male and female children suffering from fever and cough or cough with short rapid breathing. However, at a provincial level,

compared to girls suffering from these ailments, boys in Coast province were more likely to be given health care attention.

The study finds that immunisation coverage is the most significant determinant of infant and child mortality. In Coast province with higher girls relative to boys' immunisation dropout rates, there was higher female than male post neonatal mortality. In Central and Western provinces with more male than female immunisation dropout rates, boys die more than girls in the post neonatal period in Central province, and in the 12-23 age group in Western province. Regarding health care, higher male than female toddler (12-23 months) mortality in Nairobi province coincides with less frequent parental visits to health care facilities to treat boys than girls, in the event of fever and cough or cough with short rapid breathing. Higher female than male Post neonatal mortality in Coast province also coincides with higher health care coverage given to boys, relative to girls in the event of fever and cough and also cough with short rapid breathing.

The study recommends an intensification of immunisation promotion programs placing greater emphasis on equal immunisation coverage for male and female children in Coast and Central province, and reduced immunisation dropout rates for subsequent doses after the first dose of DPT and polio vaccines. The study also calls for change in attitude and practice regarding health-seeking behaviour so as to increase health care coverage among children of both sexes, especially in Nyanza and Western provinces. Further research is recommended on a household level analysis of the effect of family composition on mortality differentials by sex in Kenya.

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CHAPTER ONE

INTRODUCTION

1.1 Introduction

The higher male mortality rates in the world during the neonatal period is consistent with evidence from many societies that the biological risk of death is higher among male children than among female children. The reversal of the sex differential of mortality, markedly so during childhood and persisting through adolescence was postulated to be reflective of sex-biased health and nutrition related behaviour favouring male children (Pebbley & Amin, 1991; Meegama, 1986; Ware, 1986; Preston, 1976).

The International conference for Population and Development (ICPD `94) echoed that in many parts of the world, there is excess and preventable mortality among female infants and children based on the unequal treatment of the children in the provision of nutrition, health care, education etc. Kenya has not been spared the horror and today, many organizations have sprung up advocating for gender equality and equity. Discrimination against the girl child has been at the centre of most of their activities.

It is against this background that this study looks at the behavioural mechanisms (sex biased attitudes in the utilisation of health services, intra family food distribution etc.) which has led to the observed Infant and Child mortality patterns in the country. Suffice it to say that data gathered from the Kenyan scenario (1979 census; 1989 Kenya Demographic and Health Survey, KDHS; Ewbank et al., 1986) on infant and child mortality differentials by sex reveals that female children are better off when compared to their male counterparts.

Statement of the problem

In Kenya, the growing literature on mortality suggests several generalizations. These studies have shown that there is excess male infant and child mortality (Anker and Knowles, 1977; Mott, 1982; United Nations 1985). Evidence from the most recent data set (KDHS 1993), indicates that though small, there exists sex mortality differentials in Kenya and that with the exception of Turkana district, there is a higher infant death

probability among male births for all the provinces covered by the survey.

However, such aggregate figures and generalisations normally mask significant differentials between different socio-economic and demographic groups and geographical areas in a country. In Koyugi's 1992 scrutiny of age specific hazard rates for example, he found excess female mortality in some age segments such as 1-3 months and 12-24 months in rural Kenya.

The many studies carried out in Kenya on mortality differentials have left unanswered several important questions. For instance, studies by Kichamu, 1986; Ondimu, 1988; and Kibet, 1982 describe the differentials but fail to offer explanations as to why they exist. There is therefore need to go beyond mere description of mortality differentials and come up with explanations to the emerging differences. Mott (1982) and Ewbank et al. (1986) give variant explanations for the differentials. Ewbank et al. attributes excess male deaths at infancy and childhood in Kenya to biological factors. Mott attributes excess Male deaths to the value attached to girls or the bride price they bring. Both explanations for the emerging sex mortality differentials are inferential in the sense that the explanatory factors have not been linked to mortality at the level of the individual child.

This study attempts to look at the determinants of the mortality differences between male and female infants and children at all parity levels and in most age segments in Kenya. The scarce literature on mortality differentials by sex means that little is known of how these factors work together to influence the different male and female infant and child mortality rates. There is therefore need to know the behavioural mechanisms that may be responsible for observed sex mortality differentials at infancy and childhood in Kenya. There is also need to know which of these factors are more important in determining sex mortality differences in the country.

Justification of the study

KDHS collected extensive information on the demographic and social trends in Kenya, which makes data for this study to be readily available. It is important to study sex differentials because it helps to determine the

health and nutritional problems faced by one and not the other sex of the same population living in the same environment.

The study has both research and policy significance. From the policy point of view, findings from this study will provide invaluable information on sex differentials in mortality which could be used as a basis for measuring health inequalities among and within communities, and for identifying those population groups whose lives can be improved by appropriate changes in government nutrition and health policies aimed at improving male and female infant and child health. This study will also help leaders measure the progress of their immunisation and nutrition campaigns and where necessary target education campaigns and services to population subgroups at a higher risk.

From the research point of view, most previous studies in the country tend to overlook mortality differentials by sex and instead concentrate on regional differentials. This study will hence fill the research gap overlooked by many scholars in the country.

1. 4 Scope and limitation of the study

The study Attempts a representation of the whole country- Kenya. It will look at all infants less than one year old and children of between one and four years. Limitation of time, money, and lack of variables to be studied in other data sets e.g. the census, will delimit the study to rely on KDHS data alone.

KDHS sample points were selected from a national master sample maintained by central bureau of statistics, the third national sample survey and evaluation program (NASSEP-3). Though the sample was national in scope, it excluded all the three districts in Northeastern province and four other northern districts namely; Samburu, Turkana; Marsabit and Isiolo, which together account for close to 4 percent of Kenya's population. The study may therefore not truly represent districts such as Turkana, which previous studies have shown to exhibit high female and not male mortality.

The survey covered 7540 women of child bearing ages 15-49. Many studies have in the past documented

evidence that not all women in this reproductive age span are fecund. Furthermore, not all under-fives were covered since KDHS did not collect data from children of deceased, institutionalised or mothers who were not interviewed.

1.5 Objectives of the study

The general objective of this study is to look at the determinants of mortality differentials by sex among Infants and children in Kenya. Specifically the study aims at:

(i) Estimating infant and child mortality rates by sex and Province.

(ii) Examining sex difference in childhood mortality by birth order of the individual child.

(iii) Exploring the principal behavioural mechanisms by which sex differentials in childhood mortality are brought about. This is done through:

(a) Looking at the effect of immunisation coverage and medical care received by boys and girls on the mortality of male and female infants and children.

(b) Looking at the effect of duration of breast-feeding and nutritional status of boys and girls on the mortality of male and female infants and children.

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

In this section, a review is made of the work that has been covered on the topic of interest both in the country and in the world as a whole. This is done in order to identify the research gaps and draw comparisons of findings in previous studies with findings of this study. A theoretical framework is also discussed in this section, which identifies variables relevant to the explanatory variables used in the study. From this framework, an operational framework is derived which is helpful in meeting the objectives of this study.

2.2 Literature review

Through out the animal kingdom, there prevails an inferior male longevity. Hamilton in 1948 reviewed approximately sixty studies encompassing about seventy-five species and found inferior male longevity in almost every case. Represented were nematodes, crustaceans, insects, arachnids, reptiles, birds, fish, as well as mammals.

Life expectancy at birth among males for the world as a whole has been found to be relatively shorter than that of the females. It has also been established that in the developed nations with no sex differences in infant and child mortality, the female life expectancy is much higher than that of their male counterparts (U.N. 1993:48). However, in parts of the world with very high mortality differences in infancy and childhood by sex such as Asia, the male-female difference in life expectancy was at its lowest and in favour of women.

However, Stolinitz (1956) points out that consistently higher female longevity has been far more common than higher female age specific survival ratios. He states that since 1840's, higher men life expectancy at some ages was fairly frequent in non Western Europe before World War 1, in Latin America, Africa and Asia up until 1950's. The United Nations also ascertains that in southern Asia, between 1985 and 1990, men had a higher life expectancy than women (UN, 1993:50).

Historical evidence in the United States of America has shown how sex ratios in childhood are skewed with a relative excess of males in agriculture and frontier areas and the reverse in urban and industrial areas. This is explained by differential childcare based on sex specific economic value of children to the household in agricultural verses urban settings (Hammel et al., 1983:346 - 366).

In Europe, historical evidence from U.K. (England and Wales in the 19th century) shows that girls fared badly as compared with their male counterparts. This is because the best food was preserved for sons and husbands who brought wages to the family purse (Johansson, 1972: 163-181).

In some countries of the near and middle east and also the Indian sub-continent, there is high and excess female infant and child mortality. In most parts of southern Asia including northern India and Bangladesh, female mortality is normally higher than Male Mortality after the first month of life (Das Gupta, 1987; Dsouza and Bhuiyya, 1992; Arriaga and Way, 1988; Pebley and Amin, 1991).

Differences between the mortality of male and female children are found in nearly all populations. In almost all contemporary societies, male mortality rates in both the neonatal and post neonatal periods are higher than female mortality rates (Preston, 1976; Heligman, 1983; Rutestein, 1983; Ware, 1996; Gbenyon & Locoh, 1992). During the period 1985-1990, the probability of dying before age five was higher among male births than among female births for the whole world. Out of 1000 male births, 99 males were likely to die before reaching age five, whereas among 1000 female births in the same period, 96 were likely to die before age five (UN, 1993:48).

The small male-female difference in global child mortality rates between 1985-1990 masks considerable variations among the major areas of the world, particularly those in less developed regions. Africa and Latin America had the highest level of excess male infant and child deaths (16 and 17 excess deaths per 1000 births respectively). On the other hand, the probability of dying before age five was higher among female births in Asia (UN, 1993:50). Within countries, there exists a substantial degree of socio-economic and cultural heterogeneity. It is thus expected that infant and child mortality rates will differ within countries as well.

Infant lives depends principally on selected genetic characteristics, on the environment in which they are raised, on the care that they receive from their parents and on the health facilities that a society can offer them. Compared to their male counterparts, the female children have a greater survival advantage. This is attributed to the biological difference between the sexes, in which the males are physiologically disadvantaged. Females possess the 2x chromosome, greater average levels of oestrogen, a higher brain weight, invisible generative organs and easy adjustment to the environmental temperature than their male counterparts (Preston, 1976). The neonatal period is the most unfavourable for boys due to endogenous mortality.

External health and nutritional factors have however become increasingly important in determining the survival chances of the older infants (Mott, 1982). The current observed higher female mortality rates in some countries are associated with differential parental treatment of their male and female children. This is shown in uneven childcare practices, feeding and weaning practices, medical care and infanticide (Nadarajah, 1983; Meegama, 1986). Most causes of death in the first month of life are beyond the family's immediate control hence higher male mortality in the neonatal period. However, environmental factors that can easily be manipulated by family members e.g. nutritional intake, exposure to disease and the use of health services are the major causes of excess female mortality after the neonatal period (Chen et al., 1982).

Williamson (in Douglas 1966:263-272) has reviewed evidence of parental preference of sons or daughters around the world. In an overwhelming majority of cultures that he studied, there is a strong preference for sons. It is only in five cultures where there was a strong preference for daughters, two of which practised the infanticide of boys. Cleland et al. (1983) reviewed world fertility survey data from several countries. They found that only Jamaica and Venezuela had an overall preference for daughters, while fourteen countries had a strong preference for sons. Eleven countries including Kenya were found to have an overall equal preference for sons and daughters. In cases where amniocentesis (determining the sex of the child before birth) was done in India, out of a sample of 700 sex determinations in a hospital, 95% of women bearing female foetuses chose to have them evacuated but no pregnancy involving a male, even in instances where genetic defects had been

diagnosed, was terminated (Ramanamma and Bamawale, 1980: 107-110). This shows a deep-seated discrimination against girls in India even before childbirth. In Ludhiana district of rural Bangladesh, girls with older surviving sisters have higher mortality risks than other siblings, even when other aspects of family composition and socio-economic factors that may affect both family size and mortality risks are held constant (Pebley and Amin, 1991). Incidentally, the number of surviving older sisters affects girl's survival chances only after the first month of life. There is hence a strong case of preferential treatment of sons in the Asian subcontinent (which accounts for the mortality differentials in childhood and infancy by sex) since preferential treatment more often affects mortality rates only after the neonatal period. Meegama (1986) confirms the above findings. Her study indicated that in Sri Lanka, in 1986, there was continued presence of discrimination in favour of sons either in health care in times of illness or in intra-family distribution of food.

Child survival depends on nutritional status. The relationship that exists between nutritional status and infection is synergistic (Scrimshaw, 1968; Bennet and Stanfield, 1972; Gordon, 1976). Infection aggravates or leads to malnutrition through anorexia causing reduced food intake and reduced food tolerance. Malnutrition on it's part reduces the body's resistance to infection as it limits the formation of antibodies in response to antigenic stimulus and also reduces the number of phagocytes and their capacity to act, leading to reduced immunity.

The bulk of childhood deaths in developing countries are attributable to otherwise minor childhood infections that are aggravated by malnutrition. Malnutrition causes otherwise minor childhood illnesses to become killers because the child's resistance has been lowered. Epidemiological studies have documented evidence that malnutrition is associated with as much as tenfold higher risk of child death in the Americas (Puffer and Serrano, 1973); $^1/_2$ of infant deaths in Guatemala; 25 percent of infant and child deaths in India (UN, 1986); and convulsions, digestive disorders and death in Colombo municipality (Meegama, 1986).

Studies linking nutritional status to child mortality indicate that anthropometric indicators are significant predictors of infant and child mortality (Sommer and Lowenstein, 1975; Chen, et al., 1981; Jellife et al., 1966;

WHO, 1963). Children are weighed and measured and from this, indices such as weight for height, weight for age and height for age are constructed. This is compared with measures of the international reference population (as per the WHO or Harvard standards). Height is largely determined by nutritional levels during early years of life up to puberty and is therefore an indication of a person's nutritional history (Bongaarts and Delgado, 1977). Low height for age reflects long run food consumption problems and is an indicator of chronic deficiency (stunting) in vitamins, minerals, proteins and calories over an extended period of time. Weight for age is an indices of adequateness in intake in recent weeks or months. It reflects acute malnutrition (wasting).

There exists a curvilinear relationship between mortality risk and malnutrition such that severely malnourished children have many times greater risk of dying, moderately malnourished children have somewhat higher risk of dying when compared to well nourished children (Koyugi, 1992:21). Nutritional status of children under age five is a sensitive indicator of health status and reflects infant and child feeding practices. Differential allocation of food and health care within the household largely accounts for the mortality differentials by sex (Chen et al., 1981).

In Asia, Chen et al., (1981) found that nutrient intake relative to requirement is lower among female children, and that girls with diarrhoea are less likely than boys to be taken to treatment facilities. Caldwell et al., (1988) ascribed higher female child mortality in southern India to differential feeding practices. Other studies attribute the higher female child mortality rates in Asia to the more frequent use of health care for boys rather than discrimination against girls in food allocation. Such include studies on Uttar Pradesh in northern India (Basu, 1989); Matlab in rural Bangladesh (Chen et al., 1981); Khanna in India (Das Gupta, 1987; Wyon & Gordon, 1971).

In Kenya, National Nutritional Surveys (1977 and 1982) showed that malnutrition problem was most prevalent in Coast, Eastern and parts of Nyanza provinces. Although areas with more malnutrition were found to have higher child mortality, the regression analysis using district level proportion of children categorised

nutritionally as stunted yielded results indicating insignificance of the nutritional factor as a determinant of child mortality (UN, 1986). The data further indicated that there is no significant difference in nutritional status between boys and girls in Kenya. Evidence from the KDHS report (1993) backs this finding by asserting that the proportion of underweight children varies little by sex in Kenya.

Most analysts expect that son preference will leave its most visible mark on sex mortality differentials among the very poor and least educated families, among whom choices are necessarily cruellest (Ware, 1986; Muhuri & Preston, 1991; Gbenyon & Locoh, 1992). Ware (1986) further asserts that parents only discriminate when resources such as food are limited or when it becomes necessary to seek costly medical treatment. In such instances, girls are the most disadvantaged when compared with boys. Where resources become available, it becomes possible for parents to avoid the difficult decision of allocation of resources between their children. Girls therefore benefit much because their mortality is relatively easy to prevent with the allocation of marginally greater resources to their maintenance. Evidence on this score is mixed. Many studies of relationship between socio-economic status and mortality in Asia find that mortality of male and female children is equally responsive to family income (Chen, 1982; Heligman, 1987). Other studies present evidence that higher child mortality in high-income families is concentrated among male and not female children (Das Gupta, 1987).

Closely related to the socio economic status is the issue of kinship. In northern India where girls do not make long run contributions to the family household and require larger dowry during marriage, poor families maximises their (the poor families) chances of survival by giving preferential treatment in food and medical care to boys relative to girls (Bairragi & Radheshyam, 1986; Ware, 1986). For Kenya, Mott (1982) attributes the slightly higher female relative to male child survival chances to the high value attached to girls for the bride price that they bring to their families.

