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^ INFANT MORTALITY SITUATION IN KENYA: THE EFFECTS OF SOCIO-DEMOGRAPHIC AND ENVIRONMENTAL FACTORS //

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DECLARATION

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

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This Thesis has been submitted for examination with my approval as University supervisor

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DEDICATION

This •Peaco.of work is dedicated to my Mother - an inspiration.

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ABSTRACT

This study set out to^the relative effects of socio-demographic and environmental factors on infant mortality in Kenya. The study adopted the Mosley and Chen's analytical framework for the study of child survival in developing countries. The data used in this study came from Kenya Demographic and Health Survey (KDHS) of 1993. Two methods of analysis were employed in this study - Trussel's technique of estimating child mortality and logistic regression analysis. The first technique was used to estimate mortality levels and probabilities of dying. The second method was used to assess the effects of socio-demographic and environmental factors.

The results of the analysis revealed that: between 1985 and 1990 there was a sharp decline in mortality and a light increase between 1991 and 1993; and that maternal level ' of education, breastfeeding and source of water are the key factors influencing the mortality risk during childhood. Maternal education was found to be the most crucial socio-economic factor influencing infant mortality in Kenya. The study findings show that children born to educated mothers had higher chances of survival compared to those born to uneducated mothers, whereby the riskPdeath before age 5 was on the average more than twice as much for children whose mothers had no education when compared with those whose mothers had secondary level of education.

Breast feeding and preceding birth interval were the most significant demographic factors influencing the risk of death during infancy. Infants that were breastfed for longer durations had very low risks of death compared to those breastfed for shorter durations. On the same note infants born with wider preceding birth intervals also had higher chances of survival compared to those with shorter preceding birth intervals. Source of drinking water and type of toilet facility were very significant environmental factors determining infant mortality. Use of bush, pit latrines and un-piped water increase the risk of infant death. For every 1000 infants from households which had no piped water and were using pit latrines, 137 were expected to die, while those from households with piped water, only 63 per 1000 were expected to die.

The study recommends that maternal education should be a priority in policy formulation and programme designs. Basic education programmes should therefore be expanded to reach majority of female population. Breastfeeding programmes should also be encouraged as part of the child survival programmes. Policies and programmes on environmental health need to be re-formulated to guarantee higher environmental health standards so as to reduce the risk of infant deaths.

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CHAPTER ONE

INTRODUCTION

1.0. Introduction

Different changes in infant and child mortality has been observed the world over. Substantial declines in infant and child mortality rates have been observed in most •developing-countries,- Kenya in particular. These changes have been attributable to improvements in standards of living and international and national health activities (Hill and Pebly 1989). The current mortality situation in Africa south of Sahara is becoming positively promising. Declining mortality levels have been continually documented especially infant and child mortality which had been high in the continent of Africa. Hill (1987) observed that "African mortality is finally yielding its secrets. We now know that it is declining everywhere-in some places very sharply".

People have shown worries over the pace of mortality changes (mostly declining tendencies) achieved in many developing countries. As Gwatkin" (1980), Ruzicka and Hansluwka (1982) have indicated, these worries have been whether the pace will be sustained because of the slow pace of economic development; that the initial concern arose from the belief that exogenously developed, technologically sophisticated public health interventions could not bring about sustained mortality decline in the face of only limited improvements in third world living standards. Kenya as an individual country in Sub Saharan Africa has seen very encouraging trends of infant and child mortality since 1948 when data for such kind of analysis was first collected.

1.1. The Research Problem:

Kenya has been documented to be in the fore front among those countries whose mortalities have indicated declining trends. By the time of the 1948. population census, the estimated infant mortality was 184 infant deaths per thousand live births, by the 1962 population census it appeared to have dropped remarkably to 174 deaths per thousand live births. The drop continued substantially to 119 infant deaths per thousand live births in 1969 population census. By the 1979 population census, infant mortality had subsided even further to 87 per thousand' live births. Currently according to the 1993 Kenya Demographic and Health Survey (KDHS), the infant mortality is 62 deaths per thousand live births.

Some factors must have contributed to this prevailing scenario of infant mortality situation in Kenya and this may be supported by many hypotheses that have been advanced to explain infant mortality situation in different settings. As is the case with general mortality, infant mortality is also associated with socioeconomic development, improvement in nutrition, sanitation, health education, and medical and health care. Given these, some factors may have a particular effect on infant mortality to produce the existing scenario of infant mortality in Kenya. This study therefore set out to address the problem of how these factors may have directly or indirectly affected infant mortality in the recent past in Kenya.

The problem therefore is to systematically examine the infant mortality situation in Kenya and correlate the situation with the prospective factors which may have contributed to this situation. The study attempts to demonstrate that, despite these general assumptions that these factors affect and may have affected infant mortality, the contexts through which they affect infant mortality have not been systematically assessed in Kenya and as much as studies have been done on whether mothers are getting more educated or, the environmental conditions are improving and becoming more favourable to life, planning of families is taking more ground, or, medical and health care is becoming more advanced, or, socioeconomic conditions is improving substantially, little is known about the roles of these factors in the contribution to infant mortality in Kenya.

This study therefore attempts to answer the question "What is the effect of each of these factors to infant mortality in Kenya currently ?"

This study, therefore, is to examine these complexities and offer a systematic assessment of the relative roles of these factors in the situation of infant mortality in Kenya.

1.2. Objectives of the Study.

1.2.1. General objectives:

This study attempts to systematically assess the effects of socio-demographic and environmental factors on infant mortality situation in Kenya.

1.2.2.Specific Objectives:

The specific objectives of this study are: .

1: To assess the effects and significance of mother's education on infant mortality in Kenya.

2: To assess the effects of the use of piped water and improved" toilet sanitation on infant mortality in Kenya.

3: To examine the impact of birth interval and duration of breast feeding on infant mortality in Kenya.

4: To examine the impact of mother's age at child birth on infant mortality in Kenya.

1.3 Justification of the Study:

Any information regarding mortality situation in a country, plays a very important and diversified role in the national planning and any data and study of mortality enhances the identification of a country's demographic situation currently in place and clarifying its immediate demographic future. Therefore, a study on mortality puts in a clear state, progress in one of the areas of most universal human concern, prolonging of life and prevention of premature or early death. Chase (1974) observed that infant mortality has long been used as an indicator of health and is recognized to be inversely related to the socio-economic levels of populations. Bolander (1974) and Mott (1979) have observed . that infant mortality rates and post-neonatal infant mortality are among the best indicators of socio-economic development and significant health indicators of a country.

This study, therefore, will perform a "related analysis of mortality levels with other variables of social, economic, environmental and demographic concern as far as the country's development strategies are concerned and offer a systematic analysis of the effects of infant mortality correlates. This aspect has significant policy and theoretical implications.

1.4. Scope and Limitations:

This study takes into consideration the whole country by using data based on the country as a whole. The study looks into socio-demographic and environmental variables which might have contributed to the change in infant mortality decline in Kenya. Due to limited time and resources, it could not be possible to conduct a field survey to collect data for this analysis. This study therefore used secondary data from the Kenya Demographic and Health Surveys (KDHS) collected for the whole country in 1993. As has always been observed by demographers, secondary data of this nature may suffer some biases based on small sample size or incompleteness and sample errors. These biases may result in unexpected results in data anlysis. Fortunately, the KDHS data does not suffer from these kind of biases as the sample size is large enough, the responses are complete and sample errors are prety minimal. Therefore, it is expected that the results in this study will meet the criteria expected. The study focuses on socio-demographic and environmental variables in the attempt to perform the assessment.

CHAPTER TWO

LITERATURE REVIEW AND THEORETICAL FRAME WORK:

2.0 Introduction

In this chapter, literature on infant mortality is examined. The literature is examined by general assertions on mortality and by empirical findings on mortality from the developed countries through the "developing countries then settling on Kenya as a case for study. When reviewing the general assertions, postulated writings on infant mortality are examined while empirical findings examine practical researches and their results both in the developed and developing economies. Theoretical frame work, operational model and hypothesis are then derived from the literature review.

2.1. Literature Review

2.1.0. General Assertions on Mortality

Mortality has been observed to be an inescapable dimension of human experience. Hains and Avery (1982) contended that the control of mortality has been one of mankind's most startling achievements in the quest to manipulate the environment to their advantage. They observed that much of the rapid growth in population since world war II in developing nations has been basically the consequence of rapid mortality decline and that it has been asserted that the decline has been caused largely by the introduction of what they called "Exogenous" modern medical technology.

This great discourse boarders closely with the similar observations by Stolnitz (1955) whose general assertion was that this decrease in mortality rates was largely independent of economic factors and was mainly due to macro factors such as improved medical technology, disease control, and increased availability of medical facilities. However, some demographers have disputed these observations arguing that economic factors have been and continue to be important in reducing mortality rates in the less developed countries (Frederksen 1961).

It has been generally observed that, however not perfectly correlated infant mortality with average income in a given country may be, infant mortality is closely related to the overall level of well being in a country and in fact it has been regarded as one of those revealing measures of how well a society is meeting the needs of its people .

On this parallel, infant mortality has been widely used as a measure of progress within any given society, just as a contention by Newland (1981) that no cold statistic expresses more eloquently the difference between a society of sufficiency and a society of deprivation than the infant mortality rate. She notes that as a social indicator, the infant mortality rate illuminates much that a measurement of the Gross National Product (GNP) observes. Infant mortality is particularly sensitive to distributive issues, reflects not simply per capita stocks of food, clean water, medical care and others, but the actual availability of such amenities to all segments of population.

Infant mortality explains much of the general mortality, given that in most populations more people die during the first year of life than at any other single age. This explains.

why most governments mainly in The developing world wish to find means of reducing infant mortality to the lowest levels as they can afford. To do this, they need to know exactly what changes contribute or have contributed to infant mortality reductions and what factors, if any, have kept reductions from being greater.

Lower levels of mortality in modern developed countries have been attributed to improved nutrition and innovations in medical care, resulting basically from what Arriaga (1970) termed as technological and economic development, but the situation in the presently developing countries seems to differ in that mortality decline and economic and technical development do not appear to be closely related. Mortality rates of these countries have declined more rapidly than their economies have developed.

In the African situation, mortality levels have improved quite significantly. Mott (1979) asserted that mortality levels in Africa run the spectrum from among the highest in the world to, more rarely, relatively low rates and as has been indicated by the United Nations (1991), mortality has declined considerably in the African context. In the Sub-Saharan Africa region the crude death rate fell from about 24 per thousand in the early 1960s to 16 per thousand in the late 1980s, with infant mortality falling from 164 per thousand live births to 109, and life expectancy at birth increasing from 41 to 53 years. Generally there is an assumption that mortality reductions will continue in the coming decades.

Van de Walle.et al (1992) in'their study of mortality and society in Sub-Saharan Africa, revealed that there appears to have been some degree of decrease in childhood mortality between the end of World War II and 1980 in the vast majority of the African countries for which post war data exist. They summarized the magnitude of the overall fall by noting that in the Africa of the 1950s, countries were common where 30 to 40 percent of children died before achieving the age of 5 years, while it was very rare to find countries with less than 22 percent. Even though, they still argued that the observed declines vary greatly in timing and pace, observing that in some countries, fall in mortality have been dramatic. Kenya is offered as an example in a case of between the late 1940s and early 1970s being from 26 to 15 percent.