With regards to education, though studies have found an inverse relationship between maternal education and infant mortality in Kenya (Ondimu, 1987; Anker & Knowles, 1977; Caldwell, 1979), Meegama in 1986

found that for Sri Lanka, the influence of maternal education on infant and child mortality operates only in the post neonatal period. In rural Bangladesh, maternal education had the most significant effect on the nutrition status of boys while paternal education had a positive influence on the mortality of girls (Bhuiyya et al., 1986). One study finds reduced mortality differences between female and male child mortality among Indian family households with better-educated mothers (Simmons et al., 1982). Studies of Punjab, India (Das Gupta, 1987) and of Matlab, Bangladesh (Bhuiya and Streatfield, 1991) find excess female mortality to be greater in families with better-educated mothers.

In Latin America (Guatemala), the conditional probability of visiting a clinic given the existence of simple diarrhoea or diarrhoea with blood and mucus were with one exception higher for boys than for girls. This is possibly related to cultural sex preferences (Delgado et al., 1986: 145-170). Studies from Asia have documented evidence that parents visit modern health care facilities less frequently to treat girls than boys (Wyon & Gordon, 1971; Mosley et al., 1972; Basu, 1989; Chen et al., 1981).

In Africa, census data from Cameroon, Liberia, and Mozambique suggest a certain degree of discrimination against girls after infancy, which is manifested in the care given to sick children that mostly favours boys (Gbenyon & Locoh, 1992). Studies from African cities e.g. Abidjan, Bamako and Brazzaville further suggest discrimination against female children on the basis of health expenditure and frequency of visits to free clinics (Locoh, 1987).

Gbenyon & Locoh (1992) conducted a study on mortality differences in childhood by sex in sub-Saharan Africa. Using census data from Gambia (1993), Ghana (1971), Kenya (1979), Malawi (1977), Zimbabwe (1982); ten World Fertility Surveys data such as Northern Sudan (1979), Benin, Ivory Coast and Mauritania (1981-1982), and Kenya and Lesotho (1977-1978); registers of burial permits and rural multi round surveys, they found that the excess male mortality in the first year of life is most typical of the neonatal period when boys have a lower resistance. Afterwards, the risks are more even. Gaisie (1981) confirms this finding and states that the reasons for the existence of higher death rates for males relative to females in tropical Africa

stems from excess infant and childhood mortality among the males.

Regional variations in mortality differentials by sex also exists with some countries such as Mozambique and Mauritania recording excess female mortality while others such as Ivory Coast and Zimbabwe appear to have excess male mortality between children aged 1-4 years (Gbenyon and Lockoh, 1992). However, though they found that in most of Africa there is absent or insignificant mortality differences between boys and girls, they also noted that the recent declines in mortality in the region between ages 1-4 have often benefited boys more than girls.

The World Fertility Survey (1977-8) shows that Kenya has an excess female mortality in the post-neonatal period, with a sex ratio or probability of dying before age one recorded at 138 in the neonatal period and 88 in the post-neonatal period. This could be suggestive of differential treatment of both sexes in the post neonatal period. The small difference in infant and childhood mortality by sex noticed in the 1979 census data and 1989 KDHS data are attributed to inherent biological differences between the sexes rather than cultural practices (Ewbank et al. 1986:45). The only exception to this statement in the whole republic is Turkana district, which reported excess female mortality at infancy childhood and even in adulthood. Anker and Knowles (1977) also found that in Kenya males had significantly less survival chances from birth up to age three.

In a multivariate analysis of determinants of infant mortality in Kenya done by Mott (1982), males were significantly less likely to survive the first year. He attributes the slightly higher child survival rates of females than males in Kenya to the high value attached to girls for the bride price they bring their families. This conclusion could therefore be taken to mean that there is preferential treatment of girls when compared to boys in Kenya. However, this assertion contradicts the one postulated by Ewbank et al., 1986 (noted above), stating that the small difference in mortality by sex is due to biological reasons.

Such generalizations for the whole country normally mask otherwise very important variances at a micro level. For instance Koyugi's (1992) study expectation was that male infants and children suffer slightly higher

mortality in general than females. However, on further scrutiny of age specific hazard rates, he found an excess female mortality at ages 1-3 months and 12-24 months in rural Kenya. His Log (-log) plots of the life table's survival probabilities from birth shows that the differentials by sex are small and reduce with an increase in age.

Ware (1986:113) identifies three stages in the development of sex differentials in mortality. The prehistoric/traditional societies which have high levels of mortality and female mortality greatly exceeds male mortality due to heavy risks in childbearing ages, more complex societies in which females experience a mortality advantage resulting into longer lifespan than males but female mortality levels may still exceed those for men during the peak childbearing years, and complex societies in which maternal mortality has been eliminated as a major cause of death and females enjoy a mortality advantage in every age group. Life expectancy at birth for females in this last stage exceeds that of males by three years or more. This three stages do not however cover societies with marked discrimination against females in the allocation of resources, or even societies where the male are gravely disadvantaged by the impact of warfare or local feuding. It would be interesting to find out where Kenya lies in this set up.

2.3 Theoretical framework

The conceptual framework found to be relevant for this study is that one adopted by Chen et al. (1981), for the analysis of the mechanisms by which sex biased health and nutritional behaviour might operate to produce the observed mortality differences in children (see figure 1 below).

It is based on the premise that the major causes of child deaths in developing countries are protein - caloric malnutrition and common childhood infections such as diarrhoea, measles, and respiratory infections. Protein - caloric malnutrition is basically determined by the quality and quantity of food intake (including breast feeding) and infections. Infections determine nutritional status through a series of biological mechanisms, which causes loss of appetite, gastro intestinal mal-absorption of ingested nutrients and metabolic wastage of

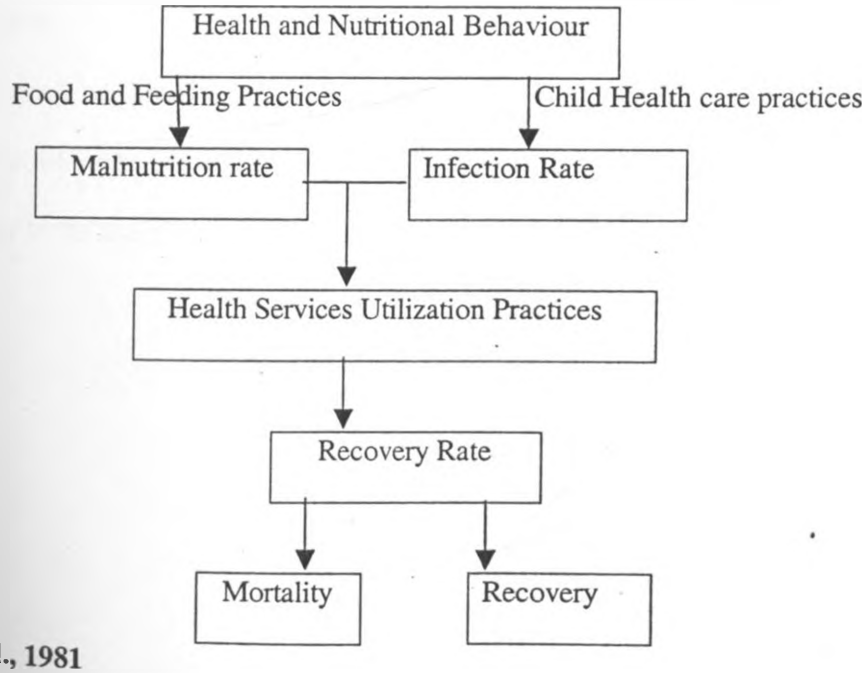
available nutrients in the body.

Infections in turn are basically determined by two factors: host susceptibility (that is, the capacity of the host to defend himself against infection), which is in part determined by the host's nutritional status, and exposure to disease transmission [believed to be affected by the quality of physical (water, sanitation and housing) and personal (child care, hygiene) environment].

In addition to nutritional status and infection, child mortality would also be expected to be influenced by health care practices in response to illness. Improved recovery would be dependent in part upon the nutritional status of the host and the utilisation of available modern medical technology (antibiotics against common childhood diseases) and oral rehydration and feeding rehabilitation).

The framework identifies several health and nutritional behavioural and outcome variables that sex biased attitudes would have to operate through in order to affect mortality. These include malnutrition rate, infection rate and recovery rate. These rates are in turn influenced by the behavioural patterns related to food intake and health services utilisation.

Fig 1: Conceptual framework of health and nutritional determinants of child mortality



Source: Chen et al., 1981

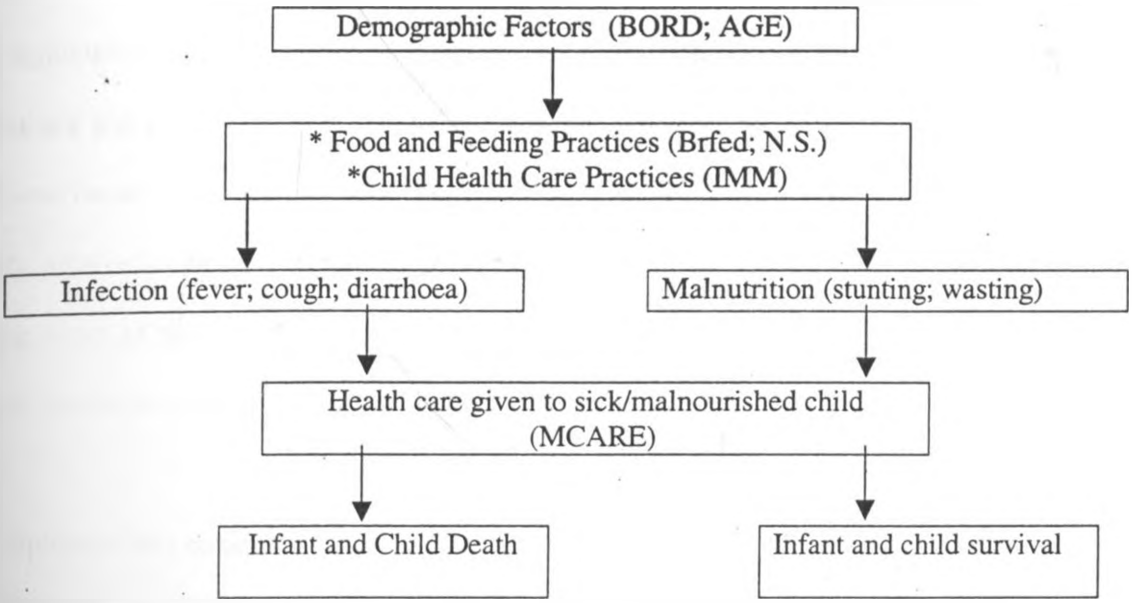
In order to meet the objectives of this study and allow for the inclusion of demographic variables, the conceptual framework shown in figure 1, which was adopted by Chen et al (1981), was slightly modified. This was on the basis of the assumption that the health and nutrition behaviour of a parent towards a child will partly be influenced by the birth order and age of the individual child.

Variables selected for use in this study are based on factors identified from previous studies on the subject and is covered in the literature review. In this study, the parent's nutritional behaviour (food and feeding practices) shown in the conceptual framework in fig 1 is operationalised through the *duration of breast feeding* variable and the *nutritional status* variable (represented by weight for height and height for age). The parent's health behaviour toward the child (child health care practices in fig 1) is operationalised through the *immunisation coverage* given to an individual child variable.

Depending on the type of care a child receives, he or she will be infected with fever, cough, diarrhoea, or be malnourished as is represented by stunting (low height for age) and wasting (low weight for age). Health services utilisation variables included in this study is the type of *health care given to sick children in the event of illness* variable. Finally, the outcome variable in the study is the risk of death during infancy and childhood up to age five.

Because of the small sample size used by the study, it was not possible to compute malnutrition rate, infection rate and recovery rate (shown in Chen et al.'s (1981) model in figure 1). Consequently, these rates are left out altogether in the study's operational model, schematically presented in figure 2.

Fig 2: Operational model used in the study of the determinants of sex mortality differentials in infancy and childhood in Kenya.



Source: adopted and modified from the Chen et al. conceptual framework, fig. 1

KEY:

BORD: Birth order of the individual child

AGE: Age of the individual child

Brfed: Duration of breast-feeding of the individual child

N.S: The Nutritional status of the individual child (given by anthropometric indicators, height for age and weight for height).

IMM: The Immunisation coverage given to individual children

2.4 Conceptual hypotheses

This study hypothesises that the health and nutritional behaviour of the parent towards the child and also the demographic characteristics of the child will have an effect on male-female mortality differences in infancy and childhood in Kenya.

2.5 Operational hypotheses

The study expects to find:

(i) No difference in the death of boys and girls by birth order or age of the individual child.

(ii) No significant difference in male and female infant and child deaths, by duration of breast-feeding and Nutritional status.

(iii) Male and female children given better immunisation coverage have significantly lower risks of death, relative to their counterparts in worse categories.

(iv) In the event of an illness, male or female children given appropriate medical care compared with their counterparts will be associated with lower risks of death.

2.6 Definition of key concepts

Neonatal Mortality:	The probability of dying within the first month of life.
Post neonatal mortality:	The difference between infant and neonatal mortality.
Infant mortality:	The probability of dying before the first birthday.
Under five mortality:	The probability of dying between birth and the fifth birthday.
Child mortality:	The probability of dying between the first and the fifth birthday.
Place of residence:	It refers to the usual province of residence. Included here are those provinces in which the 1993 KDHS survey was carried out. This includes Nairobi province, Central province, Eastern province, Western province, Coast province Nyanza province and Rift valley province.
Immunisation drop out rate:	Not all children who received DPT1 and Polio 1 vaccines received subsequent doses of DPT 2 and 3, and Polio 2 and 3 vaccines. The difference between the first and last doses of DPT and polio vaccines administered to an individual child is called an immunisation dropout rate.

CHAPTER THREE

DATA SOURCES AND METHODS OF ANALYSIS

3.1 Introduction

In this chapter, the source of data used in this study is discussed. The main source of data in this study is the 1993 Kenya Demographic and Health Survey (KDHS). Direct methods of data analysis are used in the study. Infant and child mortality rates, sex mortality ratio, mortality rates by birth order and immunisation dropout rates are estimated. A multivariate regression analysis is also run.

3.2 Data sources

The 1993 Kenya Demographic and Health Survey (KDHS) was used as the source of data. It was a nationally representative survey of 7540 women aged between 15 - 49 years and 2336 men of 20 - 54 years. The fieldwork took place from mid February to mid August 1993. The National Council for Population and Development and the Central Bureau of Statistics, with the technical assistance of Macro International Inc conducted it. The Kenya government and the United States Agency for International Development (USAID) funded it. Data was collected on fertility, infant and child mortality, knowledge and practice of family planning, maternal and child health and AIDS awareness.

From the KDHS birth history data, child files were created for all the births occurring to women in the most recent five-year period preceding the survey i.e. July 1989 to July 1993. From this, data was obtained on study variables such as the birth order, use of health facilities, immunisation coverage, duration of breast-feeding, and mean weight and height of the children. Information was also obtained on the children's survival status up to age five. Information on the mother's education and on the household's socio-economic characteristics was also collected from the 1993 KDHS. A problem with child files is that they assume that the

individual children are independent cases. Linking them to particular households becomes a problem, a factor that makes it difficult to obtain information on the number of surviving older brothers and sisters at the birth of the index child.

3.3 Data quality

As noted earlier, the source of data is the 1993 KDHS, which was carried out by well-trained researchers and research assistants. In spite of this, the quality of data used in this study may have had some limitations, which may be beyond the scope of the research.

This study analyses Kenyans population based on age, sex and birth order. The main problem with the quality of sex data particularly in developing countries relate to differential completeness (Shryock & Siegel, 1976). Estimates of infant and child mortality in this study are calculated from retrospective birth histories based on questionnaires administered to individual women in the 1993 KDHS survey. Characteristic of most retrospective studies, the study estimates may be replete with errors that arise as a result of memory lapse, political reasons or deliberate misreporting of infant births and deaths due to religious reasons and cultural taboos which may make it hard for the mother to disclose past deaths (Kpedekpo, 1977). A cursory inspection of the data quality reveals no evidence of selective under reporting or age at death misreporting. This is because the proportion of death that occurred during the first month of life (during which time under reporting of infant death is usually most severe) is quite plausible (44- 50 percent). Secondly, the data exhibits higher male than female deaths in the neonatal period, a pattern consistent with established mortality estimates for the whole world.

Anthropometrical indicators (height for age and weight for height) were used to assess the child's nutritional status in this study. The validity of such indices is determined by the coverage of the population of children under study. However from the study data source, only 84 percent of eligible children were represented in the analysis. Excluded from the analysis were children whose information on height for age

was missing because they were not at home when the interviewer called by. Also excluded were information on children whose month or year of birth was not reported by the mother and also those children with improbable height or weight measurements resulting from recording or misreporting errors.

Information on immunisation coverage was based on vaccination cards and also the mother's verbal reports. In places where vaccination cards were available, an interviewer recorded the vaccination dates directly from the cards. Where the vaccination cards were not available, mothers were asked to recall if a particular vaccine was administered. This therefore opened room for errors in the study data arising due to memory lapse or deliberate misreporting of the vaccines given to individual children of a particular sex. Secondly, the quality of immunisation data may be suspect because polio 0 was only recently introduced in Kenya. Apart from the fact that in most places mothers may have confused this vaccine for polio 1 vaccine, it is also possible that some cards in various health centres did not have the Polio 0 vaccine listed on them. It is because of this reasons that this study decided to use only polio 1,2 and 3.