Linda et al (1993) also made a very revealing observation that child mortality continues to depreciate m many areas, but the drop may have stagnated or even reversed in some countries, and that the AIDS pandemic threatens to increase mortality among young adults in some African countries. Hill and Hill (1988) contend that the good news about mortality in Africa is that it has been falling and that by the early 1980s the average expectation of life had increased from 40 years to about 50 years. Despite droughts, natural disasters and famine, mortality appears to have dropped in all parts of the continent, though the rate of decline has shown substantial variation. The bad news about mortality in Africa - they observe - is that it is still higher on the average across the continent, than any other continent.

On the same note Hill (1987)"asserted that child mortality has reduced since the late 1940s in most countries for which data are available, where as in the early 1950s between 25 and 35 percent of children died before age 5 in most African countries and by the late 1970s most countries were clustered in the range of 15 to 25 percent dying by age 5 also that patterns of change vary greatly between countries where as in Mozambique, child mortality appears to have been essentially constant throughout the period while in others such as Kenya, Congo and Ghana the probability of dying by age 5 fell by almost 50 percent.

Analysis of mortality trends also suggests that declines are continuing to occur in a number of countries, as is imparted by Ewbank and Gribble (1993). They also argue that one of the factors contributing to the decline in infant and child mortality has been the provision of health services. A number of initiatives over the past 25 years have fostered child survival through promoting relatively simple, affordable, and proven technology. Heligman et al (1993) clarify this by explaining that in Africa, between 1985 and 1990 an estimated 4.1 million children died annually before their fifth birth day and were deprived of the most basic requirements for a healthy life. Therefore the first aim of many health programmes in Africa is to provide children with a reasonable chance of living a long and healthy life.

Although infant and child mortality rates are declining in most of Sub-Saharan Africa, only two countries - Botswana and Zimbabwe - currently are estimated to have infant and child mortality rates as low as the major goal calls for by. the year 2000. Most other countries will require declines of more than one third to achieve the goals of infant mortality rates by 50 per 1000 and child mortality rates of 70 per 1000.

Ewbank and Gribble (1993) explain further that in the past, mortality reductions probably have been the result of a number of factors, including health programmes (and control of epidemics), changes in diets and health behaviours and general economic development visible in education and road building, among others and that these factors will all continue to play a role in reducing mortality in the future.

If the expansion of health services has had an effect, we should expect to find that infant and child mortality has declined during recent decades, at least in countries that have achieved improvements in services- observed Hill (1991). He noted that in the Kenyan situation, the earliest estimates of the probability of dying by age 5 (5q0) goes back to 1947 when it was 262 and by 1970, the probability of dying before age 5 had decreased to 165 and it was estimated to be 100 by 1985.

2.1.1. Empirical Findings on Mortality:

Mortality is a complex biological phenomena shaped up by two inexorable forces, the mortal nature of man and his ecological adversities (Valaoras 1974). Environmental mortality is heavily superimposed, consisting mainly of deaths caused by the host of diseases" due to* macro-organisms or to noxious substances of the environment, to nutritional defects and to accidents or violence in general. Mondot-Bernard (1977) gives a related view that death results from a variety of causes. In infancy, death results mostly from infections, deficiency diseases and accidents. Whereby in Africa, infection and deficiency diseases are the most important. Direct causes like gastroenteritis and measles which very often lead to infant mortality rank before respiratory diseases, malaria and malnutrition.

Mortality levels during infant and early childhood are influenced by a complex of social, cultural, economic and health conditions that include the availability and quality of medical, water supply, sanitation food and housing, educational level- of parents (particularly mothers) and the quality of child care (United Nations 1986). In a further ' examination by the United Nations (1986) they found out that the lower the levels of economic development in a society, the higher the level of infant mortality and the greater the contribution of malnutrition and infections, parasitic respiratory and diarrhoeal diseases to overall mortality.

Puffer and Serrano (1973) studied infant and child mortality patterns in several Latin American cities and the investigation revealed a strong synergism between poor nutrition and environmental factors, and concluded that children who were underweight at birth owing to poor maternal nutrition and who were poorly nourished after birth were susceptible to infection associated with unsafe water, poor sanitation and inadequate housing. Their "study" also showed that a high proportion of the households reporting infant deaths lacked adequate water resources, though they did not analyze systematically the relation between the two.

There is a general consensus that increasing educational attainment is associated with declines in infant mortality (Bicego and Ahmed 1996, Caldwell 1979, Anker and Knowls 1977, and Brass 1979). Caldwell (1979) while examining education as a factor in mortality decline in Nigeria observed that educated mothers may be expected to break with tradition or become less fatalistic about illness and adopt many of the alternatives in child care and therapeutics that become available in the rapidly changing society. He found out that an educated mother is more capable than an illiterate one of demanding attention of doctors and nurses. He observed that the mother's knowledge of the available medical facilities is likely to be superior and she will tend to regard their use as a right and not as a boon.

Mott (1979) argued that the inverse association between educational attainment and infant mortality has been attributed to many causes. These include the likelihood that more education is associated with breaks with traditional family practices, less fatalism about illness, more effective child care and medical alternatives, better utilization of available foods, from nutritional perspective and more personal and intensive attention by the mother with more of the family resources spent on the child. He explains further that the external health and nutritional factors become increasingly important in determining the survival" chance of older infants. To the extent that these environmentally based death causes are more prevalent in developing societies one ordinarily anticipates that the lesser the level of development in a country, the greater the proportion of infant deaths which occur after the neonatal period.

In Sub-saharan Africa, most countries have indicated declines in under five mortality, Bicego and Ahmed (1996) however posit that in all but three of these countries the declines have been modest - less than 20% decline in the 10 year period preceding the survey - and in five countries the declines have been 10% or less. In Bicego and Ahmed's study mother's education is shown to be a key factor related to mortality risk during childhood. Death before age 5 is on average more than twice as common among children whose mothers did not complete primary school as among those whose mothers attended secondary school.

This foregoing observation concurs with Chase (1974) that Socio-economic indicators of mortality are often based on education as a factor. Chase argued that these socio-economic considerations have a strong influence on health care as well, for it is those families with the fewest resources who have the greatest difficulty in financing health care. She observed further that if education is limited, other resources relating to health matters are often also limited for example she gives nutrition, recognition of important symptoms, importance of preventive care, and finances to purchase medical care. In her study on education of mothers and infant mortality (1974) she found out a considerable conformity between the education of parents and mortality-mortality decreased with the level of education in each age group.

An examination of the effects of development on mortality differentials has revealed that the interaction between environment," economic resources,, pathogenic agents and mortality are certainly clearer for the pre-industrial societies than the more complex industrial societies. Galini (1977) asserts that in more complex dynamic model, mortality, biological factors and physical environment and socioeconomic factors are influenced by development.

Rogers (1979) also had an overview of the situation of mortality and its determinants as it were by indicating that the determinants of change in mortality in underdeveloped countries are difficult to unravel because they include improvements in health technology and its availability, education, sanitation, clean water supply, and a host of many other environmental variables. Newland (1981) observed that high infant mortality is associated with certain social problems that may persist even in the face of rising per capita income. She gave environmental contamination, lack of education, discrimination against women, poor health services and the related variables. She contends that a high or rising infant mortality rate or even a stagnating one with income gains, is the sign of a development process gone astray and that a rapidly declining rate may signify an improvement in social and environmental conditions that is disguised by slow growth.

Some studies have been done to analyze the effects of some, selected variables on infant and child mortality. Merrick (1985) analyzed the impact of access to piped water on trends and income class differentials in child mortality in Brazil. Merric began with a review of what available data indicated about general trends in infant mortality since 1950, he "then concentrated on changes in urban areas between 1970 and 1976 using census data for the first date and survey data for the second date. He used path regression analysis technique to test a recursive model linking supply and demand for piped water to selected variables to examine their joint effects on child mortality. He found out that piped water in the household is likely to be of most direct benefit in lowering child mortality by reducing exposure to water-borne diseases, particularly diarrhoeal disorders. Increase in the amount of water used contributes to better hygiene and that elimination of bacteriological contamination reduces the risk of infection through intake.

The roles of changes in variables and changes in the structures of relationships on infant mortality decline has been done in Malaysia for the periods between 1946 and 1975 by Da Vanzo and Habicht (1986). They used ordinary least square regression analysis and the logit regression analysis to determine the contribution of differences in explanatory variables between the two time periods. The analysis identified several factors contributing to the dramatic decline in infant mortality and one factor that prevented the infant mortality rate from declining even more rapidly - the findings were that education of the mother, water sanitation, birth spacing contributed greatest portion of the decline. Substantial reduction in breast feeding kept infant mortality rate in Malaysia from declining as rapid as it would have otherwise.

In their analysis of the reproductive patterns and child mortality in Guatemala, Pebley and Stupp (1987) employed a multivariate form of life table analysis, a harzad model to estimate the coefficients that measure the relationship between each of the independent variables. Their results indicated that children of women-at younger or oldest ages are subject to highest risk of mortality, birth spacing effects are significant 0-10 months of ages's survival. Maternal age had a very strong and significant curvilinear affect for the children of less educated mothers, where as the coefficient were small and not significant for children of educated mothers. Maternal education and the length of breast feeding have several crucial roles in the association of child mortality with maternal reproductive history. Both higher education and longer breast feeding have strong beneficial effect on child's chance of survival.

Many studies have been conducted to examine the relationship between infant mortality and birth spacing; Bicego and Ahmed (1996); Winikoff (1993); Davanzo et al (1983); Rutstein (1984); Cleland and Zeba (1984); Cecile de Sweamer (1984); Hobcraft et al (1985); Pebley and Stupp (1987) among others have severally on different situations, examined thoroughly this association. Rutstein in a 1984 study of data from the world Fertility Survey (WFS) was the first to show decisively that the pace of childbearing is closely linked to survival chances of children. Subsequent researches have demonstrated a strong relationship between child spacing and the risk of child mortality in developing countries.

The current study by Bicego and Ahmed (1996) also confirmed this. They observed that part of the observed bivariate association appears to be due to common cause household factors mediated by replacement of the dead children. The most pronounced "effects of short birth intervals on childhood mortality occurs during the neonatal period, 1-4 years.. Children born after long intervals (48 + months) generally have better survival chances in every age category than children in the reference group 24-47 months, especially after neonatal period.

Earlier Cland and Zeba (1984) examined the effect of birth spacing on childhood mortality in Pakistan and revealed that the survival chances of siblings are correlated for a variety of reasons, which may be entirely unrelated to the spacing. They found out that when the elder of a sibling pair dies in infancy, the interval to the next birth will tend to be shortened by involuntary cessation of breastfeeding leading to early resumptions of ovulation and/or a desire to replace the dead child. Thus a spurious association may be found between the length of the preceding interval and survival of the younger of the siblings pair. However they indicated that this problem may be overcome by taking into account the survival of the preceding child.

. Al-Hassan Conteh et al (1990) examined the environmental risk of childhood mortality in Liberia using data from the Demographic and Health Survey. Using a multivariate logistic

regression analysis, effects of type of sanitation facility available and of water source were distinguished, after adjusting for rural-urban residence, sex of child, birth interval **length** and access to health services. Maternal literacy, birth intervals less than two years and male sex also remained significant predictors of childhood death. A very short birth **interval** (less than two years) was the strongest predictor of child death, with **a** chance of dying 1.5 times that of children born four or more years after the most recent sibling. Of the measurable environmental risk factors in their data, only water source proved a good predictor of childhood mortality. They did a multivariate analysis using logistic regression procedures to calculate odd ratios for exposure categories of the main study variables (water supply and sanitation) adjusted for the effects of hypothesised confounding variables (maternal literacy, urban-rural residence, sex, birth interval length, linguistic group as a proxy for ethnic group] address to health services).

Child mortality has been found to be higher by 20 percent where there were no toilet facilities as compared to those with access to either flush or outside toilets. When household water source was a river or stream, risk of a child's was 1.3 times that of children in households where water was from piped source. Children of illiterate mothers had a risk of child's death 1.3 times those of literate mothers. Children born less than two years after the previous child were 1.5 times more likely to die than those born four or more years later. Concerning access to health services, there was some difference at the national level in risk of death between those living in close proximity to a clinic or living far from it.

Maternal age has also been associated with infant mortality. Caldwell (1979) observed that in some instances maternal age has been found to be associated with an above average level of infant mortality as are birth of parity one as well as very high parity. The high parity infant "mortality risk is exacerbated by having those births spaced closely together. Economic Commission for Africa (ECA)(1991) discussed maternal age, live birth interval and education of mother as determinants of infant mortality. They argue that in demographic analysis, maternal age is very important variable because it determines when child bearing starts and ends. It is expected that older women would have more child loss experience because of the longer exposure to risks of child bearing and child mortality. The length of birth interval influences child bearing and child mortality in that, shorter birth intervals of less than two years and longer intervals of more than 36 months are all associated with higher estimates of child mortality. Education of mother equips her with knowledge and skills of child bearing and child care. The women are usually exposed to new ways of thinking about their environment and themselves. Education of mother is therefore very influential on infant mortality.

Mother's age at birth has important health and social ramifications (Bicego and Ahmed 1996). The relationship between age at birth and birth order varies across socio-cultural settings depending on levels and age patterns of fertility. Where age at marriage is rising, first birth are often delayed to a later age, especially among those segments of population that are in transition. Under patterns of lower late fertility, older age at birth is less likely to be associated with grand multiparity although this varies across social strata (Bicego and Ahmed 1996). It has been observed that while very young age at birth and older age at birth continue to be associated with heightened risk of dying in the first five years, there is substantial variation among countries.

Part of the negative association between very young mother's age at birth and child survival may be attributed to the tendency for very young mothers to be socially and economically disadvantaged (Gevonimus and Korenman 1993). The most pronounced effect of young mother's age at birth on child survival occur during the first month of life, although the excess risk persist throughout the first year period. Average excess risk associated with young age of the mother falls from 34%- in the neonatal period, to 30% in the post neonatal period, to 21 % during ages 1-4 years.

Breastfeeding is another crucial factor in infant mortality. Page et al (1992) did an illustrative analysis of breast feeding in Pakistan and found out that breast feeding plays a very important role in child health. Breast milk usually meets all the child's nutritional requirement both in quality and composition, for the first few months of life even later after 4-6 months as supplementary foodstuff become increasingly needed, it can still meet a substantial part of the child's requirement. Da Vanzo et al (1983) supported this in their examination of how biological and behavioral influences on mortality vary during the first year of life in Malaysia and found out that an important potential determinant of mortality is length of breast feeding.

United Nations (1954) in an intensive study of foetal, infant and early childhood mortality found out that infant mortality vary with the order of birth , which is a biological factor,the highest mortality being found among first births and the highest order births. They explained a reduction, in the size of families, and therefore in the proportion of births of higher order may obviously have some effect upon infant mortality. The size of the family, however often varies inversely with the degree of social and economic advancement, the largest families being found in the under developed areas of the world. The degree to which biological factors are permitted to operate seems to be to a large extent controlled by the social climate. They went on to discuss the relationship between environmental and socioeconomic factors and infant mortality.

2.1.2. Empirical Kenyan Experiences:

By the 1948 population census, Kenya was probably in the midst of the demographic transition and mortality levels had started to decline (Mott 1979). Paralleling the decline in general mortality, estimated infant mortality rates also appeared to have declined sharply. The 1962 census estimated that 174 out of every 1000 babies born died in the first two years of life and when he did his study on infant mortality in Kenya he found out that it had declined further to 87 infant deaths per 1000. He emphasized the role of education and type of marriage, birth order, birth spacing, age of mothers at birth, improvements in the environmental conditions associated with infant life and general improvements in the quality of life in Kenya - be they improvements in health and medical care or nutrition. He also emphasized the socio-economic factors, while arguing that this perhaps is one of the indications of societal socio-economic development.

In 1982, Mott made a general observation that even though the decline in mortality over the preceding decades has been considerable, much remains to be done in the field of health and medical resources and nutrition. He conceptualized that the chances of survival for infants form different socio-economic backgrounds or geographic areas still differ considerably. His critical analysis revealed that further increase in rural health services may substantially reduce overall infant mortality and that most importantly, a reduction in the number and proportion of large families would also have substantial impact on infant mortality.

Anker and Knowls (1977) and Kibet (1981) did a correlation of infant and child mortality with urban population, female literacy, malaria cases, kilometre of roads, population density and number of beds per 1000 population using 1969 and 1979 censuses respectively. Anker and Knowls measured infant and child mortality by considering the life expectancy at birth (e_0) while Kibet used the probability of dying at age 2 (q[2]). Both used Brass estimation technique to obtain their levels. While running regression Kibet, found out that Malaria and mother's education were the two major factors affecting child mortality in Kenya. On the same note Koyugi (1982) while assessing the mortality • se^^^in Siaya district, used logit life table system and found out that mothers belonging to better off socio-economic group have lower child mortality.

While evaluating various techniques for estimating mortality in Kenya, Ronoh (1982) employed the logit lifetable system to analyze both female adult mortality and child mortality levels, hence constructing lifetables for the females. In 1983 Nyamwange carried out a study on child mortality in Nairobi so as to estimate urban mortality (Nairobi being a case study). He found out that even though there was medical achievement in Nairobi, there still continued to exist mortality differentials. His further findings were that residents of the high mortality areas, also originated from high mortality regions in the country. He concluded that immigration plays some important role in the urban mortality differentials.

Muganzi (1984) set out to examine the effect of various factors affecting infant mortality in Kenya. He grouped these factors into two general categories-those associated with the individual woman/child and those associated with the social and environmental setting within which they live. The individual variables included age of woman, education, sex of child etc. The second set of variables constituted the contextual variables such as availability of health facilities, water supply, sanitation and prevalence of malaria. He found out that breast feeding and the number of pregnancies to a woman in particular are major determinants of mortality in the country. The findings showed that the effects of the contextual variables on infant mortality is stronger at the regional level where for some regions larger percentage of the population have poor access to such facilities as health services, water supply and sanitation.

Thus children born in such regions have lower chances of survival given that their individual characteristic already exposes them to higher mortality. The Findings point to the fact that efforts aimed at reducing infant mortality in Kenya must focus not only on individual characteristics of the population, but also with a greater emphasis on the distribution of essential facilities, water supply, health services, as well as .eradication of malaria.

Bunyasia (1984) carried out a study on the seasonality patterns of. causes of deaths in Kenya and found out that environmental factors were responsible for both regional and seasonal variations in patterns of death. He found out that the three leading groups of diseases were infective and parasitic diseases of respiratory system and circulatory diseases. Nyokangi (1984) also found out that the elimination of infective and parasitic diseases that are related to unhygienic environment would increase the life expectancy at birth.

Kizito (1985) estimated the completeness of death registration using the age specific growth rate technique and also constructed life tables at district levels in Kenya. Mudaki (1986) used the information on orphanhood to study adult mortality, hence also constructing lifetables by a linkage of the information on child and adult mortality using the Coale-Demeny model lifetables. He also used the multiplicative model of synthetic approach and the age specific growth rate technique to adjust for possible mortality change between the years 1969 and 1979 at the national level. Kichamu (1986) used the Trussell's multipliers for the North models to estimate mortality in Kenya. Using vital registration in central province as a case study. The parameters he used were q(2), eo and IMR which were given at the national, and sub-national levels for possible differentials.

Odhiambo (1991) estimated the mortality differentials according to maternal education, marital status and place of residence. He used a multivariate regression analysis and found a significant relation between the ratio of observed to expected deaths and length of breast feeding, age at introduction of supplementary foods, water treatment, maternal education and attendance of antenatal clinics by pregnant mothers. Education appeared to be very important and significant in affecting ratio of observed to expected deaths. There was also a significant relationship between toilet facility, source of water, treatment of cord and ratio of observed to expected deaths.

Ouma (1991) set out to determine the socio-economic and environmental risk factors among others which are associated with infant and child mortality at the divisional and individual levels in Siaya district. He classified the socio-economic factors as maternal education, place of residence, marital status while the environmental risk factors were: housing conditions, availability and use of toilet, water source, cooking and lighting energy and the concentration in the home. He found out very high infant and child mortality rates (lqO) of 173/1000 and q2 of 208.8/1000 resulting in a life expectancy at birth of only 41.2 years. He also found out that there was a dramatic decline in infant and child mortality between 1963 and 1967 and infant mortality.Is Inversely proportional to the level of mother's education. Stepwise regression analysis revealed that place of cooking, fathers occupation and maternal education have a significant effect on infant and child mortality at a significance level of 0.05.

2.2. Theoretical framework:

Several factors have been documented to affect infant mortality in any given community or a country. These factors range from socioeconomic, cultural, environmental to demographic. Mosley and Chen (1984) assert that determinants of infant mortality necessarily operate through a common set of biological mechanisms, or proximate determinants, to exert an impact on mortality.

Meegama (1980) set a framework for the analysis of infant mortality and contends that it should take into consideration several factors that influence and determine the level of mortality. He therefore gave the following broad classification of these factors:

1: Demographic, 2: Environmental, 3: Medical and health care, 4: Cultural,

5: Economic.

Anker (1987) offers a theoretical consideration and measurement of explanatory variables of mortality. He grouped the determinants into two broad headings:

Household and individual characteristics (micro level variables), and;

2: Macro level conditions, usually considered to be associated with government policy

His ideas share the same magnitude with those posited by Meegama, though he has a too broad classification of the factors considered. Having a closer look at both frameworks, we find that, the demographic factors affect the health of the mother to the extent of exposing her offsprings to a higher risk'of infant mortality. Environmental factors expose the infant to infections spread by environmental factors resulting to diarrhoeal diseases, including gastro-enteritis.

The incidence of these diseases depends on mainly two factors: the availability and use of hygienically constructed lavatories and the availability of uncontaminated drinking water. Cultural factors also have an effect on mortality, the custom of early weaning could lead to serious problems when a child is fed contaminated food which has little or no 'nutritional value.