Like immunisation, data on medical care coverage given to sick children, depended entirely on the mothers' report on the prevalence and treatment of various ailments among children. Information obtained was mostly subjective as it depended entirely on the symptoms that the mother considered serious, and on the mother's knowledge of the medicine that their children received. Given cultural differences in reporting, the information obtained on this variable could therefore have varied widely within the country.

3.4 Methodology of data analysis

Owing to the sample size used in the study, direct demographic techniques were used in the analysis of data, with the child as the unit of analysis. Estimates of infant and child mortality rates and differentials by sex were derived directly from the mortality information, based on the KDHS birth history data covering the period July 1989 to July 1993. From this data set, the date of birth of each child was obtained in months and years, the survival status for each birth was ascertained, and where relevant, age at death was determined and

the sex of the child recorded.

The study distinguished four survival intervals neonatal (the first month of life), post neonatal (1-11 months), toddler (12-23 months) and child (24-48 months), and noted deaths of all children in each of them. By following births in each age interval since July 1989 and distinguishing those who died from those who survived, the study was able to calculate male and female infant and child death rates for the whole country and also for all the provinces covered by the survey.

3.4.1 Infant and child mortality rates

Mortality rates were calculated using the formula

$$DR_a = \frac{D^i_a}{P^i_a} \times 1000 \quad \text{..... i}$$

Where;

DR_a = Death rate in age interval a

D^i_a = Number of deaths of infants and children in age group, a.

P^i_a = Number of persons Exposed in age interval, a.

3.4.2 Mortality sex ratios

The indices used by the study to measure mortality differences by sex were the ratio between the male and female infant mortality rate ($_1m_0$), and the ratio between male and female child mortality rate at ages 1 and 4 years ($_4m_1$). This measure of sex differentials is given by taking the death rates of females in each age interval and dividing it by that of the males in the same age interval as shown in formula (ii).

$$SMR = \frac{FDR_a}{MDR_a} \quad \text{.....ii}$$

Where,

SMR is the mortality sex ratio

FDR_a is the female death rate in an age interval, a.

MDR_a is the male death rate in the same age interval, a.

3.4.3 Mortality rate by birth order

The demographic technique used to calculate the mortality rates among children (0-4 years) of specific birth orders is given by the formula presented below:

$$Cia15\text{-}49 = \frac{D^{i}_{a\ 15\text{-}49}}{P^{i}_{a\ 15\text{-}49}} \times 1000 \quad \text{..... iii}$$

$C^{i}_{a15\text{-}49}$ is the mortality rate among children of specific birth orders, born to women aged 15-49.

$D^{i}_{a15\text{-}49}$ is deaths of male or female children (0-4 years) born in a given order to women aged 15-49 years.

$P^{i}_{a15\text{-}49}$ is the number of all children (irrespective of sex) born to women aged 15-49 in the mother's place of residence (usually a province or country).

Note: These rates were worked out for male and female children separately.

3.4.4 Immunisation dropout rate (IDR)

IDR is given by the formulas (iv) and (v).

% given DPT 1 - DPT 3.....(iv)

% given Polio 1 - Polio 3.....(v)

Where:

(iv) Is the percentage of children receiving DPT 1 vaccination minus the percentage of children receiving DPT 3 vaccination.

(V) Is the percentage of children receiving Polio 1 vaccination minus the percentage of children receiving Polio 3 vaccination.

3.4.5 Regression Analysis

To assess the relative effects of the variables of interest on the male and female mortality, various approaches have been postulated which uses the child as the unit of analysis. This includes the ordinary least

square regression, the logit regression and the log linear regression.

The log linear regression is appropriate for studies with a dichotomous outcome variable. It allows for the simultaneous incorporation of all the age intervals in the regression analysis and assumes that the conditional probability of dying during a given age interval differs between individuals with different socio-economic and demographic characteristics. It would be the most appropriate for this study. However, because of lack of a statistical package program to compute the estimates, the model was not used.

The ordinary least square regression was not used because it's assumption is inappropriate for a 0,1 dependent variable, hence inappropriate for this study.

A logistic Regression does not allow the analysis of all the age segments simultaneously. It is however chosen in this study as the best fitting and most parsimonious model to assess the relative effects of variables of interest on male and female mortality. This is because it is appropriate for a 0,1 dependent variable and the covariates of the child in each age segment. From a mathematical point of view, the logistic distribution is an extremely flexible and easily used function. It also lends itself to a biologically meaningful interpretation (Hosmer and Lemashoow, 1989). Epidemiologists have found it appealing because the logistic function assumes an S shape which provides a description of combined effect of several risk factors on the risk of disease. It is also the only approach, which affects the relative odds of dying rather than absolute mortality.

Logistic regression is a mathematical modelling approach that can be used to describe the relationships of one or several independent variables to a dichotomous or binary dependent or outcome variable. For the sake of this study, it describes the relationship of immunisation, nutrition, breast-feeding, and birth order variables to the probability of dying at age intervals less than 1 month, 1-11 months, 12-23 months, and 24-59 months. Each explanatory variable has a reference category. The dependent variable takes the value of unity if the child failed to survive through a specified age range and zero if the child survived.

The logistic model is designed to describe a probability, which is always some number between zero and one. The model is therefore always set up to ensure that whatever number we get will always be some number

between 0 and 1. It has a set of assumptions:

-The dependent variable must be dichotomous or binary coded 0 or 1.

-The conditional mean of the regression must be bounded between 0 and 1.

-The errors must be binomially distributed.

-The variables are intervally scaled.

The logistic model may be expressed as is shown in equation (vi) below,

$$\ln[{}_nq_x/({}_np_x)] = \alpha + \tau A + \beta X \quad \text{.....(vi)}$$

Where,

${}_nq_x$ is the probability that a child who survived to age x dies in the interval between x and x+n;

${}_np_x = 1 - {}_nq_x$;

α is the intercept representing the odds of dying for children for whom the values of all covariates equal zero; this parameter allows the risk of death to vary among the age strata in this study.

τ is the vector of coefficients of the age covariate vector A;

β is the vector of coefficients of the vector of other covariates, X.

To fit the Logistic regression model in equation (vi) to the set of data used in this study requires that the values of the unknown parameters be estimated. To estimate the parameters, the study uses the Maximum Likelihood Estimation method (MLE).

The study constructs a likelihood function, which expresses the probability of observed data as a function of the unknown parameters. The maximum Likelihood Estimators of these parameters are chosen to be those values, which maximise this function. Thus, the resulting estimators are those, which agree most closely with the observed data. This study prefers MLE to the discriminant estimates of logistic parameters because:

(a) Unlike the discriminant function, MLE does not depend on a *priori* assumption of multivariate

normality. If the normality assumption is not correct as is usually true in most applications, then discriminant function estimates can result in estimate coefficients β_i that are incorrect.

(b) MLE generally gives slightly better fits to the logistic model, judged by comparing the observed and expected numbers of cases per decile of risk.

(c) The MLE also result in the total expected number of cases equalling the observed total, which is not a property of discriminant estimates.

Halperin, Blackwelder and Verter (1971); Press and Wilson (1978) recommend MLE for use if one wants to estimate the actual magnitude of parameters or the probabilities of events under the logistic model. The discriminant function approach would work reasonably well, even when the normality assumption is violated, if one is fitting the logistic model in order to isolate relevant risk factors by means of tests of significance. MLE is found useful for this study because the study is mainly interested in estimating the probability of death under the logistic model, and estimating the actual magnitude of parameters.

The computation of maximum likelihood estimates are best done by the computer based on statistical packages with written logistic regression programs. An example of such a package is BMDP statistical package with a stepwise regression program for maximum likelihood estimation.

The interpretation of logistic results is done using logistic coefficients; beta (B) and the exponential of beta (exp B). Exp B gives the estimates of the odds ratio associated with each category of the explanatory variable. If the odds ratio of a given category is greater than one, this indicates an increased likelihood of the risk of dying. When the odds ratio is less than one, this indicates a lower risk of dying when compared to the reference category. The logistic coefficient beta is the difference in the predicted log odds of the outcome between those in the higher risk category and those in the reference category.

In this study, the enter method is used. This method tends to force all variables into the equation irrespective of their significance. Variables were entered on a step number. Estimated results were done

separately for male and female infants and children. A key independent variable in the study (Medical care provided to sick children in the event of illness) was not incorporated in the logistic regression that was run. This is because of the way in which the data was recorded in the KDHS data set. When this explanatory variable is included in the logistic model, the logistic regression analysis does not run because the dependent variable has only one value (i.e. only those children alive). For a logistic regression to run, the dependent variable must have two values e.g. dead and alive for our study.

The effectiveness of a model in describing the outcome variable is otherwise known as the goodness of fit. The adequacy of a given model will be assessed by fitting a complicated model that contains additional parameters representing particular types of departure (deviance) from the initial model. The likelihood ratio test can then be applied to determine whether the additional regression coefficients associated with the more complex model are equal to zero. When the variance is discrete, the test is equivalent to the Pearson chi square test. The Pearson chi square value will be used to assess the goodness of fit. The smaller the p value, the better the goodness of fit. A large P value is a clear indication of a substantial problem with the model. If the p value of the whole equation is less than 0.05, then the model will be considered to be adequate. However, caution should be taken in making conclusions on this basis because a large sample size will imply a correspondingly larger value of the chi square statistic even if the model substantially fits the observed cases.

Statisticians have also developed the standard error (SE) estimate to measure the reliability of the estimated equation and also give an assessment of the goodness of fit. It also measures the scatter of the observed values of the dependent variable around the regression line. If the SE happens to be zero, this implies that the estimating equation is a perfect estimator of the dependent variable. However, the larger the SE estimates, the greater the dispersion of the observed values around the regression line.

3.4.6 Definition of variables used in the regression analysis

(a) *Dependent variable*

The dependent variable in the analysis is the log of odds of dying in a particular age interval. All four age intervals [< 1 month; 1 - 11 months; 12 - 23 months; and 24 - 48 months] are pooled in the multivariate analysis. As noted, the dependent variable takes the value 1 if the child failed to survive through the specified age range and 0 if the child survived. The definition of Independent variables and the frequencies in different categories are as follows:

(b) *Sex variable*

Whether the individual child is female, (select if B4 = 1) or male, select if B4 = 0)

(c) Health and Nutrition covariates

* Immunisation dummies: Reference category (children with nil immunisation); some immunization (1 = yes, 0 = no); complete immunization (1 = yes, 0 = no)

* Breast-feeding dummies: Reference category (< 10 months,); Brfed2 (0-19 months, 1 = yes, 0 = otherwise); Brfed3 (20+ months, 1 = yes, 0 = otherwise)

* Nutrition variables: Height for age (HTA2) represents children with standard deviations greater or equal to -2, (1 = yes, 0 = no); HTA1 represents a child with below -2 standard deviation (it forms the reference category).

*Weight for height (WH2) represents children with standard deviations greater than or equal to -2, (1 = yes, 0 = no); WH1 represents children with below -2 standard deviation, (it forms the reference category).

(d) Birth order dummies

It is coded Bord2 (1 = yes, 0 = otherwise); Bord3 (1 = yes, 0 = otherwise); Bord 4+ (1 = yes, 0 = otherwise) Bord1 (forms the reference category).

(e) Age Dummies:

CMC1: Individual child less than 1 month (Reference category)

CMC2: Individual child 1-11 months (1 if yes, 0 if otherwise)

CMC3: Individual child 12-23 months (1 = yes, 0 = otherwise)

CMC4: Individual child 24-59 months (1 = yes, 0 = otherwise)

CHAPTER FOUR

INFANT AND CHILD MORTALITY DIFFERENTIALS

4.1 Introduction

In this chapter, infant and child mortality rates by sex are given for all the provinces covered by the 1993 KDHS. Variations by sex in the study variables such as Breast feeding; Immunization; Nutrition; Prevalence of morbidity; and care given to sick children are discussed. Estimates for the dependent and explanatory variables are derived directly from frequencies and cross tabulations of data in the 1993 KDHS child files.

4.2 Infant and child mortality rates by sex in Kenya, 1993

In table 4.1, the study presents male and female infant and child age-sex specific death rates. It also gives a measure of mortality sex differentials (the ratio of female to male mortality rates for neonates, post neonates, toddlers, and children). Calculations are for the period 1989 - 1993 for each of provinces covered by the KDHS

The rates are estimated directly by following up each birth to all women in the reproductive age 15-49 and identifying those who survived and those who did not. Calculations are on the basis of persons exposed in particular age segments. Because rates are calculated by splitting exposure, the infant mortality rate in this work is given per 1000 exposure ($_1M_0$) rather than per 1000 live births ($_1q_0$). Infant mortality rates calculated on the basis of exposure ($_1M_0$) are normally larger than conventionally calculated infant mortality rates ($_1q_0$) for the same population because of the size of the denominator.

Table 4.1 Infant and Child Mortality Rates and Female - Male Ratios by Age at Death, Sex and place of Residence: Kenya, 1993.

Region		Mortality rates (per 1000 persons exposures) and female-male mortality ratios by age at death in months					
	Sex/Ratio	< 1	1-11	0-11	12-23	24-48	0-48
KENYA	MALE	27.3	31.0	58.3	13.9	25.7	97.9
	FEMALE	24.3	32.1	56.4	13.3	23.9	93.6
	F/M	0.89	1.04	0.97	0.96	0.93	0.96
RIFT VALLEY	MALE	11.6	15.9	27.5	9.6	10.5	47.6
	FEMALE	18.9	14.0	32.9	5	15.3	53.2
	F/M	1.6	0.88	1.2	0.52	1.5	1.1
EASTERN	MALE	36.6	21.6	58.2	10.9	3.5	72.5
	FEMALE	19.6	22.5	42.1	8.1	13.8	64.0
	F/M	0.53	1.0	0.72	0.74	3.9	0.88
WESTERN	MALE	27.0	31.4	58.4	27.6	32.3	118.3
	FEMALE	24.2	32.5	56.7	26.2	10.5	93.4
	F/M	0.90	1.0	0.97	0.95	0.33	0.79
COAST	MALE	31.3	13.9	45.2	16.0	19.8	81.0
	FEMALE	26.1	27.3	53.4	12.8	12.3	78.5
	F/M	0.80	2.0	1.2	0.8	0.62	0.97
NYANZA	MALE	35.8	91.6	127.4	15.7	23.3	166.4
	FEMALE	39.6	97.5	137.1	22.4	29.3	188.3
	F/M	1.1	1.1	1.1	1.4	1.3	1.2
CENTRAL	MALE	27.1	21.7	48.8	-	-	-
	FEMALE	14.2	5.7	19.9	6.8	-	-
	F/M	0.52	0.26	0.41	-	-	-
NAIROBI	MALE	47.2	-	-	22.7	16.1	-
	FEMALE	47.2	20.2	49.6	12.7	-	-
	F/M	1.00	-	-	0.56	-	-

Note: F/M represents female to male mortality ratios. It is derived from the percentage of female infants and children divide by the percentage of male infants and children.

Findings in table 4.1 indicate that for the most recent five-year period (1989-1993), Kenya had a male infant mortality rate ${}_1M_0$ of 58 per 1000 persons exposed in the age group, and a female ${}_1M_0$ infant mortality rate of 56 per 1000 person exposed in the age group. Under-five male mortality rate (${}_4M_0$) for the same reference period was 98 per 1000 person exposed in the age group, and female 94 per 1000 person exposed in the age group.

In the neonatal period, male mortality exceeds female mortality rates for the whole country, a sex differential consistent with established higher biological risks of male children. During the post neonatal period, the pattern is reversed with slightly higher female death rates. This is consistent with other studies

carried out on Kenya such as the 1977-78 World Fertility Survey (WFS), which recorded excess female post neonatal mortality rate with a sex ratio probability of dying of 88. However, the post-neonatal mortality differences by sex have reduced between 1978 and 1993. Findings from KDHS, 1993 cross tabulations shows an excess post-neonatal female mortality of only 4%. Excess post neonatal female mortality could be attributed to the fact that after the first month of life, environmental and care related factors that are susceptible to societal manipulation come into play. In spite of this, the overall male Infant mortality rates are greater than that of their female counterparts in Kenya.

The infant female to male sex ratios for Kenya in the period 1989-1993 was 0.97 while the under five-sex ratio was 0.96. Note that the closer the sex ratios to 1.0, the smaller the differences in mortality by sex. These sex ratios therefore mean that at the time of the survey, female infant and child mortality rates for Kenya were lower than that of their male counterparts. However, mortality differences by sex were small for the whole country, noticeable in the neonatal (< 1 month) and child (24-48 months) and absent in the toddler (12-23 months) age categories.

A closer inspection of the mortality rates reveals that the differences in mortality by sex are quite marked for some age groups in some provinces. Though post neonatal male mortality rates in central province (21.7) were much lower compared to male rates for Nyanza (91.6), it was excess when compared to post neonatal female mortality rates in the same province (5.7). The post neonatal female/male mortality sex ratios of 0.26 in central province imply an excess post neonatal male mortality in that province. Excess male mortality was also recorded in western Province in the age group 24-48 with female sex ratios of 0.33. Post neonatal female mortality in coast province (27.3) was low when compared to Nyanza province (97.5). However, the female to male post-neonatal mortality sex ratio of 2.0 implies that coast province had an excess female over male post-neonatal mortality rates. Eastern province with lower female child mortality rates than Nyanza and Rift valley provinces, also recorded excess female mortality rates with a female - male mortality sex ratio of 3.9 in the 24 - 48 age group.

4.3 Immunization coverage

Male and female children in Kenya are vaccinated with Polio and Measles vaccines, BCG for protection against tuberculosis, and DPT for protection against diphtheria, pertussis and tetanus. Table 4.21 represents results of cross tabulations of all children who had received specific vaccinations at any time before the survey, by sex and place of residence in Kenya in 1993.

Information shown in the table was obtained from a combination of the mothers' report and vaccination cards as is presented in the KDHS data set. A disadvantage with data obtained from the mothers report is that it may have errors that arise from lapsed memories misleading information given by the mother. The age group 12 - 23 months was selected for use in the study because it represents only those children who have reached the age at which they should be fully vaccinated.

The Polio 0 vaccine was excluded from the analysis because it has only recently been introduced in Kenya on routine basis. Consequently, not all children had received this vaccine by the time of the survey.

From table 4.2 below, no significant differential in vaccination coverage for male and female children was recorded in Nairobi, Nyanza and Eastern provinces. Male children in Western and Rift valley provinces were more likely than their female counterparts to receive DPT, BCG, and Polio vaccines. In Coast and Central provinces, a much larger percentage of female children (10% more than males) were given BCG, DPT and polio vaccines.

In all the provinces covered by the survey, vaccination coverage for subsequent doses of DPT and polio vaccines declines among both male and female children. For example, in coast province, 41 percent of male children and 51 percent of female children received DPT 1 vaccine while only 37 percent of those male children and 41 percent of those female children received doses of DPT 3 vaccine. This represents a dropout rate of 4 percent and 10 percent for male and female children respectively.

Table 4.2 **Percentage of Children 12-23 months who received BCG, DPT, and Polio Vaccines, by Sex and Place of Residence in Kenya, 1993**

PROVINCE	SEX	BCG	DPT			POLIO			FULLY	NUMBER
			1	2	3	1	2	3		
COAST	B	42.4	41.0	40.3	37.4	41.0	40.3	37.4	36.6	63
	G	52.5	51.0	44.6	41.0	50.1	44.6	41.0	48.5	76
	D	-10.1	-10	-4.3	-3.6	-9.1	-4.3	-3.6	-11.9	
EASTERN	B	47.3	46.1	44.8	41.8	46.1	44.2	41.2	47.6	79
	G	50.3	47.9	45.5	43.0	47.9	45.5	43.0	42.9	86
	D	-3	-1.8	-0.7	-1.2	-1.8	-1.3	-1.8	4.7	
WESTERN	B	50.6	48.3	44.3	41.5	48.9	44.9	39.2	41.9	97
	G	40.9	40.9	39.2	36.4	40.9	38.6	34.1	30.2	89
	D	9.7	7.4	5.1	5.1	8	6.3	5.1	11.7	
CENTRAL	B	42.5	41.8	38.6	37.3	41.8	38.6	37.3	50	65
	G	55.6	56.2	51.6	51.0	56.2	51.6	50.3	46	88
	D	-13.1	-14.4	-13	-13.7	-14.4	-13	-13	4	
RIFT-VALLEY	B	50.5	49.8	46.4	43.2	48.9	46.4	42.6	43.6	167
	G	45.1	44.2	40.4	37.6	43.6	40.4	37.0	44.8	152
	D	5.4	5.6	6	5.6	5.3	6	5.6	-1.2	
NAIROBI	B	49.0	49.0	49.0	46.9	49.0	49.0	46.9	43.6	25
	G	46.9	46.9	44.9	44.9	46.9	44.9	44.9	44.8	24
	D	2.1	2.1	4.1	2	2.1	4.1	2	-1.2	
NYANZA	B	47.3	46.3	43.0	38.2	44.4	42	38.2	40.7	105
	G	46.9	45.9	43.0	38.2	45.4	42.5	37.7	45.7	102
	D	0.4	0.4	0	0	-1	-0.5	0.5	-5	

B = Boys; G = Girls; D = The % difference between male and female given specific vaccines. A minus sign(-) denotes more girls than boys were Vaccinated

4.4 Immunisation dropout rates

As noted, not all children who were immunised with DPT 1 or polio 1 vaccines received subsequent doses of DPT 2 and 3 and polio 2 and 3 vaccines. Table 4.3 below shows the difference between the first and last doses of DPT and polio vaccines administered to individual children by the time of the survey in 1993.

Table 4.3 Immunization dropout Rates (in percentages) children (12-23 months), by sex and place of residence, Kenya 1993.

PROVINCE	D P T 1 – DPT 3			POLIO 1 – Polio 3		
	MALE	FEMALE	M – F	MALE	FEMALE	M - F
EASTERN	4	5	-1	5	5	0
WESTERN	6	5	1	10	7	3
CENTRAL	5	5	0	5	2	3
RIFT VAL	7	6	1	7	7	0
NAIROBI	2	2	0	2	2	0
NYANZA	8	8	0	6	7	-1
COAST	4	10	-6	4	10	-6

Note: This table is worked out from table 4.2. M-F is the difference between the male drop out rate and female drop out rate.

From the table above, it is evident that other than Coast province which recorded very high female dropout rates between the first and third doses of DPT and Polio vaccines among children 12 - 23 months, no major differences were seen in the male and female immunization drop out rates in other provinces. The high female immunization dropout rates among children in Coast province also corresponds to excess female Post neonatal mortality rates shown by a female/male sex ratio of 2.0 documented in table 4.1.

Nairobi province recorded an equal immunization dropout rate for both male and female children. In Central and Western provinces, for subsequent doses of polio, higher dropout rates were recorded among male children. Interestingly, central province with higher polio dropout rates among male children also recorded excess male post neonatal mortality rates (a female sex ratio of o.26). Western province also recorded excess male child mortality rates with a female/male sex ratio of 0.33 (see table 4.1).

In summary, more female than male children were vaccinated in Coast province. However, higher dropout rates for subsequent doses of DPT and Polio vaccines were also recorded among female children in the province. In Western province, more male than female children were likely to be vaccinated. Slightly more male than female dropout rates were also recorded between the first and third doses of DPT and Polio vaccines. In Central province, high vaccination coverage was recorded among female children and a higher dropout rate for polio vaccine was recorded among the male children. In Nairobi, Nyanza and Eastern Provinces, no sex differences were recorded in vaccination coverage.

4.5 Breast feeding

Breast-feeding influences a child's growth and development and thus affects the child's risk of morbidity and mortality. Almost all children in Kenya (96.9% male and 97.2% female) had been breast fed for some period of time by the time of the survey. In Kenya, the place of residence does not influence the percentage of children breast-fed. 97.9% of children in western, 97% in Nyanza, 96% in coast 97% in Nairobi and 98% in central provinces were breast fed by the time of the survey, 1993. The table below shows the percentage of male and female children breast-fed for various durations in Kenya, 1993.

Estimates in table 4.4 below are based on the current status, that is the proportion of children under five years of age who at the time of the survey were breast-feeding. From the table, no significant differentials are noticed in the duration of breast-feeding among male and female children under- five years in Kenya. The proportion of male and female children in Kenya who were breast-fed for durations of between 0-9 months, 10-19 months, and over 20 months was found to be almost the same. Most of male and female children in Kenya were breast fed for periods between 10 and 19 months.

Table 4.4 Percentage of breastfeeding children under five years of age, by sex and region of residence in Kenya, 1993.

		Duration of Breast feeding in months			
Region	Sex	0-9	10 - 19	> 20	No. of Children
Kenya	Male	21.9	48.5	27.2	2040
	Female	20.7	49.5	27.4	2029
Nairobi	Male	31.6	36.8	29.8	57
	Female	26.7	35.6	35.6	45
Central	Male	18.5	56.6	23.7	173
	Female	16.2	58.8	24.5	204
Coast	Male	25.0	38.8	32.5	240
	Female	22.3	45.0	28.1	242
Eastern	Male	18.8	44.6	31.4	303
	Female	15.0	50.3	32.0	306
Nyanza	Male	25.7	45.6	27.0	395
	Female	24.8	44.5	28.8	400
Rift valley	Male	21.4	54.1	22.3	542
	Female	20.1	53.2	23.1	498
Western	Male	18.6	51.2	29.3	328
	Female	22.8	48.8	28.1	334

The table above further shows that at the provincial level, Nairobi had the highest percentage of children of either sex who were breast fed for durations less than ten months. Of this proportion, male children were the most affected. Incidentally, Nairobi also had the highest percentage of children who were breast fed for durations of over twenty months, a majority of whom were the female. This implies that in Nairobi among children of both sexes who were breast fed, the male dominates the shorter durations while the female dominates the longer durations.

Eastern province had the lowest percentage of children breast fed for durations less than ten months, most of whom were the male. Rift valley also had the lowest percentage of children breast fed for over twenty months, a higher proportion of whom were the female. Overall, there was no noticeable difference in the months of breast-feeding for male and children at the provincial level.

4.6 Health care given to children during illness

Infant and child survival depends on the prevalence and treatment of childhood illnesses. The most common illnesses, which are the major causes of morbidity and mortality among children in Kenya, include fever, diarrhoea and acute respiratory infection. Information on disease prevalence and the treatment received in the event of illness is very subjective and mainly depends on the symptoms that the mother considers serious and also on her knowledge of medical treatment. This section presents the estimates of the prevalence of these illnesses as well as data on the treatment for male and female children separately.

Table 4.5 Prevalence and treatment of fever and cough among children under five years, by sex and region of residence.

Background ccc		% With fever and cough	% Given medical treatment	Number of children
Region	Sex			
Kenya	male	40.4	44.3	2778
	female	39.7	41.8	2792
Nairobi	male	38.8	53.1	98
	female	34.4	57.9	90
Central	male	40.6	48.1	310
	female	43.5	46.5	338
Coast	male	41.3	63.6	356
	female	34.8	51.9	356
Eastern	male	34.5	51.2	406
	Female	31.8	48.6	434
Nyanza	male	45.5	35.6	470
	female	51.4	36.5	459
Riftvalley	male	34.6	40.0	254
	female	35.2	38.7	264
Western	male	50.8	36.9	400
	female	44.8	33.7	411

Note: Figures are for children born in the period 1-59 months preceding the survey.

Fever is a symptom associated with malaria, which is an endemic in much of Kenya and accounts for a significant proportion of morbidity and mortality among children in Western, Nyanza, and central provinces. Fever and cough is also a common symptom of acute respiratory infection, which in itself is one of the major causes of morbidity and mortality among children in Kenya.

Table 4.5 indicate that fever and cough was most prevalent among children (irrespective of sex) in

Nyanza, Western and Central provinces, with combined sex prevalence percentages of 48.5, 47.8, and 42.1 respectively. The lowest prevalence percentages of fever and cough among both male and female children were recorded for Eastern province with a combined sex prevalence proportion of 33.2%. At the national and provincial level, Kenya has no pronounced difference in the prevalence of fever and cough by sex. Of children ill with fever and cough two weeks before the survey, 40.4 percent were male while 39.7 percent were female. Chen et al. (1981) argues that infectious rates are determined by exposure to diseases, which is a function of the quality of the physical and personal environment, both of which are highly dependant on child care practices. From this argument, and also given that this study finds no pronounced difference in the prevalence of fever and cough in the country, it is concluded that in Kenya, male and female children are subjected to the same physical (water, sanitation) and personal (child care hygiene) environment.

Incidentally, though both male and female children in Nyanza and Western provinces were more likely to be infected with fever and cough in the country, they were less likely to receive health-care coverage. Only 35.3 percent of both male and female children in Western and 36.1 percent of male and female children in Nyanza, who were ill with fever and cough two weeks before the survey received some form of health care.

At the national level, there is no significant difference in the health care given to male and female children in Kenya. 44.3 percent of male and 41.8 percent of female, who were ill with fever and cough two weeks before the survey, were given satisfactory health attention. These national figures however mask significant differentials by sex in the treatment given to ill children at the provincial level. In coast province for example, parents more often take male and not female children for treatment in the event of illness. Of children ill with fever and cough two weeks before the survey in coast province, 63.6 percent of the sick male children compared to 51.9 percent of the sick female children were given health treatment.

Table 4.6 Prevalence and treatment of cough and short rapid breathing among children under five years, by sex and region of residence, Kenya, 1993.

Background characteristics		% with short rapid breathing.	% given treatment for cough	number of children
Region	sex			
Kenya	Male	43.0	87.4	2778
	Female	46.1	86.9	2792
Nairobi	Male	33.3	83.7	98
	Female	32.3	89.5	90
Central	Male	49.6	88.1	310
	Female	57.7	85.5	338
Coast	Male	35.6	95.4	356
	Female	44.8	89.4	356
Eastern	Male	44.9	92.3	406
	Female	50.0	90.8	434
Nyanza	Male	46.5	87.7	470
	Female	48.1	86.7	459
Rift valley	Male	42.5	80.6	254
	Female	45.1	81.6	264
Western	Male	40.5	86.7	400
	Female	37.3	89.6	411

Note: Figures are for children born in the period 1-59 months preceding the survey.

Cough and short rapid breathing are signs and symptoms of pneumonia. In the KDHS, children ill with coughing accompanied with short rapid breathing during the two weeks preceding the survey were used in estimating the prevalence of acute respiratory infection. However, KDHS estimates of acute respiratory infection prevalence does not include other acute respiratory infection related symptoms (cough and colds, wheezing, ear infection and streptococcal sore throat) covered under the WHO guidelines for the ARI case management.

Results in table 4.6 indicate that Kenya had no significant differentials in the prevalence and treatment of acute respiratory infection by sex. At the provincial level, a slightly higher percentage of female children in Coast, Central and Eastern province suffer from acute respiratory infection when compared to their male counterparts. In Nairobi province, among ill children of both sexes, a higher proportion of ill children who

were given some form of treatment for cough were the female. In coast province, the reverse is noticed whereby more ill male than female children received treatment for an episode of cough.

Table 4.7 below shows that during the two weeks preceding the KDHS survey, diarrhoea was most prevalent among boys and girls in Western, Nyanza and Coast provinces. The lowest diarrhoea prevalence percentages were recorded in Central and Nairobi provinces. Children in Coast and Nyanza provinces with diarrhoea were more likely to be given health attention than children of either sex in other provinces. The least health care coverage for children of either sex with diarrhoea was recorded in Nairobi province.

Despite the fact that there is no noticeable difference in the prevalence of diarrhoea by sex in Kenya, There were noticeable differences in the treatment given to male and female children suffering from diarrhoea in Kenya. For an episode of diarrhoea, parents visit modern health facilities or providers less frequently to treat the female than the male children. For instance, in Kenya, 44.2 percent of the ill children given health care were male while only 36.8 percent were female.

At a provincial level, there is significant differentials by sex in the treatment of diarrhoea, noted in Central and Rift valley provinces where male children are notably treated better compared to the female children. However, in Nairobi and Eastern provinces, there was no noticeable difference in the treatment given to male and female children with diarrhoea.

Table 4.7 **Prevalence and Treatment of diarrhoea among children under five years, by sex and region of residence, Kenya,1993.**

Background characteristics		%with diarrhoea	% given medical treatment	Number of children
KENYA	Male	14.6	44.2	378
	Female	14.5	36.8	375
NAIROBI	Male	11.8	30.0	10
	Female	11.7	30.0	10
CENTRAL	Male	10.6	48.1	27
	Female	9.2	16.1	31
COAST	Male	14.6	58.0	50
	Female	16.4	61.4	44
EASTERN	Male	12.8	32.7	52
	Female	12.3	32.7	53
NYANZA	Male	18.7	58.3	84
	Female	18.3	62.4	85
RIFTVALLEY	Male	12.1	50.0	76
	Female	13.2	35.4	79
WESTERN	Male	21.4	40.0	79
	Female	20.7	35.6	73

Note: Figures are for children born in the period 1-59 months preceding the survey.

In conclusion, table 4.1 shows that Coast province recorded higher female than male post neonatal mortality rates were mortality rates. A positive correlation may be made between the excess female post neonatal mortality in coast province and the less frequent parental visits to health care facilities to treat girls for an episode of fever and cough or cough with short rapid breathing in the province. On the other hand, in Nairobi province available estimates of toddler (12-23) mortality reveals a female mortality sex ratio of 0.56 implying excess male deaths at that age. Interestingly, parents visit health care providers more often to treat female and not male children for an episode of fever and cough and also cough with short rapid breathing in Nairobi province.

4.6 Nutrition status

Anthropometric measures such as weight, height, skin-fold thickness, and arm circumference provide perhaps the simplest and most direct means for assessing an individual's caloric nutritional status. Due to lack of information in the KDHS data set on aspects of nutritional status such as skin fold thickness, protein and vitamin deficiency, other standard procedures of determining the nutritional status of the population are used in this study.

Height for age is an indicator of cumulative growth deficits. Weight for height measures the current nutritional status of the child. Figures obtained are compared with a standard population of healthy well-fed children as per the sex specific Harvard weight for height and height for age standards, the United Nations, or World Health Organization recommended standards. Such comparisons are presented using centiles, percent of the reference median values or standard deviations.

This study uses the international reference population recommended by the WHO as the reference population. Any child with a height for age or weight for height Z score below -2 standard deviation is classified as chronically or acutely malnourished or severely wasted or stunted. Children with Z scores equal to or greater than -2 standard deviation are classified as healthy well-fed children.