As per the observations by Belgin and others (1984), that the ability by an infant to survive the first few years of life and the quality of that survival is a function of many environmental and social stress that impinge upon the individual child, beginning during pregnancy and continuing through infancy and childhood, it is expected of this study to conceptualize this process through the formulation of a general framework that identifies or orders the determinants in their whole set up of demographic, socio-economic, cultural and environmental context. In this study only those factors that are critical in the process were selected analysis and the expected results were still arrived at without much loss of

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critical information. The study therefore assumed a proximate determinant approach'that only selected mother's education, toilet facility, source of water and the demographic factors for analysis.

This study is therefore built on the premise that mother's education as a strong maternal factor is a major determinant of child survival and this factor heavily impacts infant survival through the included environmental and demographic factors. This study therefore has the following theoretical framework:

Socio-demographic, and environmental factors may affect infant mortality.

2.3. Conceptual hypotheses:

The following conceptual hypotheses can be derived from (he above theoretical framework:

1: Socio-demographic factors influence infant mortality, and,

2: Environmental factors influence infant mortality.

2.4. Conceptual framework:

Belgin et al (1984) assert that the ability to survive the first few years of life and the quality of that survival is a function of many environmental and social stress that impinge upon the individual child beginning during pregnancy and continuing through infancy and childhood. The complexity of this process may be simplified conceptually by formulating a general framework that identifies and orders its determinants in terms of their causal proximity to the biological -outcomes of disease and death. They explain that the framework is based on the premise that the social conditions of life are major determinants of child survival, and that these determinants make their impact through a set of intermediate mechanisms that can be decomposed analytically. Within the framework, disease and health are direct consequences of a set of factors originating in the social conditions of life and behaviour of families.

Mosley and Chen (1984) in their analytical framework for the study of child survival in developing countries explain that development of a conceptual framework for the study of child survival requires both a definition of the independent and dependent variables and that the development of a proximate determinants approach to the study of child survival is based on the following premises:

1: More than 97 percent of the newborn infants can survive through the first five years of life in an optimal setting.

2: This probability of survival is reduced in any society through the operation of social, economic, biological, and environmental forces.

3: It is through the basic proximate determinants that the independent variables operate to influence the risk of disease and the outcome of disease process.

4: Specific disease and nutrition deficiency in a population may be reviewed as biological indicators of the operations of the proximate determinants.

5: Growth faltering in children is the cumulative consequence of multiple disease process (including biosocial interactions).

They explain that the model depends on the identification of a set of proximate determinants that directly influence the risk of morbidity and mortality which they give as:

1; Maternal factors- "Shown to exert an independent influence on pregnancy outcome and infant survival through its effects on maternal health. Short birth spacing, combined with young maternal age'(synergism)-may also exist-between maternal variables;

2; Environmental contamination- referring to the transmission of infectious agents to children (and mothers);

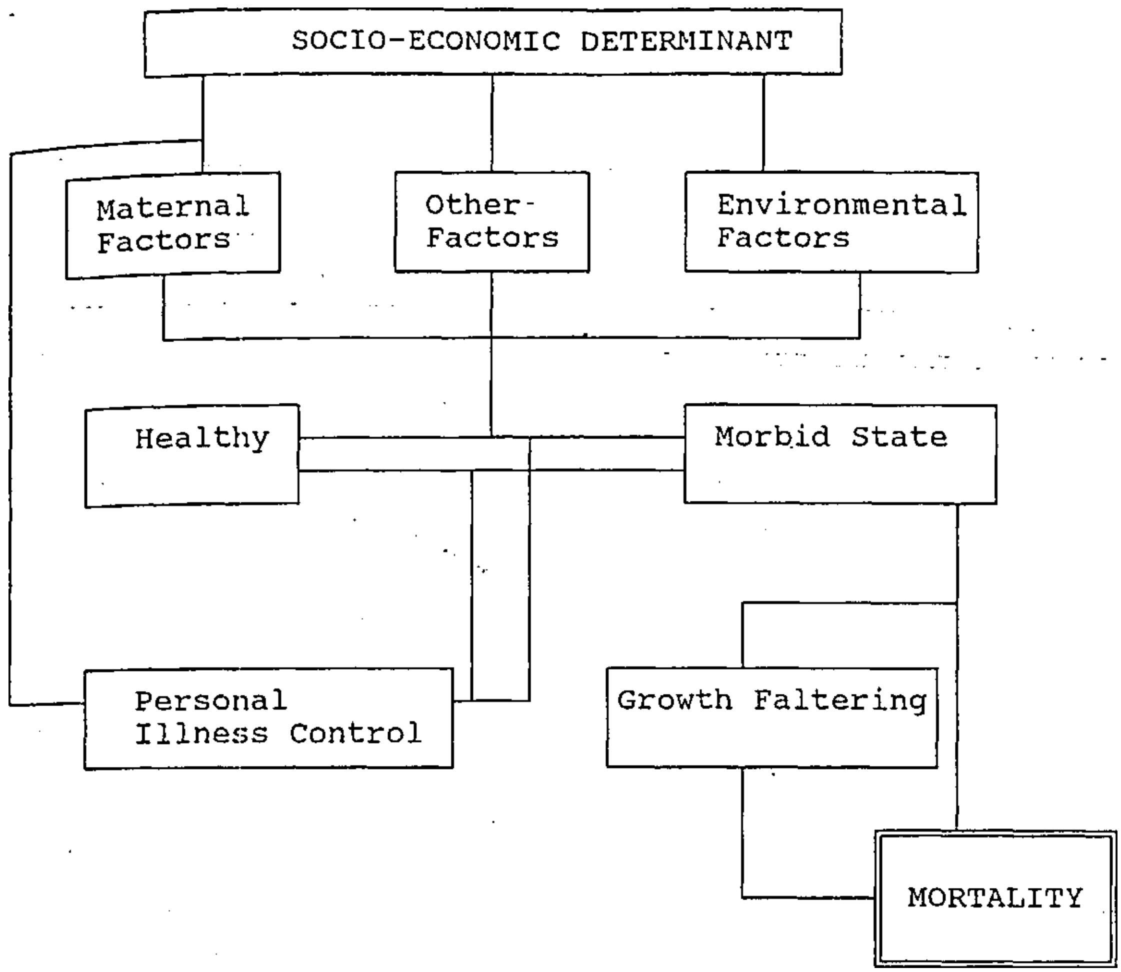
3: Nutrient deficiency involving the intake of the three major classes of nutrients- calories, proteins, and the macronutrients;

4: Injury includes physical injury, and poisoning and;

5: Personal illness control- preventive measures to avoid diseases.

This model therefore borrows ideas from Mosley and Chen.

Figure 1- The Conceptual Model.

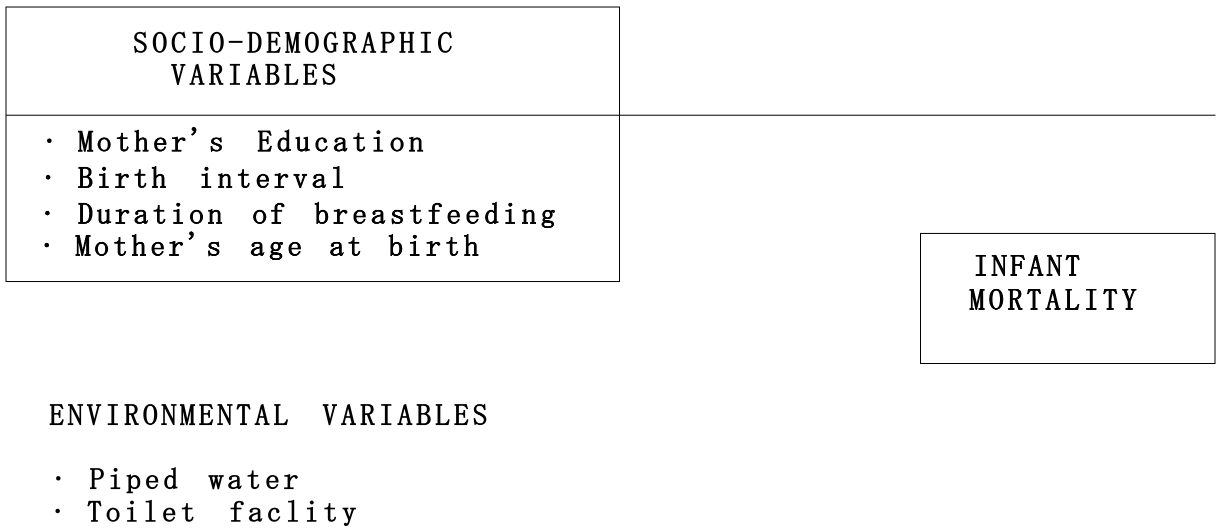


Source: Adopted from Mosley and Chen (1984)

2.5. **Operational** Model:

rhe Operational model defined for this study is thus:

Figure 2: The Operational Model.



^dependent Variables Dependent Variahlo

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Level of Mother's education

'Birth Interval

Duration of breastfeeding Infant Mortality

Mother's age at birth

Type of toilet facilities

Source of drinking Water

Definition of Concepts.

Infant mortality:- The deaths occurring to live born children who have not yet reached their first birth day.

. Birth interval:- Time elapsed in months between two consecutive pregnancies.

Maternal Education:- The number of years the mother had spent in an educational institution receiving formal education.

Type of water and sanitation:- Data relating to the percentage of population using a kind of source of water i.e piped water, streams and rivers etc. Sanitation is measured in terms of the percentage with or without sanitation facilities.

7. Operational Hypotheses.

e study has the following operational hypotheses:

The level of mother's education has significant effect on infant mortality.

Wider birth interval has significant effect on infant mortality in Kenya.

Longer duration of breastfeeding has significant effect on infant mortality in Kenya.

Mother's age at birth has significant effect on infant mortality in Kenya.

Type of toilet facility has significant effect on infant mortality In Kenya.

The use of piped water has significant effect on infant mortality in Kenya.

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CHAPTER THREE

DATA AND METHODS OF ANALYSIS:

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I. ^jg chapter, sources of data, sampling design, collection, quality of data and methods of

[1] analysis are discussed in detail.

3.0: Sources of Data:

The data used in this study came from Kenya Demographic and Health Survey (KDHS) of 1993.

The variables considered in this analysis included:

1: Infant Mortality Whether the child died in its first year of life.

\\ Mother's education - Years of schooling completed.

): Birth interval: time elapsed in months between two consecutive pregnancies.

I: Duration of breastfeeding:- Number of months of un supplemented and supplemented breast feeding in the first twelve months of life.

: Mother's age at child's birth.

: Type of toilet facilities.

: Source of drinking water and sanitation.

•I: Sample Design, Collection and Quality of Data.

he Kenya Demographic and Health Survey (1993) was conducted to collect data regarding ertility, Family Planning and Maternal and child health. The KDHS 1993 covered 7,540 women !ed between 15 and 49, and 2,336 men aged between 20 and 54. The previous and original ktnct boundaries were used to maintain comparability with the 1989 survey.

q-^e KDHS sample was done on the National Sample Survey and Evaluation Programme (MASSEP) basis. The sample is national in coverage, but excluding North Eastern Province with four Northern districts which account for only 5% of Kenya's population. The NASSEP master sample is a two stage design, stratified by urban-rural residence and within the rural stratum, by **individual** districts. Sample weights were used to compensate for the unequal probability of **selection** between strata. Therefore, in this study weighted figures were used. The following types of questionnaires were used to extract information :

1: Household schedule.