Since height for age and weight for height are both sensitive indicators of health status and reflects infant and child feeding practices, our study will use the height for age indices, which is an indicator for cumulative growth deficits. Low height for age (stunting) is an indicator for long run food consumption problems, not necessarily ill health at the time that the child was measured. In this study, height for age was preferred instead of the weight for height indices because the later reflects nutritional deficiency of recent onset, usually a few weeks or months old and could therefore be as a result of ill health at the time that the child was measured.

Table 4.8 Current nutritional status of children under five years (represented by height for age), by sex and region of residence in Kenya 1993.

Background characteristics		% Below -2 SD	% Above -2 SD	Number of children
Region	Sex			
Kenya	Male	45.1	54.9	2778
	Female	43.8	56.2	2792
Nairobi	Male	28.6	71.4	98
	Female	24.4	75.6	90
Central	Male	41.9	58.1	310
	Female	39.8	60.2	338
Coast	Male	59.8	40.2	356
	Female	53.4	46.6	356
Eastern	Male	57.6	42.4	406
	Female	54.4	45.6	434
Nyanza	Male	42.3	57.7	470
	Female	44.8	55.2	459
Rift valley	Male	44.3	55.7	738
	Female	47.0	53.0	704
Western	Male	41.2	58.8	400
	Female	42.5	57.5	411

Note: * Figures are for children born in the period 1-59 months preceding the survey. Percentages are for children with Z scores below and above -2 standard deviation (SD) from the reference population.
* % Below -2 SD reflect both the stunted and severely stunted children.

Cross tabulation estimates on figure 4.8 above indicate that for the whole country, there were no significant differences in the nutrition status of male and female children at the time of the survey. Healthy well fed children in the country consisted of 54.9 percent of males and 56.2 percent of females. Nairobi province had the highest percentage of healthy well-fed male and female children (71.4 and 75.6 respectively), with very few cases of acutely undernourished children, which consisted of 28.6 percent males and 24.4 percent females. Coast and Eastern provinces had the highest percentages stunted children, many of whom were the males.

Slight differentials are noticed in the nutritional status of children in coast province, where female children (46.6 percent) are better nourished when compared to their male counterparts (40.2 percent). On an

average however, there are no significant differences in the nutritional status of children even at a provincial level.

4.8 Birth order

In table 4.9 below, the study presents estimates of male and female child (0-4) mortality by birth order. These estimates are based on cross tabulations of birth order by sex and survival status, based on individual children born between 1989 and 1993.

Estimates in the table 4.9 are based on the application of direct demographic techniques on cross tabulation results. They show that consistent with other studies (such as Ikamari 1996), combined sex figures on mortality by birth order in Kenya exhibits a U shaped curve. Mortality for the first birth is a little higher than that for the second and third births after which it rises again.

In birth order 1 and 4+, higher male mortality sex ratios were recorded for the whole county. This implies that for the period covered by the survey, more male than female deaths were recorded among children of birth order 1 and 4+. 0-4 mortality differences by sex were largest at birth order 1 with a male/female sex ratio of 1.23, suggesting higher male child mortality rates. The birth order data for males and females in Kenya follows the usual pattern of more male than female child deaths at Birth order 1 and is consistent with other studies from other parts of the world such as Das Gupta 1987:82.

Table 4.9 further shows that at the provincial level, combined sex (0-4 years) mortality by birth order portrays U or J shaped curves for all provinces in Kenya. The exception to this are Central and Nairobi provinces.

Table: 4.6 Child Mortality by Birth Order, Sex and place of Residence, Kenya 1993.

RESIDENCE	SEX /male to female ratios	Child mortality rates (per 1000 exposures) by birth order			
		1	2	3	4+
KENYA	Male	10.0	4.6	4.6	20.2
	Female	8.1	5.3	5.1	19.7
	Total	18.1	9.9	9.7	39.9
	M/F ratio	1.23	0.87	0.90	1.03
CENTRAL	Male	2.9	5.8	1.5	13.1
	Female	2.9	4.4	1.5	4.4
	Total	5.8	10.2	3.0	17.5
	M/F ratio	1.00	1.32	1.00	2.98
COAST	Male	7.8	3.9	6.5	17.0
	Female	7.8	9.1	3.9	14.4
	Total	15.6	13.0	10.4	31.4
	M/F ratio	1.00	0.42	1.67	1.18
NAIROBI	Male	14.4	-	14.4	9.6
	Female	9.6	4.8	4.8	9.6
	Total	24.0	-	19.2	19.2
	M/F ratio	1.50	-	3.00	1.0
EASTERN	Male	10.0	3.3	4.5	15.6
	Female	6.7	3.3	3.3	15.6
	Total	16.7	6.6	7.8	31.2
	M/F ratio	1.49	1.00	1.35	1.00
NYANZA	Male	19.7	8.1	4.5	42.2
	Female	16.2	10.8	11.7	44.0
	Total	35.9	18.9	16.2	86.2
	M/F ratio	1.22	0.75	0.38	0.95
RIFT VALLEY	Male	5.3	1.3	3.3	11.2
	Female	2.6	0.7	3.3	15.9
	Total	7.9	2.0	6.6	27.1
	M/F ratio	2.04	1.86	1.00	0.70
WESTERN	Male	12.2	7.8	5.6	23.3
	Female	12.2	5.6	5.6	18.9
	Total	24.4	13.4	11.2	42.2
	M/F ratio	1.00	1.39	1.00	1.23

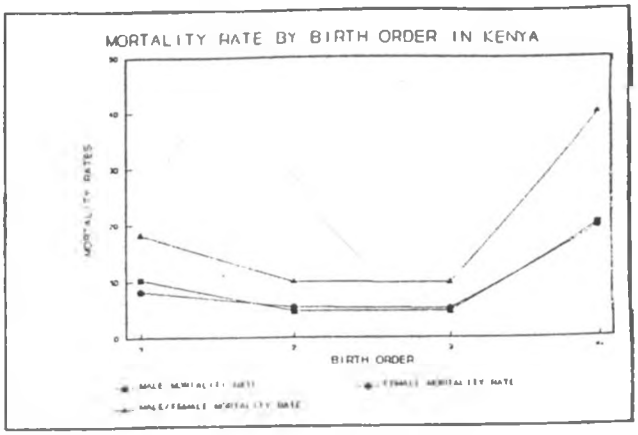
Note: Male/Female mortality sex ratios are given by dividing male children death rates by the female children rates. In the calculations of mortality rates the denominator (children born in the mothers place of residence) is not desegregated by sex or birth order.

Apart from birth order 1 where males die more than females in almost all provinces, excess female child mortality was noticed in birth order 2 in Coast province and in birth order 3 in Nyanza province. The study also found excess male mortality in birth order 2 in Rift valley province, birth order 4+ in Central province and birth order 3 in Nairobi and Coast provinces.

The highest mortality rates were recorded among male children of birth order 1 in Nyanza province, where for every 1000 births in the mothers' place of residence, 20 male born were likely to die. More girls born in birth order 1 were also likely to die in Nyanza province than in any other province in Kenya in that

for every 1000 births in the province, 16 girls were likely to die. Figure 3 below schematically presents mortality rates by birth order in Kenya. It shows that mortality by birth order in the country exhibit a U shaped curve. Other figures on mortality rate by birth order can be found in appendices A to G.

figure 3: mortality rates by birth order, Kenya.



In this section, the effect of sex-biased parental care (use of health facilities, duration of breast feeding, immunisation coverage and feeding practices (as is seen from anthropometric indicators), on the risk of male and female under five mortality is inferential in the sense that the practices have not been linked to mortality at the level of the individual child. This therefore calls for an estimate of logistic regression to assess the relative effect of the variables of interest on male and female infant and child mortality. A multivariate logistic regression analysis is introduced in the following chapter in order to examine the effect of immunisation, nutrition, and breast-feeding and birth order on the mortality of male and female children in Kenya, and also to perform tests of statistical significance.

CHAPTER FIVE

DETERMINANTS OF INFANT AND CHILD MORTALITY DIFFERENCES BY SEX

5.1 Introduction

This section gives the results obtained from a multivariate logistic regression. The method enter was used to analyze the data. This method tends to force all the variables in question into the equation irrespective of their significance. Variables were entered on step number. As noted, the dependent variable in the analysis is the log odds of dying in a particular age interval. Four age intervals are pooled in the analysis and the risk of death is allowed to vary in the age strata. To estimate the effect of immunisation coverage, child nutrition status, duration of breast feeding and other covariates on infant and child mortality, four logistic regression models are designed consisting of 6082 infants and children born five years before the KDHS 1993 survey.

As noted, a key variable in the study (medical care given to sick children in the event of illness) is not incorporated in the logistic regression analysis. This is because of the way in which the information on medical care given to sick children is presented in the KDHS data set. It portrays in the logistic regression analysis that the dependent variable has only one value, and therefore contains only information on children alive and not children dead. For a logistic regression to run, the dependent variable must have two values. It is possible that information on medical treatment given to sick children, contained in the data set used, was not recorded for children who were sick and subsequently died.

To meet the objectives of this study, a regression analysis was run separately for 3047 girls and 3035 boys.

5.2 Description of variables used in the multivariate regression analysis.

(a) Nutrition status variables

Anthropometric indices weight for height and height for age are used to determine a child's nutritional status. Weight for height, WH2, represents children with standard deviations greater than or equal to -2. It consists of healthy well-fed children (0 if not; 1 if yes). WH1 Represents children with less than -2 standard deviation also classified as wasted (It forms the reference category). Height for age, HTA2, represents healthy well-fed children with standard deviations greater than or equal to -2 (it is coded 1 if the case; 0 if otherwise). - HTA1 represents stunted children with less than -2 standard deviation (it forms the reference category).

(b) Immunisation variables

It refers to whether or not a child received DPT1, DPT2, DPT3; Polio1, 2, 3; BCG; or measles vaccines. Dummies were created for these variables, and they included:

Nil :Indicates children who had not received any form DPT 1, 2 or 3 vaccines; Polio 1, 2 or 3 vaccines; BCG vaccine; and measles vaccine, which form the reference category.

SOME :Indicates children who had received only one or some of the vaccines listed under the Nil category (1 if the case; 0 if otherwise).

COMP :Indicates children who had completed immunisation i.e. received all doses of the vaccines mentioned under the nil category (1 if the case; 0 if otherwise).

(c) Breast feeding durations variables

It refers to the duration of breast-feeding that a child received. The variables are re-coded:

Brfed1 :Indicates breast-feeding durations less than 10 months (forms the reference category).

Brfed2 :Indicates breast-feeding durations of 10-19 months (1 = yes; 0 = otherwise).

Brfed3 :Indicates children breastfed for periods over 20 months (1 if yes: 0 if otherwise).

(d) Birth order variables

The variable BORD refers to the ordinal position in which the child was born in a family. It is coded:

BORD1: Consists of all the first-borns in a family. It forms the reference category.

BORD2: Consists of all second-born children in a family (1 if yes, 0 if otherwise).

BORD3: Consists of third born children in a family (1 if yes, 0 if otherwise).

BORD4+: Consists of children born in the forth and higher birth orders in a family (1 = yes, 0 = otherwise).

(e) Sex Variables

Whether an individual child was female (select if B4 = 1); or male (select if B4 =0).

(f) Age variables

Dummies created for this variable includes:

CMC1: Indicates an individual less than 1 month old (forms the reference category).

CMC2: Indicates an individual child is between 1-11 months old (1if yes; 0 if otherwise).

CMC3: Indicates an individual child is between 12-23 months old (1 if yes; 0 if otherwise).

CMC4: Indicates an individual child is between 24-59 months old (1 = yes; 0 = otherwise).

(g) Dependent variable

As noted, the dependent variable is the log odds of dying in a given age interval. It takes the value of 1 if the child failed to survive through the specified age range, and zero if the child survived. It is represented by ln(nqx/nPx) with x = < 1; 1-11; 12-23; 24-59 months.

(h) Estimated Parameters Used in the regression analysis

Beta = Beta Coefficient; SE = Standard Error; -2LL = -2 Log Likelihood; DF = Degree of Freedom; P = Model chi square values (P values of Pearson chi square).

5.3.1 Logistic regression estimates for individual children in Kenya, 1993:

Model 1 in table 5.1 below estimates the log odds of dying as a simple function of age and sex of individual children. The age interval to which an individual child applies is controlled through a set of dummy variables. In this basic model, age on its own is not a significant determinant of male and female infant and child survival in Kenya.

Model 2 adds to model 1 nutrition variables involving anthropometric indicators (height for age, HTA2 and weight for height, WH2). Coefficients of variables reflecting age and additive nutrition variables remain insignificant, indicating that nutrition just like age is not a significant determinant of male and female infant and child mortality in Kenya.

Model 3 in table 5.1, adds the immunisation variable to nutrition and age variables in model 2. Male and female children are categorised into those who have received some form of immunisation and those who have received complete immunisation. With this addition, coefficients for age and nutrition remain insignificant. Boys who have received some and complete immunisation have a significantly lower probability of dying compared to boys with nil immunisation. The log odds of dying for boys with some immunisation are -2.0888 lower than those for boys with no immunisation. The corresponding relative figure for boys with complete immunisation is -1.6114. The odds of death for boys with some immunisation are reduced by the factor .1238, relative to the reference category (boys with nil immunisation). Complete immunisation reduces the odds of death by Exp(-1.6114) which equals to 0.1996 relative to the reference category for boys.

Table 5.1: Logistic regression estimates of determinants of infant and child mortality in Kenya by sex, 1993.

COVARIATES	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
	Beta	SE	Beta	SE	Beta	SE	Beta	SE
SEX	BOYS							
CONSTANT	-5.194	6.749	5.996	135.862	6.920	223.893	7.196	222.74
AGE DUMMIES								
CMC2	2.593	6.752	-7.183	135.862	-6.719	223.893	-6.646	222.74
CMC3	2.478	6.752	-8.079	135.863	-6.521	223.894	-6.374	222.74
CMC4	2.847	6.750	-7.627	135.862	-6.063	223.893	-5.928	222.74
NUTRITION								
HTA2			-8.227	8.610	-9.305	13.169	-9.246	13.195
WH2			-8.972	6.978	-9.818	10.649	-9.767	10.676
IMMUNISATION								
SOME					-2.088 ***	.2055	-2.038 ***	.2076
COMP					-1.611 ***	.2041	-1.632 ***	.2065
BREASTFEED								
BRFED2							-.256	.1988
BRFED3							-.192	.2458
BIRTHORDER								
BORD2							-.551 +	.2966
BORD3							-.218	.3015
BORD4+							-.428 *	.2193
	-2LL = 1672.77; DF = 3031		-2LL = 9.54; DF = 3029 +*+		-2LL = 970.65; DF = 3027 +*+		-2 LL = 962.49; DF = 3022 +*+	
				GIRLS				
CONSTANT	-6.1997	8.4057	-8.721	78.3067	-9.728	129.558	-9.720	129.04
AGE DUMMIES								
CMC2	3.3524	8.4079	7.397	78.3070	9.594	129.558	9.9996	129.04
CMC3	3.8191	8.4070	7.032	78.3069	10.181	129.558	10.4012	129.04
CMC4	3.7516	8.4062	7.052	78.3068	10.223	129.558	10.5039	129.04
NUTRITION								
HTA2			-8.322	8.3523	-9.365	12.975	-9.3334	12.946
WH2			-8.981	6.8898	-9.785	10.677	-9.7334	10.636
IMMUNISATION								
SOME					-1.590 ***	.2019	-1.511 ***	.2065
COMP					-1.737 ***	.2036	-1.743 ***	.2070
BREASTFED								
BRFED2							-.8996 ***	.2150
BRFED3							-.6883 ***	.2476
BIRTHORDER								
BORD2							-.0056	.2894
BORD3							.1895	.3017
BORD4							-.0696	.2251
	-2LL = 1634.97; DF = 3042		-2LL = 1263.60; DF = 3041 +*+		-2LL = 973.57; DF = 3039 +*+		-2LL = 950.050; DF = 3034 +*+	

*** significant at 0.001 level; ** significant at 0.01 level; * significant at 0.05 level; + significant at 0.10 level; +*+ Pearson chi square statistic (p value) less than 0.05. Standard error (SE) of constants was not significant. **NOTE:** Results are based on 2795 male cases with 240 male deaths and 2815 female cases with 232 female deaths.

Additionally, table 5.1 above also shows that the presence of some and complete immunisation significantly lowers infant and child female mortality, relative to nil or no immunisation among girls. Some immunisation is associated with a decrease of -1.5902 in the logit of risk. The odds of death for the same population category are reduced by 0.2039 relative to the reference category (girls with nil immunisation).

In model 4, breast-feeding and birth order variables are added to those variables in model 3. All the coefficients in this model remain similar in magnitude and significance to those in model 3. Additive variable, duration of breast-feeding is a significant determinant of the mortality of girls. It is however not a significant determinant of the mortality of boys. Girls who were breast fed for 10-19 months have mortality significantly lower than girls breast fed for durations less than 10 months. At a significance level of .001, breast-feeding female children for durations of 10-19 months is associated with a decrease of -0.8996 in the logit of risk, relative to breast-feeding female children for less than 10 months. Girls breast-fed for 10-19 months had 0.4067 reduced odds of death. Estimated coefficients for girls breastfed for over twenty months is -0.6885, indicating a reduction in the relative risk of dying, relative to the reference category (female breast feeding for duration less than 10 months).

Table 5.1 further demonstrates that Birth order has a significant influence on the mortality of boys. Interestingly on the contrary, birth order does not significantly influence the mortality of girls in Kenya. Compared with the reference category, estimated coefficients for birth order is negative among boys indicating a decrease in the risk of dying for male children born in birth order 2 and 4+. The odds of death for boys are reduced by the factor 0.5763 (birth order 2) and 0.8040 (birth order 4+), relative to the reference category (boys of birth order 1). This results

were significant at a 5 percent level for boys born at or after the forth birth order, and significant at only a 10 percent level for boys born in birth order 2.

The effectiveness of the overall model is assessed using the P values of the Pearson chi-square statistic. For both male and female children in Kenya, model 1 inadequately explains the dependent variable (log odds of dying before reaching age five), given that its P value is greater than 0.05. However, Models 2, 3 and 4 among both male and female children, each have a p-value or model chi square significance value of 0.000. Given that these P values are less than 0.05, we conclude that models 2, 3, and 4 among both boys and girls are adequate in explaining the dependent variable.

5.3.2 Logistic regression estimates for individual children by province.

Logistic regression estimates for the determinants of Kenyan male-female mortality differentials in infancy and childhood was also done for each of the provinces covered by the 1993 Kenya Demographic and Health Survey. This section shows the logistic regression estimates of mortality on immunisation, nutrition, breast-feeding, age and birth order, by province.

(a) Central province

Model 1 in table 5.2 shown below demonstrates that age has no significant independent influence on infant and child mortality among boys and girls in Central province. However, with the addition of nutrition variables in model 2, the variable representing girls in age interval 1-11 months becomes significant at a 5 percent level. The odds of death for girls in age interval 1-11 months are elevated by the factor exp (2.0417) = 7.704, relative to the reference category (girls <1month).

Table 5.2 Logistic regression estimates of the determinants of infant and child mortality by sex in Central province, 1993.

COVARIATES	Model 1		model 2		Model 3		Model 4	
	BETA	SE	BETA	SE	BETA	SE	BETA	SE
	BOYS							
CONSTANT	-6.1997	22.239	5.4764	450.323	22.3034	2014.828	20.0935	2013.334
AgeDummies								
CMC2	2.2891	22.262	-8.185	450.323	-23.214	2014.829	-22.8301	2013.335
CMC3	3.5084	22.246	-7.617	450.323	-11.699	2010.919	-10.0258	2009.934
CMC4	3.2697	22.242	-7.723	450.323	-21.977	2014.828	-21.5239	2013.334
NUTRITION								
HTA2			-8.323	46.639	-19.088	166.947	-13.7001	161.4757
WH2			-9.356	35.356	-18.418	129.656	-16.5953	118.2027
IMMUNISATION								
SOME					-1.542 +	.8621	-2.6276 *	1.2718
COMP					-21.876	126.731	-22.4539	116.7661
BREASTFEED								
BRFED2							-2.3019	1.669
BRFED3							.4977	1.951
BIRTH ORDER								
BORD2							3.4340 +	
BORD3							1.3812	1.9128
BORD4							3.5869 *	1.7711
								1.6230
	-2LL = 126.680; DF = 328		-2LL = 105.605; DF = 326 +*+		-2LL = 37.338 +*+; DF = 324		-2LL = 27.085 +*+; DF = 319	
	GIRLS							
CONSTANT	-4.2341	.5815	-3.546	.5856	-.8522	.7335	-1.1406	1.0969
AGE DUMMIES								
CMC2	.9199	.9254	2.042 *	.9766	1.7863	1.3393	2.7429 +	1.7091
CMC3	1.2137	.7748	1.1479	.7846	2.9466 *	1.3130	3.4947 *	1.4564
CMC4								
NUTRITION								
HTA2			-8.299	39.4257	-9.1141	58.024	-9.2155	56.2338
HTA3			-9.039	31.4933	-10.641	44.491	-10.8299	42.8876
IMMUNISATION								
SOME					-2.289 +	1.2496	-2.9053 +	1.5158
COMP					-2.987 **	1.1790	-2.8793 *	1.3213
BREASTFEED								
BRFED2							-.9629	1.1531
BRFED3							-1.0506	1.7910
BIRTH ORDER								
BORD2							1.8967	1.2461
BORD3							-.5662	1.8859
BORD4							.5090	1.2082
	-2LL = 81.132; DF = 350		-2LL = 65.331; DF = 348 +*+		-2LL = 43.372; DF = 346 +*+		-2LL = 39.207; DF = 341 +*+	

*** Significant at .001 level. ** Significant at .01 level. * Significant at .05 level + significant at .10 level. +*+ P value of Pearson chi square statistic less than 0.05 Standard error (SE) of constants is not significant; Note: Results reported from the regression analysis in the table are based on 353 female cases with 9 female deaths; and 332 male cases with 16 male deaths. Cmc 4 estimates are not included because of redundancies in design matrix.

Model 3 in table 5.2 adds to model 2 a set of immunisation variables representing boys and girls who had received some form of immunisation and those who had received complete immunisation. Once these variables are added, the age variable representing girls in age interval 1-11 months loses its significance. In its stead, a variable representing girls in age interval 12-23 months gains significance at a 0.05 level. This indicates that girls in the 12-23 month age interval have a significantly higher mortality relative to those less than 1 month old.

Model 3 also demonstrates that in central province, child mortality was significantly lower among girls who had received some and complete immunisation, and boys who had received some immunisation. Some form of immunisation lowers the odds of death for girls by a factor 0.1014, relative to the reference category (girls with nil immunisation). The odds of death for boys with some immunisation are lowered by the factor 0.2139, relative to the reference category (boys with no immunisation). The model also shows that girls with complete immunisation have low relative odds of dying, namely exp (-2.9869) = 0.0504. Interestingly, complete immunisation has no significance on the mortality of boys.

Model 4 adds breast-feeding and birth order variables to those present in model 3. The addition of these variables makes the age variable among girls (cmc2), which had lost significance in the previous model, to regain significance, if only at a 10 percent level. Mortality is significantly higher among girls in the age intervals 1-11 months and 12-23 months than girls less than 1 month old. The model's coefficients also shows that boys born in birth order 2 and 4+ have mortality that is significantly higher than those of their counterparts born in the first birth order. On the contrary, birth order is not significant in influencing the mortality of girls.

The significance of the model is assessed from the P values of the Pearson chi-square statistic. P values for boys and girls in Model 1 are 0.6644 and 0.2615 respectively. Because

they are more than 0.05 the model is not significant in explaining the log odds of dying for male and female children before reaching age five. On the contrary, models 2, 3 and 4 each have P values less than 0.001 for both boys and girls. Because these values are less than 0.05, these models adequately explain the log odds of dying before reaching age five among both boys and girls (the dependent variable).

(b) Nairobi province.

Table 5.3 below gives the estimated parameters of logistic regression of mortality on a set of variables in Nairobi province. In model 1 of the table, age does not significantly affect infant and child mortality of males in the province. However, the log odds of dying are higher for females in the 1-11 month age interval by the factor 2.0919, relative to females in the reference category (less than 1 month).

In model 2, mortality of girls becomes highly significant at ages 1-11 months and 12-23 months relative to the reference category (girls less than 1 month old). The log odds of dying are higher for girls in age interval 12-23 months by 2.9957. However, when immunisation variables, birth order variables, and breast feeding variables in model 3 and 4 of table 5.3 is added to those in model 1 and 2, variables representing girls in age interval 1-11 months in Nairobi province loses its significance.

To assess the effectiveness of the overall models, the P value of the Pearson chi square statistic was used. The P values for models 2, 3 and 4 for girls and models 2 and 3 for boys are 0.000, indicating that the models are adequate in explaining the dependent variable. However, models 1 and 4 for boys and model 1 for girls does not adequately explain the dependent variable (log odds of dying before age five), given that their P-values are greater than 0.05

Table 5.3 Logistic regression estimates of the determinants of infant and child mortality by sex in Nairobi province, 1993

Covariates	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
	BETA	SE	BETA	SE	BETA	SE	BETA	SE
	BOYS							
constant	-2.9789	.5918	-1.6740	.6291	19.681	159.444		
Age dummies								
cmc2	.9640	.9576	1.6740	1.1814	-9.0835	109.453		
cmc3	.8995	.8516	1.3863	.9895	11.2076	102.118		
cmc4								
Nutrition			-8.9982	49.418	-10.166	181.347		
HTA2			-10.2071	45.765	-20.177	162.142		
WH2								
Immunisation					-20.779	159.439		
SOME					-10.802	102.122		
COMP								
Breastfeed								
BRFED2								
BRFED3								
Birth Order								
BORD2								
BORD3								
BORD4								
-2loglikelih	55.176		31.682 +*+		12.137 +*+			
degreeoffree	103		101		99			
	GIRLS							
constant	-3.9890		-2.9957	1.0247	-1.7918	1.0801	-10.843	197.589
Age dummies								261.255
CMC2	2.0919+	1.1840	4.0943 **	1.5438	13.6492	205.023	22.278	
CMC3	1.5911	1.2506	2.9957 *	1.4318	13.3076	210.838	22.871	
CMC4								
Nutrition								
HTA2			-10.5127	77.3468	-19.211	577.899	-17.489	
WH2			-11.7452	70.3408	-3.9547	525.159	-5.409	
Immunisation								
SOME					-24.142	380.219	-32.643	
COMP					2.0388	423.961	12.420	
Breastfeed								
Brfed2							4.6199	
Brfed3							1.5172	
Birth Order								
Bord2							9.7447	
Bord3							-3.5640	
Bord4							-0.4656	
-2logliklihо	41.576		18.085 +*+		5.742 +*+		4.499 +*+	
Degreeoffree	99		97		95		90	

**Significant at .01 level, * significant at .05 level, + significant at .10 level. +*+ P value of the Pearson chi-square statistic less than 0.05. Note: Results in the regression analysis are based on 102 female cases with 6 deaths, and 106 male cases with 8 deaths. Male estimates for model 4 are missing because the final solution was not found. Standard Error (SE) of constants is not significant.

(c) Coast province

Table 5.4 below shows that in Coast province, female children who have received immunisation have a significantly lower mortality than those who have received nil immunisation. In model 3, the log odds of dying are lower for females with some immunisation by -2.6139. Girls who have received complete immunisation have a log odd of dying of -1.6630. Male children with some immunisation have log odds of dying that is -2.1013 lower than those in the reference category (boys with nil immunisation), While the odds of death for boys with complete immunisation are reduced by a factor exp (-1.3981) = 0.24707. The addition of immunisation variable to those present in model 2 significantly lowers the risk of dying in age interval 1-11 months among boys. Coefficients reflecting age intervals for girls however remain insignificant.

In model 4 of table 5.4, breast-feeding and birth order variables are added to those present in model 3. Most coefficients remain similar in magnitude and significance among boys in coast province. However, among girls, breast-feeding variables become significant at the level of 5 percent while birth order variable becomes significant only at a 10 percent level. Model 4 of table 5.4 also shows that girls breast fed for durations of 10-19 months and above 20 months have an odds of dying that is reduced by the factor exp (-1.7215) = 0.1788, and exp (-2.7977) = 0.06095 respectively, relative to the reference category (girls breast fed for less than 10 months). On the contrary, boys breast-fed for the same durations in Coast province have insignificant estimated coefficients. The model further demonstrates that child mortality is significantly higher among girls born in birth order 2. The log odds of dying are higher for girls of birth order 2 by 1.6083 relative to the reference category (females of birth order 1). Birth order however has no significant influence on male infant and child mortality

Table 5.4 **Logistic regression estimates of determinants of infant and child mortality by sex in Coast province, 1993**

Covariates	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
Sex	BOYS							
Age dummies								
cmc2	-.5935	.6352	.3617	.6797	-1.353 +	.7963	-1.545 +	.8429
cmc3	-.2736	.5663	-.1456	.5828	-.2193	.6706	-.228	.6939
cmc4								
Nutrition								
HTA2			-7.9206	22.244	-8.9535 ·	33.604	-8.933	33.427
WH2			-8.3752	20.515	-8.9964	31.178	-9.098	30.877
Immunisation								
SOME					-2.101 ***	.6310	-2.149 ***	.6530
COMP					-1.398 *	.5973	-1.546 *	.6416
Breastfeed								
Brfed2							.0550	.5921
Brfed3							.4595	.7067
Birth order								
Bord2							.1449	.9019
Bord3							.0715	.7904
Bord4							-.2976	.6518
Constant	-2.4510	.2330	-1.9021	.2397	.5953	.4872	.7340	.6953
	-2LL = 194.178; DF = 380		-2LL = 159.661; DF = 378 +*+		-2LL = 122.009; DF = 376 +*+		-2LL = 121.052; DF = 371 +*+	
Sex	GIRLS							
Age Dummies								
cmc2	-.6444	.6352	.0216	.6745	-.6661	.8120	-.5513	.8696
cmc3	-.4173	.5650	-.3193	5852	-.2549	.7378	-.5951	.8445
cmc4								
Nutrition								
HTA2			-8.8714	34.016	-8.673	30.651	-10.0676	47.818
WH2			-9.4013	31.333	-9.3414	28.093	-10.3205	43.476
Immunisation								
SOME					-2.614 ***	.6731	-2.903 ***	.8001
COMP					-1.669 **	6489	-2.154 **	.7456
Breastfeed								
Brfed2							-1.7215 *	.8128
Brfed3							-2.7977 *	1.2573
Birth order								
Bord2							1.6082 +	.9687
Bord3							-.5020	1.1611
Bord4							.4433	.8404
Constant	-2.4159	.2334	-1.6956	.2433	1.2137	.5458	1.8020	.9008
	-2LL = 193.768; DF = 380		-2LL = 152.497; DF = 378 +*+		-2LL = 101.446; DF = 371 +*+		86.809 +*+	

***Significant at the level .001;** Significant at the level .01; * Significant at the level .05; + Significant at the level .10; p-value of the Pearson chi-square statistic less than 0.05; Standard error (SE) of constants was not significant. Note: Results reported from the regression analysis in the table are based on 383 female cases with 27 deaths, and 383 male cases with 27 deaths.

The effectiveness of the overall models in table 5.4 is given by the P-value of the Pearson chi-square statistic. Given that P values of models 2, 3 and 4 are 0.000 for both boys and girls, the study concludes that these models are adequate in explaining the dependent variable (log odds of dying before age five). However, model 1 does not adequately explain the dependent variable among boys and girls in Coast province given that its P values of 0.5796 for boys and 0.4721 for girls are greater than 0.05.

(d) Eastern province

Model 1 of table 5.5 shows that in Eastern province, age does not have an independent influence on the mortality of girls. However, boys in the age interval 1-11 months have a log odd of dying that is 1.3037 times higher than boys less than 1 month. In model 2, nutrition variables, height for age and weight for height, are added to those variables in model 1. When this is done, the coefficients representing age for boys in Eastern province remains the same in magnitude and significance. However, the odds of death among girls aged 1-11 month is significantly elevated by the factor exp (1.0593) = 2.88435, relative to the reference category (girls less than 1 month old).

In model 3 the immunisation variable is added to the variables present in model 2. When this is done, the age interval variable (cmc2) loses its significance. In its stead, additive immunisation variables (some and comp) become highly significant. Male and female children who had received some form of immunisation had significantly lower mortality than male and female children with nil immunisation. The log odds of dying are lower for males with some immunisation by -3.7874 and lower for females with some immunisation by -1.6367, relative to the reference category (children with nil immunisation). However, whereas the odds of death for girls with complete immunisation is significantly reduced by the factor exp (-1.6106) = 0.1999 relative to the reference category (female with nil

immunisation), Complete immunisation is an insignificant determinant of the mortality of male children. Model 4 of the table also shows that breast-feeding duration and birth order have no significant independent influence on the mortality of boys in Eastern province. On the contrary however, girls in the province who are breast fed for durations over 20 months have a low relative odds of dying, namely exp (-1.8174) = 0.16245.

The effectiveness of the models used in table 5.5, in describing the dependent variables are given by the P value of the Pearson chi square statistic. Among boys, the P values, which are less than 0.05 for all the models (0.0035 for model 1, 0.0000 for models 2,3 and 4) implies that the models adequately explains the dependent variable. However, among girls in Eastern province, model 1 has P-values of 0.8242, which implies that the model is not adequate in explaining the dependent variable. However, models 2,3 and 4 for girls have p values of 0.0000 implying that they adequately explain the dependent variable.

Table 5.5 Logistic regression estimates of the determinants of infant and child mortality by sex in Eastern province, 1993.