2: Women's questionnaires.

3: Men's questionnaires

4: The service availability questionnaire.

The data for estimation of mortality rates were collected in the women's questionnaires.

3.1.1 Quality.

The KDHS data provides an approximate information suitable for estimating infant mortality levels, differentials and trends. This is because all the primary variables which have been mentioned in section 3.2.1 are usually available, unlike other sources of data like Kenya Fertility Survey and the Censuses. The response rate for the survey is acceptable; i.e the response rate

94.8% while eligible male response was 84.6%.

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Ven though this may be the case, these data being secondary in nature, may suffer some slight

erroors which may be acceptable as limitations before any analysis is done.

3.1.2 Sample Design

The KDHS sample is national in scope , with the exclusion of all the three districts in North **Eastern** Province and four other Northern districts (Samburu and Turkana in Rift Valley Province jnd Isiolo and Marsabit in Eastern Province). All the excluded areas account for less than 5% of (enya's population. A two stage stratified sample consisting of 536 sample units (Clusters) was used.

3.1.3 Possible Biases

In order to obtain data on sex, date of birth, survivorship status and current age or age at death of each of the respondent's live births, and retrospective birth history questions were posed. This may reduce the data to being susceptible to omission-biases caused mainly by memory lapse. However, this was not the case for KDHS. Other possible data collection errors could include understanding of events, misreporting of age at death and date of birth.

11.4 Methods of Analysis

foe aim of this study was to see how well-we can explain the infant mortality situation in Kenya, filiation of the relationship between infant mortality and the given explanatory variables was Re to show how they affect infant mortality and have shown sufficient variation over time that ky could affect the mortality trend. After estimating the relationship, an examination was done 5 see how well these factors can explain infant mortality situation in Kenya. An assessment was 0lle of the relative roles of explanatory factors, and to see the structure of the relationship between infant mortality and its determinants and assess the importance of these-in explaining **infant** mortality situation.

In the study indirect method of analysis was employed. This was because as much as there are other direct methods of analysis, the indirect methods offer a wider option of type of data that can be used and still arrive to the same results. In this case, it was chosen because it allows the use of the number of children ever born instead of number of children dead. We note that mothers have easy time reporting the number of children ever bora hence minimizing any omissions.

Two methods of analysis were employed in this study. Trussel's technique of estimating child mortality was used initially to estimate mortality levels and probabilities of dying. This is an indirect method of demographic analysis. Trussel's technique of estimating child mortality. was used because it is the most flexible and life table based method that allows the estimation of the probabilities of dying as it involves the conversion of proportion of children ever born (these are well reported as mothers can easily remember) into estimates of the probability of dying before, attaining certain exact childhood ages. This method therefore, is able to employ either children surviving or the number of children dead and still arrive to the same results.

ttte second method was Logistic Regression Analysis (multivariate). This method was used to lunate the likelihood of survival for infants given the socio-economic, demographic and environmental conditions. This method helped in examining the relationships between the explanatory variables and the dependent variable (infant mortality), —. - "

agression analysis was also used to assess the structure of the relationship between infant **mortality** and its determinants and in assessing the importance of these in explaining infant mortality situation in Kenya. The choice of logistic regression analysis was based on the fact that its coefficients are the best natural logarithms of the relative odds by which the determinants of mortality are different for risk of dying. The use of dichotomous dependent variable in logistic | **regrssion** analysis refocuses the analysis, from examining the determinants of infant mortality in i general to the examination of the determinants of infant survival versus death also, from a I mathematical point of view, it is an extremely flexible and easily used function which lends itself to a biologically meaningful interpretation compared to other methods.

|3.2: Trussell's Technique of Estimating Child Mortality

[The Trussell's technique of estimating child mortality is a version of the original technique leveloped by Brass- a procedure which involves converting proportions dead of children ever rn reported by women in age groups 15-19, 20-24, 25-29, 30-34......45-49 into estimates of foe probability of dying before attaining certain exact childhood ages. Brass developed a 'rocedure to convert the proportions dead among children ever born to women in successive five ,ear age groups (denoted by D(i)) into estimates of the probability of dying between birth and lxact age x (denoted by q(x)).

To Urease the flexibility of the Brass' original method, Trussell estimated a third set of ultipliers using Least Squares Regression on data generated from the model fertility schedules **aenerated** by Coale-Demeny life tables-the second set of multipliers were computed by Sullivan (Manual X).

jj! 1975 Trussell proposed more satisfactory multipliers incorporating pl/p2 and p2/p3 (pi) being the average parity or average number of children ever born reported by women in age group (i). These multipliers offer good indicators of fertility schedules adequately well. The general assumption of this procedure is that the risk of dying of a child is a function only of the age of the child and not of other factors such as mother's age or the child's birth order.

.2.1: Data Required By This Method:

The following data are required when this method is to be employed:

The number of children ever born (CEB), classified by sex and by five year group of mothers.

Note: The classification by sex for children ever born and surviving is desirable, not essential.

The number of children surviving (or the number dead), classified by sex and by five year age group of mother.

The total number of women (irrespective of marital status), classified by five-year age group, (all women not merely ever married'must be considered).

•^•2: Computational Procedure

following is the computational procedure employed in Trussell's Technique.

STEP 1:

Calculation of average parity of women: Average parity is the average number of children ever born by women in a given group. Calculated thus: . . .

p(j) = CEB(i)/FP(i). ... . !...(3.1),

Where P**(i)** is **the average parity of women of age group (i) where (i)** = 1,2,3,4. . . .7 **and** 1 **=** 15_19(2= 20-24, 3 = 25-29,. . . . . .7 = 4549.

Therefore P(1) is the parity for women in age group 15-19, etc.

CEB(i) is the total number of children ever born by women in age group (i).

FP(i) is the total number of women in age group (i) irrespective

of their marital status. The denominator FP(i) should include all women up to and including those who did not respond to the questions on CEB (whose parity* are-not stated). They are included under the assumption that they are childless as it Has been documented that quite a majority of younger women reported as being with not stated parity, are, actually childless-parity zero.

STEP 2:

Calculation of proportion of children dead among children ever born. This is the ratio of the total children dead to the total children ever born. Calculated thus:

$D_{(i)}$ = CD(i)/CEB(i)

Where D(i) is the proportion of children dead for women of age group (i).

is the number of children dead reported by women of age group (i).

CEB(i) is the total number of children ever born by these women.

Calculation of Multipliers **k(i).** This is used as an adjustment **factor** to the proportion dead.

Thus k(i) = a(i) + b(i) P(l)/P(2) + c(i) P(2)/P(3)

\Vhere a(i), b(i) and c(i) are the Trussell's coefficients for estimating child mortality.

Table 3.1: Coefficients For Estimation Of Child Mortality Multipliers When Data are

Age Group	Index	Coefficients		
		a(i)	b(i)	c(i)
15-19	1	1.1119	-2.9287	0.8507
20-24	2	1.2390	-0.6865	-0.2745
25-29	3	1.1884	0.0421	-0.5156
03-34	4	1.2046 -	0.3037	-0.5656
35-39	5	1.2586	0.4236	-0.5898
40-44	6	1.2240	0.4222	-0.5456
45-49	7	1.1772	0.3486	-0.4624

Source: Manual X.

i STEP 4:

| Calculations of probabilities of dying at age x, q(x).

This is arrived at after calculating D(i) and k(i) for each age group (i) hence the product of these proportions dead D(i) and the corresponding multiplier k(i).

pusqCx) = k(i) D(i)

|For$_x$= 1,2,3,4,5, 10, 15, 20 and i = 1,2,3,4,5,6,7

The value of x is not generally equal to that of (i) because x is related to the average age of

|ie children of women in age group (i).

Estimates of the probability of dying q(x) are obtained for different values of exact ages as the product of the reported proportions dead, **D**(i) and the corresponding multipliers k(i).

3.3: Logistic Regression Analysis

The Logistic Regression analysis was used in this study to estimate the likelihood of survival for infants given the socio-economic, demographic and environmental conditions. Logit analysis is an extension of the linear probability regression models which express the dichotomous dependent variable as a linear function of the explanatory variables. In Logistic Regression analysis, the outcome variable is binary or dichotomous.

Logistic analysis models assume the conditional probability that an infant will live or die given the factors in the model. In logistic analysis unlike linear or multiple regression, the dependent variable is defined by the log odds* which is also known as the logit transformation of p(x). The model takes the fornr.-

$$\ln\left[\frac{p(x)}{1-p(x)}\right] = a + p \quad \text{........ 3.1}$$

where oc + 6 is the logit transformation of p(x) commonly denoted by the (p).

The logit distribution is defined as: p = $1/(1 + e^{-x6})$ 3.2

This distribution ranges from 0 to 1 as x6 goes.from **-oo** to + **oo.**

Hanushek and Jackson (1977) posit that if:

p ^ l/(l+e"x0> as in equation 3.2, then: -

j.p = e y(1+e>) = 1/(1+e"jj). 3.3

Rearrangement of these expressions gives

I = log p/l-p = log p - log(l-p)

-log(l+e'|3) - [log(e^) - log(1+e^)] = x^.............3.4

I is called the logit or the log of the odds ratio. As p goes from 0 to 1 x^goes from -oo to +°o and L goes from -oo to +oo. Thus while the probabilities are bounded the logits are unbounded with respect to the values of x. An odds is the ratio of the frequency of being in one category to the frequency of not being in that category and is interpreted as the chance that an individual randomly selected will be observed to fall into the category of interest. The odds ratio is used in I logit analysis to measure the effect of the independent variables on the dependent variables.

3.3.1: Estimation of Logistic Parameters

The logistic model has two basic approaches to estimating the parameters (£) from a set of data.

i(l) Maximum Likelihood Estimation,

p) Discriminant Analysis.

p this study Maximum Likelihood estimation is' used. The maximum likelihood criterion is pularly used in statistics because it is known-usually to be the asymptotically efficient estimator.

The criterion is simply answering the question, "What underlying parameters would be most likely to have produced the observed data ?" The maximum likelihood estimation technique can be applied where the explanatory variables are truly categorical or where the only data available have been previously categorised or where continuous and categorical explanatory variables are mixed together. In Maximum Likelihood estimation, for example, if one has a sample of n **infants** and that the jth infant has values xj1, xj2, xj3. . . . . xjp, for the variables x1, x2, xp. A dummy variable xO is introduced such that xjO = 1 for all cases and yj is defined'thus:.

$$y1 = \sum_{i=0}^{P} 6_{1xp} \ldots\ldots\ldots\ldots 3.5$$

Then the logistic model Pj = 1/[1+exp'(-yi)] = exp(yi)/[1+exp(yi)]. 3.6

Where qj = 1-Pj = 1/[1 +exp(yi)].