Covariates	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
	BETA	SE	BETA	SE	BETA	SE	BETA	SE
sex	BOYS							
Age dummies								
cmc2	1.3037 **	.4135	1.960 ***	.4685	8895	.7303	.9484	.7521
cmc3	-.4289	.6449	-.5248	.6541	.0160	.8373	-.1450	.8782
cmc4								
Nutrition								
HTA2			-9.592	37.209	-9.354	34.057	-9.112	33.84
WH2			-9.7996	30.215	-8.873	28.211	-8.961	27.69
Immunisation								
SOME					-3.787 ***	.7035	-3.804 ***	.7294
COMP					-.9893	.8293	-1.0875	.8516
Breastfeed								
Brfed2							-.5772	.7434
Brfed3							-1.1458	.9489
Birth Order								
Bord2							-.4755	1.197
Bord3							.8323	1.083
Bord4							-.2470	.8150
constant	-2.8792	.2654	-2.2478	.2715	8834	4974	1.3271	.7808
-2LogLikelihood	207.301 +*+		160.031 +*+		89.535 +*+		86.553 +*+	
Degree of Freedom	434		432		430		425	
sex	GIRLS							
constant	-2.9087	.2651	-2.2119	.2720	.2040	5360	.8726	.8099
agedummies								
cmc2	.3060	.4993	1.0593 *	.5415	-.2800	.6319	-.3149	.6826
cmc3	.1614	.5321	.1326	.5468	.0307	6046	.2041	.6159
cmc4								
Nutrition								
HTA2			-9.2279	37.341	-9.3146	35.289	-9.434	34.566
WH2			-9.8361	29.464	-9.7698	27.902	-9.6581	27.319
Immunisation								
SOME					-1.6367 **	.5646	-1.7560 **	.6415
COMP					-1.6101 **	.5360	-1.7053 **	.5735
Breastfeed								
Brfed2							-.3730	.5426
Brfed3							-1.8174 *	.8949
Birth order								
Bord2							-.6097	.8410
Bord3							-.3539	.9093
Bord4							-.1054	.6350
-2Loglikelih	199.518		156.896 +*+		130.060 +*+		123.352 +*+	
Degreeoffree	457		455		453		448	

*** Significant at the level .001; ** significant at the .01 level; * significant at the .05 level; + significant at the .10 level; +*+ P value of the Pearson chi square statistic less than 0.05. Note: regression analysis results are based on 460 female cases with 26 dead; and 437 male cases with 30 dead. Standard error (SE) of constant is not significant.

(e) Nyanza province

From model 1 and 2 of table 5.6 below, age and nutrition have no significant influence on the mortality of girls in Nyanza province. The addition of nutrition variables to those in model 1 however negatively influences the mortality of boys in the age interval 12-23 in the province. The mortality of boys at age interval 12-23 is associated with a decrease of -0.6333 in the logit of risk. With the addition of immunisation variables to those variables in model 2, coefficients for age and nutrition status remain the same in magnitude and significance among girls in Nyanza province. Immunisation as an independent variable significantly lowers girls' mortality.

The coefficient of dying for girls with some immunisation is significant at a 10 percent level, while it is significant at a .001 level for boys. Receiving complete immunisation significantly lowers mortality among both male and female children in the province. In model 3, the addition of immunisation variable significantly lowers the odds of death for male children in age interval 1-11 months and 12-23 months by exp (-0.9877) = 0.372 and exp (-0.8083) = 0.445 respectively, relative to the reference category (males less than 1 month old). However, even with the inclusion of both immunisation and nutrition variables, the effect of age on female infant and child mortality remains insignificant.

Model 4 of the table 5.6 shows that breast-feeding and birth order have no significant independent influence on the mortality of girls in Nyanza province. Most coefficients in the model remain similar in significance and also in magnitude to those in model 3. For male children however, being born in birth order 2 and 4+ significantly affects mortality at a 10 percent level in that male children born in birth order 2 have a log odds of dying that is -1.0590 lower than boys born in birth order 1. The odds of death for boys born in and after the fourth birth order are also reduced by the factor exp (-0.6883) = .5024 relative to the reference category.

Table 5.6 Logistic regression estimates of the determinants of infant and child mortality in Nyanza province by sex, 1993.

Covariates	model 1		model 2		model 3		model 4	
	BETA · SE		BETA	SE	BETA	SE	BETA ·	SE
sex	BOYS							
constant	-1.6129	.1451	-.7191	.1615	1.1788	.3399	1.9066	.4803
age dummies								
cmc2	-.5325	.3501	-.1788	.3924	-.9877 *	.4509	-1.093 *	.4770
cmc3	-.2434	.3132	-.6333 +	.3317	-.8093 *	.3880	-.7229 +	.3961
cmc4								
Nutrition								
HTA2			-9.0668	22.537	-8.635	21.2351	-8.479	21.17
WH2			-9.9306	16.694	-9.801	15.5230	-9.735	15.45
Immunisation								
SOME					-1.250 ***	.3740	-1.242 ***	.3830
COMP					-2.174 ***	.3918	-2.188 ***	.4030
Breastfeed								
Brfed2							-.4362	.3865
Brfed3							.0595	.4575
Birth order								
bord2							-1.0590 +	.5537
bord3							-1.0579	.6469
bord4							-.6883 +	.4114
-2LL	466.909		339.988 +*+		257.106 +*+		249.862 +*+	
degreeoffree	566		554		552 ·		547	
sex	GIRLS							
constant	-5.1941	13.4988	-1.8909	271.689	-1.6914	271.611	-.6382	271.6
age dummies								
cmc2	3.236	13.5023	1.4854	271.689	2.1906	271.611	1.5748	271.6
cmc3	3.432	13.5014	.6465	271.689	1.8917	271.611	1.3549	271.6
cmc4	3.709	13.4995	1.2633	271.689	2.7228	271.611	2.1148	271.6
Nutrition								
HTA2			-9.3120	21.730	-9.5114	20.731	-9.4566	20.54
WH2			-10.065	16.992	-10.2108	16.036	-10.256	15.88
Immunisation								
SOME					-.6609 +	.3875	-.7651 +	.4041
COMP					-2.055 ***	.3561	-2.09 ***	.3748
Breastfeed								
Brfed2							-.5717	.3875
Brfed3							.4483	.4152
Birthorder								
bord2							.4696	.5568
bord3							.6660	.5865
bord4							-.4964	.4291
-2LL	495.638		355.124 +*+		282.246 +*+		271.572 +*+	
degreeoffreed	551		549		547		542	

*** significant at the .001 level, ** significant at the level .01, * significant at the level .05, + significant at the level .10; +*+ p-value of the Pearson chi-square statistic less than 0.05. Note: Regression analysis is based on 555 female cases with 92 deaths, and 559 male cases with 83 deaths. Standard error (SE) of constants is not significant.

The significance of models 1, 2, 3 and 4 in table 5.6 above is assessed from the P values of the Pearson chi-square statistic. Since both male and female children in model 2, 3 and 4 each have P values of 0.000, the study concludes that these models are adequate in explaining the dependent variable. However, model 1 does not adequately explain the dependent variable among both male and female children in Nyanza province given that its' P-value is greater than 0.05 (I.e. 0.2562 for boys and 0.4117 for girls).

(f) Rift valley province

Model 1 and 2 of table 5.7 below shows that age and nutrition status have no significant influence on the probability of infant and child survival in Rift valley province. The addition of immunisation variables to those in model 2 however shows that both male and female children who had received some and complete immunisation had significantly lower mortality compared with those children with nil immunisation of the same sex. While coefficients for complete immunisation was significant at a 1 percent level among female children, it was significant only at a 10 percent level among the male children.

With the addition of breast-feeding and birth order variables in model 4 to those present in model 3, most coefficients in previous models remained similar in magnitude and significance. However, Whereas durations of breast feeding was insignificant among male children in the province, breast feeding for periods of between 10 and 19 months significantly lowers mortality among girls, by a relative odds of dying that is reduced by the factor exp (-1.9613) = 0.1407. Model 4 also demonstrates that birth order has no significant independent influence on the mortality of girls. On the contrary, boys born in birth order 2 had significantly reduced risks of dying relative to boys born in birth order 1. The relative odds of death of boys in birth order 2 as compared to birth order 1 is 0.1164.

The effectiveness of the overall models in Rift valley province is assessed using the P-value of the Pearson chi-square statistic. For both male and female children, model 1 is not adequate in explaining the dependent variable, given that its' P-values are greater than 0.05 (0.2404 for boys and 0.0556 for girls). Models 2, 3 and 4 each have P-values of 0.000, which makes the study to conclude that these models are adequate in explaining the dependent variables (the log odds of dying before age five among both male and female children).

Table 5.7 Logistic regression estimates of the determinants of infant and child mortality by sex in Rift Valley province, 1993.

COVARIATES	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
	BETA	SE	BETA	SE	BETA	SE	BETA	SE
SEX	BOYS							
CONSTANT	-6.1997	15.726	5.229	317.71	5.540	317.44	6.218	317.37
AGE DUMMIES								
CMC2	2.387	15.737	-7.627	317.71	-6.178	317.44	-5.982	317.37
CMC3	2.576	15.734	-8.133	317.71	-5.892	317.44	-5.577	317.37
CMC4	3.303	15.727	-7.499	317.71	-5.333	317.44	-5.084	317.37
NUTRITION								
HTA2			-8.406	27.108	-8.925	25.009	-9.114	24.51
WH2			-9.026	22.870	-8.118	21.498	-8.823	20.99
IMMUNISATION								
SOME					-2.337 ***	.5354	-2.604 ***	.5829
COMP					-.9579 +	.5024	-.9631 +	.5112
BREASTFEED								
BRFED2							-.2977	.4736
BRFED3							-.7602	.7017
BIRTH ORDER								
BORD2							-2.151 *	.9310
BORD3							-.1052	.6866
BORD4							-.4843	.5339
-2LOGLIKELI	262.264		218.108 +*+		176.291 +*+		167.253 +*+	
DEGREEOFFREE	769		767		765		760	
SEX	GIRLS							
CONSTANT	-7.2017	21.164	6.085	260.244	6.863	428.307	7.411	425.074
AGE DUMMIES								
CMC2	3.0428	21.759	-8.6496	260.245	-7.372	428.307	-7.754	425.074
CMC3	3.6182	21.170	-8.9326	260.245	-6.715	428.307	-7.709	425.074
CMC4	4.4701	21.165	-8.0458	260.244	-5.849	428.307	-6.788	425.074
NUTRITION								
HTA2			-8.9645	26.733	-10.430	39.217	-10.329	39.181
WH2			-9.3230	23.606	-9.636	35.566	-9.821	34.536
IMMUNISATION								
SOME					-3.113 ***	.5656	-2.909 ***	.5929
COMP					-1.686 **	.669	-1.6504 *	.6948
BREASTFEED								
BRFED2							-1.9613 **	.7880
BRFED3							-1.1225	.7458
BIRTHORDER								
BORD2							-.2555	1.2935
BORD3							1.329	.9613
BORD4							1.0038	.7639
-2LOGLIKEL	245.592		190.868 +*+		168.650 +*+		159.194 +*+	
DEGREEOFFRE	451		449		447		442	

*** Significant at the .001 level; ** significant at the .01 level; * significant at the .05 level; + significant at the .10 level; +*+ p-value of the Pearson chi-square statistic less than 0.05. Note: Estimates of the regression analysis are based on 773 male cases with 32 deaths, and 739 female cases with 34 deaths. Standard error (SE) of constants is not significant.

(g) Western province

Table 5.8 below shows that immunisation is a significant determinant of male and female child mortality in western province. Model 3 demonstrates that at a 5 percent significance level, the odds of death for girls with some immunisation are reduced by the factor exp (-1.0580) = 0.347, relative to the reference category (girls with nil immunisation). At a .001 significance level, the log odds of dying are lower for boys with some immunisation by the factor exp (-2.0669) = 0.127, relative to boys with nil immunisation. Receiving complete immunisation also significantly reduces mortality of boys and girls.

In model 4, breast-feeding girls for a period of 10-19 months significantly lowers their mortality as compared to breast-feeding them for durations less than 10 months. The odds ratio of births to die among girls breast-feeding for 10-19 months is less by 0.312 times when compared with girls breast-feeding for periods less than 10 months. For boys, the breast-feeding coefficients are insignificant. Model 4 also demonstrates that birth order 2 and 3 have no significant influence on male and female child mortality. However, mortality is significantly reduced at a 5 percent level for boys in the forth and higher birth orders and at a 10 percent level for girls in the forth and higher birth orders. The odds ratio for male children to die in the 4+ birth order is less by 0.342 times that of male children in birth order 1. Girls born in such birth orders have a low relative odds of dying, namely exp (-0.9736) = 0.378.

The effectiveness of the models used in the analysis of data in Western province is assessed using the P values of the Pearson chi-square statistic. Models 1,2,3 and 4 among both male and female children in Western province are adequate in explaining the log odds of dying for boys and girls under five years of age. This is because of the P-values of these models, all of which are less than 0.05.

Table 5.8 Logistic regression estimates of the determinants of infant and child mortality by sex in Western province, 1993.

Covariates	MODEL 1		MODEL 2		MODEL 3		MODEL 4	
	Beta	SE	Beta	SE	Beta	SE	Beta	SE
sex	BOYS							
constant	-6.1997	22.240	7.1335	272.511	8.484	449.069	8.4373	449.062
age dummies								
cmc2	3.3519	22.246	-8.145	272.511	-8.321	449.069	-7.8254	449.061
cmc3	3.1086	22.245	-9.639	272.512	-8.762	449.070	-8.0874	449.062
cmc4	4.2901	22.240	-8.135	272.511	-7.404	449.069	-6.6074	449.062
nutrition								
HTA2			-8.711	24.748	-10.003	39.142	-9.8356	39.122
WH2			-9.625	17.524	-10.684	27.662	-10.6729	27.561
Immunisation								
SOME					-2.067 ***	.5513	-1.958 ***	.5705
COMP					-.6820 +	.4377	.9425 *	.4743
Breastfeed								
brfed2							-.0296	.4519
brfed3							-.1860	.6082
birth order								
bord2							-.1022	.6606
bord3							-.1325	.7792
bord4							-1.072 *	.5526
-2LL	278.496 +*+		201.724 +*+		173.320 +*+		166.867 +*+	
D Freedom	441		439		437		432	
sex	GIRLS							
constant	-7.2017	21.164	-9.758	131.465	-10.770	218.126	-10.753	216.296
age dummies								
cmc2	2.997	21.188	6.762	131.469	8.296	218.129	9.577	216.299
cmc3	5.653	21.166	8.830	131.465	11.133	218.127	12.071	216.297
cmc4	4.610	21.165	8.062	131.465	10.587	218.127	11.728	216.297
Nutition								
HTA2			-8.049	25.300	-8.806	41.159	-8.961	40.447
WH2			-9.137	17.375	-9.863	28.077	-9.844	27.577
immunisation								
SOME					-1.058 *	.4960	-1.104 *	.5264
COMP					-1.244 **	.4608	-1.240 **	.4819
Breastfeed								
brfed2							-1.165 *	.5335
brfed3							-.3260	.5375
birth order								
bord2							-.8452	.6856
bord3							-.4973	.7199
bord4							-.9736 +	.5195
_2LL	245.592 +*+		190.868 +*+		168.650 +*+		159.194 +*+	
D freedom	451		449		447		442	

*** Significant at the .001 level; ** significant at the .01 level; * significant at the .05 level; + significant at the .10 level; +*+ P value of Pearson chi-square statistic less than 0.05. Standard error (SE) of constants is not significant. Note: Estimates are based on a regression analysis of 455 female cases with 38 deaths and 445 male cases with 44 deaths.

From the foregoing facts, consistent with the study hypothesis, boys and girls receiving some and complete immunisations have significantly lower mortality rates in Western, Rift valley, Nyanza and Coast provinces. However, inconsistent with the study hypothesis, it is interesting to note that some and complete immunisation is insignificant in affecting infant and child mortality in Nairobi province. Inconsistent with the study expectations, it is found that receiving complete immunisation is not significant in lowering mortality of male children in Central and Eastern provinces.

Consistent with the study hypothesis, birth order of the individual children in Nairobi and Eastern Provinces does not significantly affect mortality of male and female children. In Rift valley, Nyanza and Central provinces, birth order has no significant influence on mortality of girls. In Coast province, birth order does not affect the mortality of boys. However, Inconsistent with the study hypothesis, there is some hint that mortality is significantly elevated among boys in birth order 2 and 4+ (central province) and female children of the second birth order (Coast province). Mortality is also significantly lowered among male and female children born in birth order 4+ (Western province), boys in birth order 2 (Rift valley province), and boys in birth order 2 and 4+ if only at a 10 percent significance level (Nyanza province).

Consistent with the study hypothesis, age of the individual child does not have an independent effect on the mortality differentials of male and female children in Kenya. However, with the addition of other variables such as the nutrition status, immunisation coverage and duration of breast-feeding of male and female children to the study's regression model, the probability of death is significantly elevated among female children in the age categories 1-11 months and 12-23 months, relative to those less than 1 month old in Nairobi and central provinces. Mortality is also significantly lowered among boys 1-11 months old in coast province, and boys of 1-11 months and 12-23 months in Nyanza province, relative to

boys in the less than 1-month age interval in the same province. Inconsistent with expectations, boys and girls in the age interval 1-11 months in Eastern province are more likely to die than children of the same sex less than one month old. Interestingly, with the introduction of other variables e.g. nutrition, immunisation, birth order, and breast feeding duration, this significance fizzles out making it to be consistent with the study hypothesis.