The quantity Pj denotes the probability that the j^m infant dies in a defined interval of time and qj denotes the probability that the infant survives. Let dj be a variable that indicates the occurrence of death (dj = 1),or survival (dj =0) in the jth infant. Thus dj = 1 with probability pj and dj =0 with probability qj. If it is assumed that the occurrence of death is independent across ' the number of the infants, the likelihood of the outcome d1,d2 ... dn is given by:

$$\prod_{J=1}^{a} Pj = \prod_{j-1}^{n} \frac{J[exp\{yjdj)}{[1+exp(yi)]} \ldots 3.7$$

This likelihood contains the factor Pj when dj = 1 and the factor qj when dj=0.

The maximum likelihood procedure differs from **the** grouped logit model by treating each unit as a separate observation rather than grouping- them to get estimates of Pj. The logic behind this **procedure** is to derive an expression for the likelihood of observing the occurrence of death and **survival** in **a** given data set like which this study has employed in the analysis. The value of this **expression** (the likelihood function) depends upon the unknown parameters of the probability **function** (6). If all the observations are obtained independently, as is reasonable in a cross-**sectional** analysis, the likelihood of obtaining the given sample is found from the product of the **probabilities** of the individual observations having the observed outcomes.

3.3.2. Interpretation of the coefficients of logistic regression

Interpretation of the coefficients of logistic regression model involves:

1. Determining the functional relationship between the dependent and the independent variables, and;
2 proximately defining the unit of change for the independent variable.

Determining the function of the dependent variable which yields a linear function of the independent variables - the logit transformation- takes the form of:

$$g(x) = Intra\ U) / [1-rc\ (x)\ ]\ )=P_0 + P_1x \qquad 3.8$$

h this model the slope coefficient represents the change in the logit for a change of one unit in independent variable x. The logit coefficients are the natural logarithms of the relative odds which determinants of mortality are different from the risk of dying.

The logistic model can be re-written in terms of the odds of an event occurring. The odds of an event occurring are defined as the ratio of the probability that it will occur to the probability that it will not. The logistic equation written in terms of odds as:

Pnh fevent) =e£o+£ixi. . . . #>*p
Pob (no event). . . . .^pxp

Then e raised to the power is the factor by which the odds change when the 1th independent variable increases by one unit, if g, is positive this factor will be greater than 1 which means that the odds are increased and vice versa. If JM is 0, the factor equals 1, which leaves the odds unchanged

The parameters in the logit model may be interpreted as ordinary regression coefficients - positive values indicate that the **independent** variables or their interactions raise the log odds of the dependent variable while negative betas show lower log odds (Pindyick and Rubinfield 1976). For example in our case, testing the effects of maternal level of education on infant mortality Sives us a logit coefficient of -.8779 to an infant born to a mother with secondary education. This means that mother's education reduces the logarithms of the odds of dying by 87 percent and that a b% born to a mother with secondary education is about 0.4156 (exp£ -0.8779) times likely to iie ^ infancy as one whose mother has no education. In measuring the actual probability of a oiven outcome for values of the explanatory variables, if one has several observations of the

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3ctual outcomes for given values of x1, .it.is possible to calculate the relative frequency of the outcome and to use this as an estimate of the probability of each x (Hanushek and Jackson 1977).

If we have a collection of P independent variables denoted by -

XI - (xi x:. . . . .XP)> conditional probability that the outcome is present is denoted by •>(Y-l/x)= In a multiple logit regression the model takes the form of

g(x) = £0 + g>lxl +£2x2 +. . . . . .^pxp

in which case

a(x) = 3.10

l+e^{8(x)}

As we had said earlier, transformation of variables (dummy) is required such that if a variable las K possible values, then K-l dummy variables are needed. If for example the jth independent variable, Xj has Kj levels Kj-1 dummy variables can be denoted as Dju and the coefficients for the dummy variables can be denoted as Bju, u=1,2. . . . .Kju-1. Therefore logit model with P variables and the variable being discrete would be:

8(x) =£0 +^1x1 +p2x2 + 2B11,,DIn+1

^hen setting the dummy (indicator) variables, if for example an x1a dichotomous variable coded 1 or 0 for exposure or non-exposure to a specified factor x2, for example infant death, a ^hotomous variable designating for example sex, coded 0=Female and l=male. In such a the coefficient^ in the term £2x2 may be interpreted as the change in the logit risk that is ^ociated with change in the variable x2 from female to male.

3.3.3. Assumptions of logistic regression

The logit analysis is based on one major assumption similar to that for the general loglinear **probability** models. The assumption is that the population under study has a multinominal distribution structure and that the sample under study is large enough, drawn* randomly and **independent** from the population.

3.3.4. Advantages of logistic analysis

Logistic analysis is fitting for analysis in this study given that:

1. It is a multivariate method for estimating relative risk. The logit coefficients are the natural logarithms of the relative odds by which the determinants of mortality are different for risk of dying.

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2: The use of dichotomous dependent variable refocuses the analysis from examining the determinants of infant mortality in general to the examination of the determinants of infant survival versus death.

3 From a mathematical point of view, it is an extremely flexible and easily used function and as (Hosmer and Lemishow 1989) observes.

It lends itself to a biologically meaningful interpretation.

P'3.5. Limitations of logistic regression analysis.

Given the assumption underlying the logit analysis (sufficient sample size), log linear approach pumes that all the observed frequencies for cells of the cross classification are greater than zero, otherwise estimation is not possible since the development of the statistical procedures and the justification for the tests of significance, depend upon having a large number of individual observations within each cell of the contingency table. Even though, Goodman (1972) has suggested a solution to overcoming this setback by replacing each sample zero by 1/R where R js the total number of Cells in the table or adding 1/2 to each elementary cell before analyzing the model with zero cells. In this study this limitation was never met since all observed frequencies were greater than zero. •

Another limitation is the assumption underlying the use of the binomial distribution with mean P_{ij}, and thus that $\log[F_{ij}/(1-F_{ij})]$ asymptotically has mean $\log[P_{ij}/(1-P_{ij})]$, it is necessary to assume that each individual observation in cell (ij) has the same probability, P_{ij} of exhibiting the behaviour being modelled. In the logit model F_{ij} is not equal to P_{ij} simply because only N_{ij} individuals are sampled, not because some of the individuals might have a different P_{ij} during the course of the experiments. If the P_{ij} must also be subscripted for each individual in N_{ij}, then:

$$1-F_{ij} \qquad ^{a} \qquad 1-E(F_{ij}) \qquad 1-P_{ij} \qquad (3)$$

even though $E(F_{ij})=P_{ij}$ even with large samples.

CHAPTER 4

INFANT MORTALITY LEVEL AND DIFFERENTIALS AT NATIONAL LEVEL

4.0 Introduction

In this chapter we estimate infant mortality level using the Trussell's technique for estimating .child mortality. The figures are calculated at national level. Differential mortality by socio-**economic,** demographic and environmental factors is also estimated using the same technique. In table 4.1a and 4.1b case distribution by the analytical factors is given.

VARIABLES	MOTHERS	TCEB	TCD
EDUCATION			
No Education	1297	7458	1088
Primary	4449	13027	1398
Secondary	1794	3524	190
TOTAL	7540	24,009	2676
ENVIRONMENTAL			
Tvpe of toilet Facility			
Bush	1083	3942	650-
Pit	5714	18355	1913
Flush	692	1338	102
TOTAL	7489	23,635	1665
Source of Water			
No tap	5065	17476	2067
Tap	2413	6276	601
TOTAL	7478	23,752	2668

totes: (TCEB = Total Children Ever Born and TCD = Total children Dead)
^ce: Study estimations based on K.D.H.S (1993).

^ble-Ub: Distribution by Demographic Variables.

VARIABLES	MOTHERS	TCEB	TCD
DEIMOGRAPHIC			
girth Interval			
< 2 Years	1707	5303	580
7.3 Years	2584 .	7978	900
^4 years	1961	6443	745
TOTAL	6252	19,724	2225
preast Feeding			
< 1 Month	64	192	20
2-3 Months	768	2405	233
> 4 months	1216	3754	348
TOTAL	2048	6351	601
Mother's Aee at Birth			
< 20 Years	3667	17295	2111
20-39 Years	1724	6539	558
> 40 Years	24	66	7
TOTAL	5415	23,900	2676

Source: Study estimations based on K.D.H.S (1993).

hthis analysis, we adopt the probability of dying at age x, q(x) for measuring infant mortality as Ms is one among the several measures of infant and child mortality which include Infant Mortality Rate (IMR), Child Mortality Rate (CMR) and life expectancy (e_0). Adopting the tassell's technique on the national data we obtain the results presented in table 4.2.

Tabic 4.2 Probability of dying at age x at national level - 1993.

	FP(i)	CEB(i)	CD(i)	P(i)	D(i)	k(i)	q(x)
1	1254	248	33	0.197767	0.133065	1.057369	0.140698
2	1154	1584	148	1.372617	0.093434	1.018816	0.095192
3	870	2703	245	3.106897	0.090640	0.966676	0.087620
4	779	3596	362	4:616175	0.100667	0.998477	0.100514
5	512	3104	365	6.062500	0.117590	1.059061	0.124535
6	455	3179	427	6.986813	0.134319	1.043787	0.140200
7	309	2347	340	7.595469	0.144866	1.023140	0.148218

Source: Study estimations based on K.D.H.S (1993).

Since all measures of infant and child mortality are functions of life tables, we therefore undertake to construct a life table.

4.1 Construction of National Life Table

When constructing a life table, we first undertake the calculation of the exact mortality levels for different values of the probability of dying at age x, q(x) which involve the use of linear interpolation. For example if we have two points *(al, bl)* and (*a2, b2),* and a point *ab* happens to be lying between these points, then:

$$\frac{tt-al}{o-a2} = \frac{b2 - bl}{b - bl}$$

Which means $a-al = \frac{(b - bl)\ ((a) - a(D)}{b2 - bl}$

ence, $a = a(l) + \frac{(b - bl)\ ((a2) - a(l))}{b2 - bl}$

wilarly, $b = b(l) + \frac{(a - al)((b2) - b(l))}{a2 - al}$

toe difference between *b2* and *bl* is unit, then,

$^{5}\quad + bO^{*} (a- al) - bO * (a - al)$

*0 j-(a-al)*bl + (a - al)b2*

y/hen we apply this procedure of linear interpolation to the national data we obtain the following results in table 4.3.

fable 4.3 Mortality levels

X	q(x)	p(x)	lower l(x)	upper Kx)	lower mort.Iev. level	intplted:
1	0.140698	0.859301	0.85924	0.87255	11	11.00463
2	0.095192	0.904808	0.89785	0.91162	16	16.50527
3	0.087620	0.912380	0.90101	0.91585	17	17.76620
5	0.100514	0.899486	0.88633	0.90354	17	17.76443
10	0.124535	0.875465	0.86868	0.88879	17	17.33738
15	0.140200	0.859800	0.85853	0.88088	17	17.05891
20	0.148218	0.851782	0.84564	0.86855	17	17.26809

Source: Study estimates.

The mean mortality level is 17.3453 which is the average for x values 2, 3, and 5.

Construction of a life table at national level using this mortality level involves further calculation of the values of L(x) and nLx which respectively are the number of persons living at the Jeginning of the indicated interval (x) out of the total number of births (it is assumed as the radix of the lifetable) and the number of person-years that would be lived within the indicated age interval (x to x+n) by the cohort of 100,000 birth assumed.

fable 4.4: **Estimation** of (lie probability of dying at national level for mortality level 17.3453.

Asie x	l(x) level 17	l(x) level 18	Actual l(x)
~0	1	1	1
1	0.92764	0.93737	0.935903
5	.0.88633	0.90354	0.900946
10	0.86868	0.88879 -	0.885759
15	-0.85853	0.88008	0.876832
20	0.84564	0.86855	0.865097
25	0.82851	•0.85307	0.849368
30	0.81027	0.83656	0.832597
35	0.79063	0.81877	0.814528
40	0.76884	0.79897	0.794429
45	0.74319	0.77531	0.770469
50	0.71346	0.74747	0.742344
55	0.67473	0.71031	0.704947
60	0.62635	0.66353	0.657926
65	0.56009	0.59829	0.592532
70	0.47082	0.50874	0.503024
75+	0.35709	0.39234	0.387027

Source: Study estimates.

The other functions of the life table nqx, npx, ndx, nix, Tx and e_0 are estimated in the following procedures, nqx which is the probability of dying between age x and x+n,

= 1-npx

npx which is the probability of surviving between aged x and x+n

$$= \frac{lx + n}{lx}$$

ndx. the number of persons who would die within the indicated age interval (x to x+n) out of the total number of births,

s lx - lx + n

nLx. the number of person-years that would be lived within the indicated age interval x to x + n.

'L» = 0.3*10 + 0.7*11

$_1L_0$ = 1.3*11 + 2.7*14

$_5L_x$ = 5(lx + Ix+5)/2 for x = 5, 10, 15.....70.

ooL75 = 175 log_{10}175 (Kpedekpo 1982).

fx, the total number of person-years that would be lived from age x = Tx+n + „L^X

$_e0$ Life expectancy at age x = Tx/lx

Therefore we obtain the following life table at the national level.

Table 4.5 Life table at national **level**

Age x	nqx	npx	l(x)	ndx	nLx	Tx	e(x)
0	0.064097	0.935903	100000	6409.66	95513.24	5904913	59.04913
1	0.037352	0.962648	93590.34	3495.746	364922.8	5809400	62.07264
J	0.016857	0.983143	90094.59	1518.712	446676.2	5444477	60.43067
10	0.010078	0.989922	88575.88	892.7051	440647.6	4997800	56.42394
15	0.013383	0.986617	87683.18	1173.499	435482.1	4557153 '	51.97294
20	0.018181	0.981819	86509.68	1572.870	428616.2	4121671	47.64404
25	0.019745	0.980255	84936.81	1677.076	420491.3	3693054	43.48002
30	0.021702	0.978298	83259.73	1806.885	411781.4	3272563	39.30547
35	0.024677	0.975323	81452.85	2009.995	402239.2	2860782	35.12194
40	0.030160	0.969840	79442.85	2395.995	391224.3	2458542	30.94731
45	0.036504	0.963496	77046.86	2812.488	378203.1	2067318	26.83196
50	0.050376	0.949624	74234.37	3739.665	361822.7	1689115	22.75382
55	0.066702	0.933298	70494.70	4702.117	340718.2	1327292	18.82826
60	0.099394	0.900606	65792.59	6539.374	312614.5	986574.2	14.99522
65	0.151060	0.848940	59253.21	8950.780	273889.1	673959.7	11.37423
70	0.230600	0.769400	50302.43	11599.76	222512.8	400070.6	7.953306
		0	38702.68	38702.68	177557.9	177557.9	4.587741

Source: Study estimates.

4.2 Reference period estimates for the given mortality levels

from our literature review, we observed that kenya is experiencing a declining rncrtolity. given ^ scenario, we shall estimate the period in which mortality levels we have obtain-ed so re^er k- Similarly, we employ the Trussell's equation for calculating time reference. T1*e coefficients f0r estimating these are given in table 4.6.

fable 4.6: Coefficients for estimating time reference period t(x) to which the value q(x) refer - North Model.

Age grp	i	d(i)	e(i)	f(i)
15-19	1	1.0921	5.4732	-1.9672
20-24	2	1.3207	5.3751	0.2133
25-29	3	1.5996	2.6268	4.3701
30-34	4	2.0779	-1.7908	9.4126
35-39	5	2.7705	-7.3403	14.9352
4044	6	4.152	-12.2448	19.2349
4549	7	6.965	-13.9160	19.9542

Source: Study estimates.

It is observed that when mortality is changing smoothly, the reference period t(x) is an estimate of the number of years before the survey date to which the child mortality estimates q(x) from the ensuing calculations refer.

Table 4.7: Reference Period for Mortality Estimates at National Level

i	x	q(x)	REf.Prd	YRS	MTHS	ACT.PRD
1	1	q(1)	1.011578	1	0.138931	1993.021
2	2	q(2)	2.189379	2	2.272554	1991.843
3	3	q(3)	3.908762	3	10.905140	1990.123
4	5	q(5)	5.978331	5	11.739970	1988.054
5	10	q(10)	8.311221	8	3.734654	1985.721
6	15	q(15)	10.885670	10	10.628050	1983.147
7	20	q(20)	13.775670	13	9.308022	1980.257

^urce: Study estimates.

l^ese figures indicate that between 1980 and 1983, mortality was almost constant. Between 1985 and 1990 Kenya then experienced a sharp decline in mortality, but this trend almost reversed .crain between 1991 and 1993 when a slight increase in mortality was experienced-see figure 4.2. prom the literature review, it was observed that Kenya has experienced a steady decline in infant ^d child, mortality since independence therefore these slight negative changes in mortality levels could possibly be explained by the economic recession experienced during these periods and I possibly the advent of the HIV/AIDS scourge. This is a period when Kenyan economy experienced a fall in the GDP from 4.3% in 1990 to 2.2% in 1991 and further down to 0.4% in 1992. These experiences operating in unison with other factors could explain the scenario well.

4.3. Differential Mortality By the Study factors

4.3.0 Introduction

Most studies have established that levels of infant and child mortality vary with socio-economic, lemographic, environmental and socio-cultural factors (see for example Bicego and Ahmad 1996 Wong others). In this section therefore, we estimate infant and child mortality rates given these factors. This leads to an evaluation of variations of mortality given these conditions. Differentials P mortality rates by these selected background factors are presented in several tables frequently. This analysis focuses on socio-economic, demographic and environmental factors they have been found to be the most significant factors in determining differential mortality in f^V£rse studies in different regions of the world.

P.1 Differential Mortality by Socio-economic factors

In this study, maternal level of education is taken to represent socio-economic factors. since clusively, or jointly with other factors of similar category, it has been found to be the most **indicative** factor. This variable has been divided into three categories:- No Education, Primary Education, and Secondary Education. The findings are given in table 4.8.

Table 4.8: Infant and Child Mortality by Maternal Level of Education.

Level of Education	lqO	4ql	e_0
Secondary	45.8	22.2	63.64
Primary	89.5	60.5	53.19
No Education	104.7	76.0	49.90

Source: Study estimates

The findings indicate that maternal level of education emerge as a key factor related to mortality risk during childhood. Death before age 5 is averagely more than twice as much among children whose mothers have no education as among those whose mothers attained secondary level of education. We notice that mothers who have attained secondary education have much lower infant mortality rate compared to those with no education as well as primary education. A difference of 59 infant deaths per 1000 is observed between no education and secondary education, therefore, an infant born to a mother with no education is 2 times likely to die at ®fancy compared to that whose mother has secondary education.

^ another component, we also notice that life expectancy for infants whose mothers have secondary education is 63 years against that of 49 years for those whose mothers have no education. The former is 1.3 times higher than that of the latter. A difference in life expectancy at birth of 14 years is found to exist between these two groups. This finding agrees with other studies conducted by Bicego and Ahmad (1996), Kichamu (1986), Boerma (1992) among others. This finding also corroborates the hypothesis that maternal education has a significant leverage on infant and child mortality such that an advancement in educational attainment considerably lowers infant and child mortality.

4.3.2 Differential Mortality by Demographic factors

Table 4.9 recapitulates the estimated differentials of infant and child mortality by demographic factors.

Table 4.9: Infant and child mortality differentials by demographic factors

I: Breast Feeding:	$_1q_0$	$_4q_1$	e_0
4+ Months	37.3	15.4	65.90
<3 Months	104.7	76.0	49.90
Not Breastfed	111.3	83.3	48.51
II: Birth Interval:	**$_1q_0$**	**$_4q_1$**	**e_0**
4+ Years	54.7	29.5	61.35
2-3 Years	83.3	54.5	54.58
^ Years	89.5	60.5	53.19

Source: Study estimates.

Duration of breastfeeding has been observed to have significant impacts on infant and child mortality. This factor therefore has a major function to perform in child-survival or mortality, prom table 4.9, we discern that infants who were never brestfed have higher mortality rate (as high as 111 infant deaths per 1000) which is 3 times that of those who were brestfed for more than 4 months.

Another demographic factor included for analysis was preceding birth interval and from table 4.9 we find that the wider the preceding birth interval, the lower the infant mortality and the higher the life expectancy and vice versa. We observe that childhood mortality for those with a preceding birth interval of more than four years was remarkably low (as low as 29 deaths per 1000 live births) compared to those whose preceding birth interval was less than 2 years. Life expectancy also increased with an increase in the preceding birth interval. We note further that the life expectancy for infants whose preceding birth interval was more than 4 years was 61 years against that of those whose preceding birth interval was less'than 2 years - which was 53. The difference in the life expectancy in this scenario was 8 years.

A study by Rutstein (1984) was the first to show definitively that the pace of childbearing is closely linked to survival chances of children. Other studies such as those of Bicego and Ahmad (1996), Boerma and Bicego (1992), Miller (1989), Hobcraft, McDonald and Rutstein (1985) ^ong others, have reemphasized our understanding of this relationship. Short birth intervals tave been observed to define mortality risk better than any other demographic variable, Specially mortality during infancy.

We are therefore right to posit that if all mothers were encouraged through some special programmes to increase the length of the intervals between siblings, then the positive effect of these factors could be reinforced.

4,3.3. Differentials by Environmental Factors

In this section infant mortality differential is estimated given some background environmental factors. These factors are Sources of drinking water and toilet facilities. A cursory of the estimated mortality differentials by environmental factors is offered in table 4.10.

Table 4.10; Infant Mortality differentials by Environmental Factors

I: Sources of Drinking water	$_1q_0$	$_1q_4$	e_0
Tap	54.7	29.5	61.3
No Tap	83.3	54.5	54.6

II: Toilet Facilities	$_1q_0$	$_1q_4$	e_0
Flush	54.0	28.9	61.5
Pit	79.1	50.7	55.5
Bush	123.3	96.3	46.2

Source: Study estimates.

Our findings tabulated in table 4.10 demonstrate that environmental factors have a great influence to the levels of infant and child mortality. From the table we observe that childhood mortality for those children whose households use Bush as a disposal system, have mortality rates three times higher than those whose households use Flush toilets. Infant mortality rate for those using flush toilets is 45 deaths per 1000, while that for those whose households use Bush-is--123 per 1000. ^fe expectancy for those who use Flush toilets is 61 years while for those who use Bush is as low as 46 years. The difference being 15 years, the highest being observed among all the analytical factors in the study.