Consistent with the study hypothesis, the nutritional status of the child does not affect male and female mortality in Kenya. In the multivariate regression analysis, variables representing the influence of the nutritional status of the child (HTA2) and (WH2) on mortality were found to be statistically insignificant. This is inconsistent with studies from other parts of the world on the effect of the nutritional status of a child on mortality (Ware, 1986; Simmons et al, 1982; Basu, 1989; Das Gupta, 1987). However, it is consistent with a district level regression analysis on the data from the 1978 and 1982 Kenya National Nutrition Surveys (UN 1986), in which although areas with more malnutrition were found to have higher child mortality rates, the proportion of children categorised nutritionally as stunted yielded results indicating insignificance of the nutrition factor as a determinant of child mortality. Similar findings were also reported by Koyugi (1992) for rural Kenya, in which community level nutrition status of children were found not to be statistically important. This lack of significance is attributed by the United Nations (UN, 1986) to the use of proportion stunted and proportion wasted, which is considered to be an inferior measure of malnutrition when compared to the use of proportion categorised as normal (UN 1986).

With regards to breast-feeding, the study finds that consistent with its expectations, the duration of breast feeding does not affect an individual child's mortality (irrespective of sex) in Nairobi, Central and Nyanza provinces. However, inconsistent with the study's hypothesis, there is some hint that breast feeding children for durations of 10-19 months in Western and Rift valley provinces; 10-19 months and over 20 months in Coast province; and

for periods over 20 months in Eastern province significantly lowers the mortality of girls. Interestingly however, the duration of breast-feeding is insignificant in affecting the mortality of boys in these provinces.

As earlier mentioned, health care given to sick children was not incorporated in the regression analysis. In so doing, tests of statistical significance were not performed on this variable. However, cross tabulation on health care given to sick children (see section 4.7) reveals that for an episode of diarrhoea, parents were more likely to visit health facilities to treat male than female children. Interestingly, this coincides with national figures of slightly higher post-neonatal female mortality rates (table 4.1). At a provincial level, for an episode of fever and cough, and also cough with short rapid breathing, parents in coast province were more likely to provide appropriate health attention to male children (Table 4.5; 4.6). Coincidentally, table 4.1 also hints at excess female post neonatal mortality rates.

CHAPTER SIX

SUMMARY, CONCLUSION AND IMPLICATIONS OF THE STUDY

6.1 Summary and conclusions

In this study, the broad research objective was to look at the determinants of sex differentials in Infant and child mortality in Kenya. Linked to this research question, the broad hypothesis was that the child's demographic factors and also the behaviour of the parent towards the child with regards to nutrition and health factors will have an effect on infant and child mortality differences by sex in Kenya.

A conceptual framework developed by Chen et al (1981) to study sex bias in the rural Bangladesh family was chosen and adopted for this study. It was slightly modified in order to allow for the incorporation of demographic characteristics of the individual child as an explanatory variable in our study. From this modified framework, six explanatory variables were defined with the dependent variable being the risk of death during infancy and childhood up to age five.

Direct methods of data analysis, with the child as the unit of analysis, were used on a subset of 1993 Kenya Demographic and Health Survey data. This was restricted to 3035 boys and 3047 girls born in Kenya since July 1989. From this data, infant and child mortality rates were estimated by sex, birth order and region of residence. Additionally, mortality sex ratios and immunisation dropout rates were calculated. A multivariate logistic regression analysis method was applied to the data set in order to examine the effect of demographic, health and nutrition variables on infant and child mortality, and also perform tests of statistical significance.

The study set out to attempt an estimation of infant and child mortality rates by sex in Kenya, 1993. The study expectation was that there is no difference in the mortality of boys and girls by birth order in Kenya. It was found that in the neonatal period, male mortality rates are higher than female mortality rates, a pattern consistent with higher biological risks among male infants. However, this pattern is reversed in the post neonatal period when Kenyan female mortality slightly out numbers that of their male counterparts, a pattern reflecting societal manipulation which tends to influence the environmental and care related factors that come into play, to influence child mortality after the neonatal period.

The study further found that at the time of the survey, mortality differentials by sex were very small and mostly in favour of female infants and children. In Kenya, the small differentials in mortality by sex were noticeable in the neonatal (< 1 month) and child (24-48 months) age groups but were absent in the toddler (12-23 months) age interval. However, at a provincial level, excess post neonatal male relative to female mortality rates, were noticed in Central province; excess male child (24-48) mortality rates relative to female child mortality rates were recorded in Western province; excess post neonatal female mortality relative to male mortality were recorded in Coast province; while in Eastern province, excess female child (24-48) mortality relative to male mortality was recorded.

The study also set out to examine sex differences in mortality by birth order of individual children. It expected to find that differences in mortality for boys and girls do not vary with the birth order of an individual child. The study found that at birth order 1, more male than female children die in Kenya, a pattern consistent with findings from

other parts of the world (e.g. Das Gupta, 1987). At a provincial level, Coast province registered significantly elevated mortality risks among girls born in the second birth order. In Central province, boys born in the second and the forth and higher birth orders experience significantly elevated mortality risks relative to female children in that province. On the other hand, mortality is significantly lowered among girls relative to boys, born in the second and also the fourth and higher birth orders in Nyanza province.

In exploring the principal behavioural mechanisms by which sex differentials in childhood mortality is brought about, the study's specific objective was to examine the effect of health care received by children on the mortality of male and female infants and children in Kenya. The expectation was that larger numbers of children of a particular sex given appropriate health care in the event of illness would be associated with lower risks of death. The study found no significant differences in the prevalence of fever and cough, diarrhoea, and also cough with short rapid breathing by sex in Kenya. This implies that both boys and girls are subjected to the same physical and personal environment.

There was also no significant difference in the treatment given to male and female children in Kenya for an episode of fever and cough or cough with short rapid breathing. However, for an episode of diarrhoea the conditional probability of visiting a health care facility was higher for boys relative to girls in Kenya. At the micro level, parents in Coast province were more likely to visit health facilities or providers to treat boys than girls for an episode of fever/cough or Acute Respiratory Infection. On the other hand, in Nairobi province, female children were favourably treated compared to male children in the event of an attack by fever and cough or acute respiratory infection.

Though national figures also portray that there was significant differentials in the treatment given to boys and girls in the event of illness, with parents visiting health facilities or providers more frequently to treat boys than girls, it was found that at the provincial level, equal treatment was given to male and female infants and children ill with diarrhoea in Nairobi and Eastern provinces.

Care given to sick children in the event of illness is correlated to mortality rates in Kenya. The study found that Coast province with excess female post neonatal mortality also had lower percentage of girls than boys given taken to health care providers/facilities in the event of fever and cough or cough with short rapid breathing. Nairobi province with a higher percentage of girls relative to boys receiving appropriate health care in the likely event of fever and cough or acute respiratory infection also recorded excess toddler (12-23) male mortality rates.

The study also established that Nyanza and western provinces had the highest prevalence rates of fever and cough among both male and female children. However, both male and female children in both provinces were given the least health care coverage for an episode of fever and cough, relative to other provinces in the country. The highest use of health care facilities in the event of diarrhoea was given to children (irrespective of sex) in Coast and Nyanza provinces. The least health care coverage for children with cough and short rapid breathing and also diarrhoea was given to children (irrespective of sex) in Nairobi province.

With regards to immunisation coverage, the study objective was to examine the effect of immunisation coverage on the mortality of male and female infants and children. The study hypothesis linked to this objective stated that greater immunisation coverage for

children of one sex would be associated with lower death risks among children of that sex. The study found that immunisation is a highly significant determinant of male and female infant and child mortality. More female than male children were likely to receive vaccination in Central and Coast provinces. However, a greater percentage of male children in Central province and female children in Coast province administered with the first doses of DPT and polio vaccines did not get subsequent doses of DPT and polio vaccines. The study also found that in Western province, male children are more likely to be vaccinated compared to the female children. However, higher immunisation dropout rates were recorded among the male children in the province. In Western, Rift valley, Nyanza and Coast provinces, male and female children receiving some and complete immunisation had significantly lowered mortality risks. However, immunisation does not significantly influence mortality of male and female children in Nairobi province. In Central and Eastern provinces, the study finds that though complete immunisation significantly lowers mortality of female children, it is not a significant determinant of the mortality of boys.

In exploring the effect of the nutritional status of children on the mortality of boys and girls, the study expectation was that mortality differences by sex is not determined by the nutritional status of individual children. It found no difference in the nutritional status of boys and girls by province. Consistent with other studies in Kenya (e.g. UN, 1986; K'oyugi, 1992), the study's provincial level regression analysis showed that although areas with more malnutrition rates such as Coast, Eastern and Nyanza provinces had higher child mortality rates, the proportion of male and female children categorised as stunted and wasted yielded results indicating that, nutrition is insignificant in

influencing male and female infant and child mortality. As noted before, this could be attributed to the use of proportion stunted and wasted, both of which are inferior indicators of mortality compared with the proportion of children classified as having normal nutritional status.

One of the study objectives was to explore the effect of duration of breast-feeding on the mortality of boys and girls. The hypothesis linked to this objective was that the duration of breast-feeding does not affect infant and child mortality differences by sex. The study found that boys and girls in Kenya are breast fed for almost equal durations. In the regression analysis, breast feeding children for durations of 10-19 months in Western and Rift valley provinces; for 10-19 months and over 20 months in Coast province; and for periods over 20 months in Eastern provinces significantly lowers the mortality of girls. Interestingly however, the study indicates that the mortality of boys in these provinces is not significantly influenced by the duration of breast-feeding.

6.2 IMPLICATIONS OF THE STUDY

6.2.1 Policy implications

One of the study findings is that more female than male children are vaccinated in Central and Coast provinces. It was also found that a high percentage of male children in Central province and female children in Coast province were not given subsequent doses of DPT and polio vaccines. There is therefore need to reformulate a comprehensive health policy regarding immunisation, so as to give emphasis to gender bias in the receipt and consequent dropout of the various vaccination doses for boys and girls in the two provinces. Because immunisation was found to be a highly significant determinant of

lowering mortality risks among both boys and girls in Kenya, policies needs to be intensified on Immunisation promotion programs. More emphasis needs to be placed on educating parents particularly in Coast and Central province on the need to give both male and female children equal immunisation coverage. This should be done with minimal cost implications since there already exists Kenya Expansion Programme on Immunisation, Implemented by the Ministry of Health and supplemented by UNICEF and WHO.

Adequate and comprehensive health policies should be formulated with greater emphasis placed on health coverage among both male and female children in Nyanza and Western provinces. This is because though the two provinces were found to have the highest prevalence rates of fever and cough among both male and female children in the country, infected children in both provinces were given the least health care coverage. This could be done with minor cost implications by incorporating into the existing curriculum on health and population, educative information for parents in these provinces, aimed at frequenting visits to hospitals to treat children in the event of illnesses.

In Coast province, parents frequently visiting medical facilities or providers to treat boys than girls for episodes of fever and cough, and also cough with short rapid breathing. This calls for a change in these parent's attitudes towards girls, a factor that can be achieved with minor cost implications through education.

6.2.2 Implications for further research

There is need to carry out further research looking at the effect of family composition on mortality differentials by sex in Kenya. Because this study used child files, which normally assume that individual children are independent cases, it was not possible to determine how the number of surviving older brothers and sisters influence the survival chances of the index child. This can only be done in the context of the household to which the individual child belongs.

The study also found that boys in birth order 2 and 4+ in Central province, and girls in birth order 2 in Coast province had significantly elevated mortality risks relative to their counterparts in birth order 1. This is not consistent with studies on mortality by birth order carried out in Kenya (Ikamari, 1996), and also in other parts of the world (Das Gupta, 1987: 82). There is therefore need for further research on this.

Because of limitations of time and finance, and because of the use by the study of child files, which treat individual children as independent cases, this study could not establish the influence of the family's socio-economic status on the mortality of male and female infants and children. The study recommends further research on a household level analysis of the influence of the family's socio-economic circumstances on infant and child mortality differentials by sex in Kenya.

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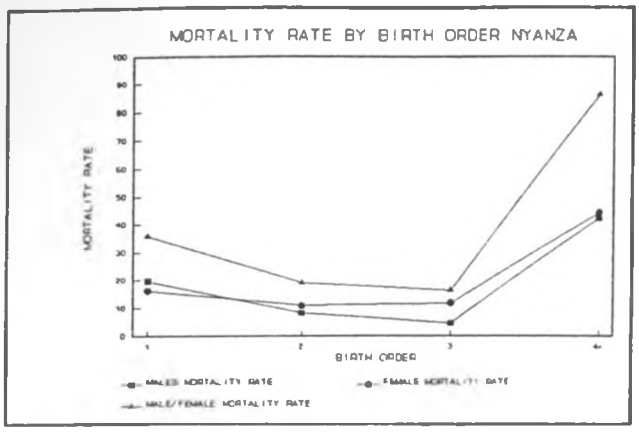
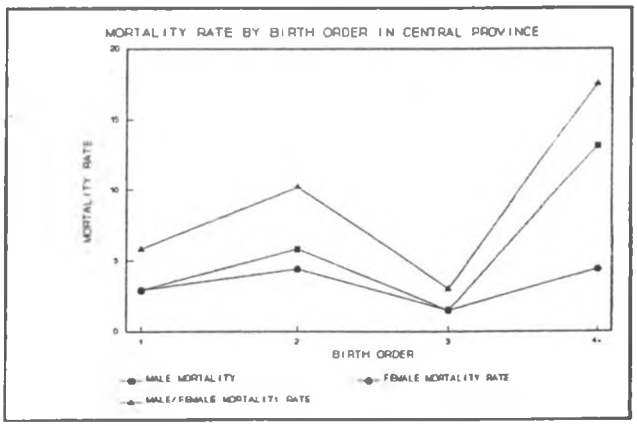
APPENDICES

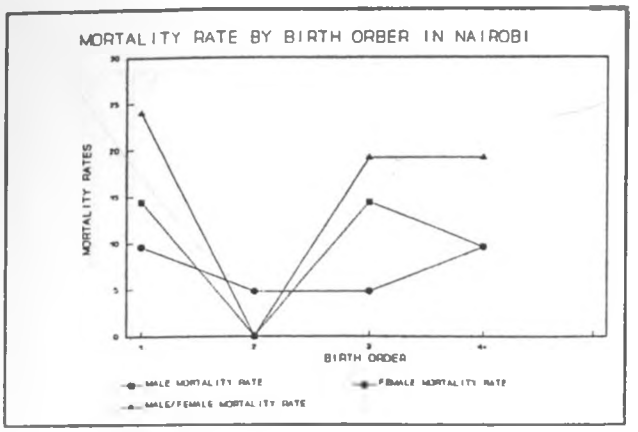
Appendix A: mortality rates by birth order, Nyanza Province



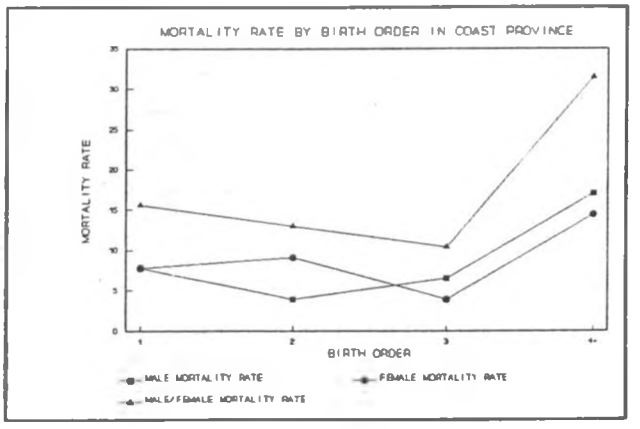
Appendix B: mortality rates by birth order, Central Province



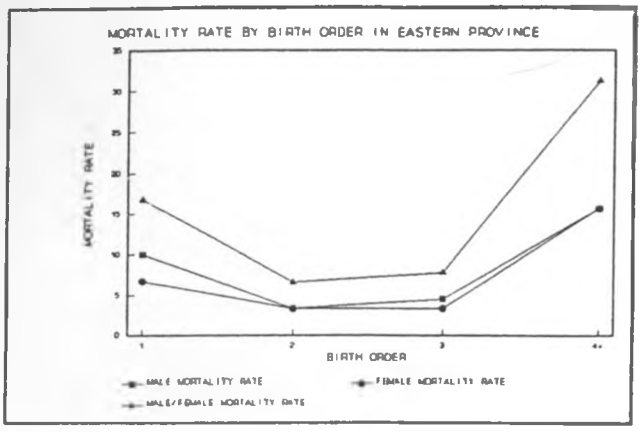
Appendix C: Mortality rates by birth order, Nairobi Province



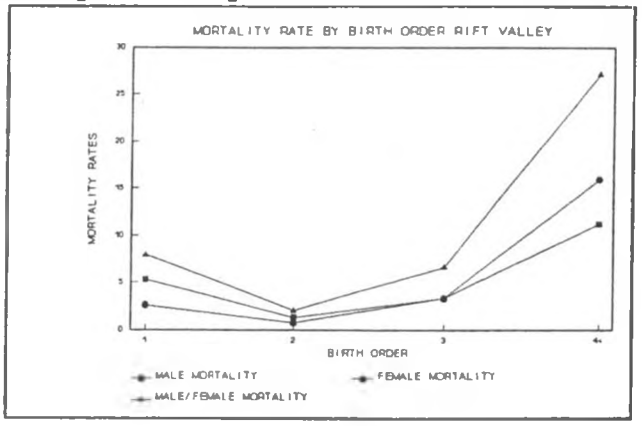
Appendix D: Mortality rates by birth order, Coast Province.



Appendix E: Mortality rates by birth order, Eastern Province.



Appendix F: Mortality rate by birth order, Riftvalley Province.



Appendix G: Mortality rate by birth order, Western Province.