Comparatively, source of water is also another very important factor in determining infant and child mortality. Those children whose households have no tapped water suffer higher mortality rates (54/1000) compared ~ to those whose households have tapped water (29/1000). The difference in life expectancy is 7 years, therefore if the proportion of households having tapped water was to increase then this difference would decrease. This finding is a rejoinder to our conceptual framework that through the basic proximate determinants, some independent factors operate to influence the risk of disease and the outcome of disease process. We find that environmental factors work through some maternal factors to influence infant mortality risk.

CHAPTERS ••-—•- - '

THE EFFECTS OF SOCIO-DEMOGRAPHIC AND ENVIRONMENTAL FACTORS ON INFANT MORTALITY

5.0. Introduction:

n this chapter, analysis of the role of socio-economic, demographic and environmental factors on infant mortality in Kenya, is performed. Multivariate Logistic analysis is used in the analysis.and results obtained from different models are given and discussed. Logistic regression analysis was used to analyze the data in all the models. There were two parts of analysis and part two of the analysis had two sections. In part 1, bivariate analysis was performed to asses the effects of each factor independently (i.e education with dependent variable, breastfeeding with the dependent variable, birth interval with the dependent variable, etc) so as to assess clearly the effect of each variable individually and determine its significance.

In part two, section 1, analysis was performed to estimate the effects of each group of factors independently to control for confounding factors and to establish clearly which set of factors are ®ore significant and have a great role to play either in reducing or increasing infant mortality, ftis section is made up of three sub-models. Sub-model one was built using only the socio-^onomic factors, that is, the Maternal level of education. Sub-model 2 was made up of kmographic variables only, that is, Duration of breastfeeding, Preceding hirth interval and Eternal age at childbirth. Sub-model three was built by fitting only the environmental factors,

jjjat is, the type of toilet facilities and source of drinking water.

n section two, we attempted to examine the interaction of factors amongst themselves through ^univariate analysis. Therefore, we came up with 4 different full models. The first model was juilt using the socio-economic factors (which were very significant) and each additional factor was introduced into the model.

The second model was made of demographic factors being introduced into the first model while third model was built by introducing the environmental factors into the second model. A fourth model was built to examine the interaction between breastfeeding and environmental factors. This *ms* on the basis of the Mosley and Chen's analytical framework which considers the *t* :nvironmental contamination through maternal factors as a risk factor in infant mortality. This study, therefore, considers the interaction of environmental factors with breastfeeding for a pedal analysis, since the effects of environmental factors can easily be felt by an infant through reastfeeding, all other things remaining constant.

t

i data-case selection, only children who were born 5 years preceding the survey period were !'ected for analysis. This was done so as to ensure that each child in this case, at least, every 'tar thing remaining the same, could have had a chance to experience the effects of the study ctors- mostly environmental factors within their households.

Variable Definition as used in the Logistic Regression iModels

In the analysis, the dependent variable is whether an infant dies or lives. This is a dichotomous variable which assumes digit 1 when an infant dies and digit 0 otherwise. The independent **variables** included in **the** analysis **are:-**

(1) Mother's level of education.

(2) Duration of breastfeeding.

(3) Mother's age at birth.

(4) Preceding birth interval.

(5) Source of drinking water.

(6) Type of toilet facilities.

These variables were further transformed into indicator (dummy) variables taking the values 1 or 0 to designate the presence or absence of an attribute.

A: Socio-Economic Factors

1) Mother's level of education:-

-Indicates mothers with no education and it forms the reference category.

- Indicates mothers with incomplete or primary education (it becomes 1 if the case is true otherwise).

- Indicates mothers with secondary education and above (it takes the value 1 if the case is true and 0 otherwise).

g: Demographic Variables

(2) Duration of breastfeeding :-

BREST1 - Indicates breastfeeding duration of less than 1 month. It forms the reference category.

BREST2 - Indicates breastfeeding duration of 2 - 3 months (it is 1 when the case is true and 0 otherwise).

BREST3 - Indicates breastfeeding duration of more than 4 months (it is 1 when the case is true and 0 otherwise).

(3) Mother's age at birth:-

MAGE1 - Indicates mother's age at birth of less than 20 years. This forms the reference category.

MAGE2 - Mother's age at birth of between 20-39 years (it assumes 1 when the case is true and 0 otherwise).

MAGE3 Mother's age at birth of 40-49 years (1 when the case is true 0 otherwise).

H) Preceding Birth Interval:-

^HOT - This connotes preceding birth interval of less than 2 years. It forms the reference ^gory.

jvlEDl - This connotes preceding birth interval- of-2-3--years (it is 1 when the case is true and 0 otherwise).

\V1DE - This connotes preceding birth interval of more than 4 years (1 when the case is true and o otherwise).

C: Environmental Factors

(5) Source of drinking water:-

TAP - This indicates when the source of drinking water in a household is a tap. (It takes the form 1 when the case is true and 0 otherwise).

NOTAP - Indicates a source of drinking water other than a tap -that is river, pond and well. It forms the reference category.

$) Toilet Facilities :-

fLUSH - Indicates the households with flush toilets. (It takes the
orm 1 when the case is true and 0 otherwise).

'IT - Indicates the households using pit latrines (it is 1 when the case is true and 0 otherwise).

USH - Indicates the households using bush as a disposal system. It forms the reference -tegory.

5.2.1 Bivariate Analysis Results:

In this part, bivariate analysis was performed to asses the effects of each factor individually and determine its significance. In "this analysis, secondary education, flush toilet and tap as source of water exhibited the highest significance. In the socio-economic model, the probability of infant death was at its lowest for secondary educated mothers. Secondary education had significant reduction effect on infant mortality when compared with no education, while primary education had insignificant reduction effect on infant mortality. Therefore,

Probability of Infant Death given secondary education = 1.8833 - 0.0142 (PRIM)-0.2137(SECC>).

However, other factors apart from breast feeding exhibited lower significant reducing effects on infant mortality. The second lowest probability of infant death was from the environmental factors - flush toilet and source of water (tap). Of the demographic factors, breastfeding for more than two to three months and more than four months had significant reducing effects on infant mortality compared to no breastfeeding or breastfeeding for less than two months.

Mother's age at birth and preceding birth interval were however insignificant.

Table 5.1: Bivariate analytical results for all factors

VAKIAHIK	6	Sit.	Exp(6)
KDICATION			
N'O'C		•	
Trim	,-0.0142	0.8152	0.985")
Scco	-0.2137	0.0089	0.8076
Constant	1.8833	0.0000	
UKEAST KKEHN<:			
Urcf 1	*	•	•
Brcf 2	-0.3228	0.0196	0.7241
Urcf 3 "	-0.6717	0.0681 -	0.5108
Constant -	•1.8539. . . . . .•	O.OOOU	—
MATERNAL ACE			
Mage I	•	*	•
Mage 2	-0.0983	0.2654	0.9064
MJSC 3	-0.5763,	0.3766	0.5620
Constant	1.8756	O.(XKK)	...
BIRTH INTERVAL			
Shot	*	*	*
Meili	-0.0577	0.2316	0.9440
WiJe	-0.1216	0.1757	0.8855
Constant	1.8830	0.0000	—
TYIE OF TOILET			
Bush		*	*
Pit	-0.M12	0.4564	0.9596
Flush	-0.4121	0.0001	0.6622 '
Constant	• 1.8950 -	0.0000	... .
WATER SOURCE			
No Tap		•	
Tap	-0.2481	0.0006	0.7803
Constant	1.8943	0.0000	-

•Relcrvnee Category.

•Source: Study estimates.

5.2.2. Bivariate Analysis in Sub-Models:

In this section multivariate analysis was performed to asses the effects of each group of factors independently (bivariate analysis) to control for confounding factors and to establish clearly- **which** set of factors are more significant and have a great role to play either in reducing or increasing infant mortality.

5.2.2.1 Sicio-Economic Factors Sub-model:

This model estimated the effects of maternal level of education as a socio-economic factor on infant mortality. This model is made up of No education (NONE), Primary education (PRIM) and secondary education(SECO). The following results were found - table 5.2.

Table 5.2: The results from the model estimating the effects of Maternal education.

Variable	>	**Significance**	**Exp (p)**
PRIM	**-0.0142**	**0.8152**	**0.9859**
SECO	**-0.2137**	**0.0089**	**0.8076**
CONSTANT	**1.8833**		
•2LL	**986.642**		
df	**1341**		

Wee: Study estimates.

The summary of the equation is tluis:-Probal)ility of infant death = 1.8833 - 0.0142 (PRIM)- 0.2137(SECO).

From the given model, secondary education exhibits greater statistical significance. It lias the lowest probability of infant death - that is the odds of death for an infant whose mother has secondary level of education is reduced by a factor 0.8076 in reference to an infant whose mother has no eduction, while the odds of death for an infant whose mother has primary level of education is reduced by "a factor of 0.9859 in reference to that whose mother has no education. Further from the model, if we employ the logistic model

$$Px=p(d=1/x) = |/(1+\exp [- (P_0{}^{+}P_{1XI}{}^{+} \quad \beta_{pxp})]\}$$

we find that if we apply the above model while holding other factors constatnt, for every 1000 infants, whose mothers have secondary education, 109 are expected to die, while for infants whose mothers have primary education, 130 per 1000 are expected to die. This gives an excess of 21/1000 deaths which can be associated with primary education and even higher for infants whose mothers have no education at all, therefore, the risk of death for infants whose mothers have primary education, relative to infants whose mothers have secondary education is 1.238 (0.130/0.105).Education therefore, is a leading factor with significant effects in infant mortality scenario. The educational advantage may be enabling mothers to maintain more hygienic child health care and standard feeding systems by affording high quality supplementary foods than those without education. In a similar study by Bicego and Ahmad (1996), mother's level of education, particularly, showed a positive association with improvement of child survival chances and was most pronounced at age 1-4 years.

5.2.2.2. Demographic Factors Sub-model:

In this model, the demographic factors were fitted alone so as to ascertain their effects when possible confounding factors are controlled. All the demographic factors in the analysis were fitted at once. The results obtained were as in table 5.3.

Hence we obtain the following equation:

The probability of an infant death = 2.0502 - 0.0599(MEDI) - 0.0150(WIDE) - 0.0560(MAGE2) - 3.1515(MAGE3) - 0.6543(BREF2) - 0.7544 (BREF3).

Table 5.3: The results of the effects of Demographic Factors fitted alone.

Variables		Significance	Exp(£)
[MEDI	-0.0599	0.1955	0.9419
1 WIDE	-0.0150	0.7915	0.9851
MAGE2	-0.0560	0.4724	0.9455
IMAGE3	3.1515	0.7413	23.371
1BREF2	-0.6543	0.0000	0.0428
|BREF3	-0.7544	0.0733	0.4703
1 CONSTANT	2.0502 992.477		

Source: Study estimates.

From the model only two factors were significant - breastfeeding duration of two to three months tod breastfeeding duration of four months and above. The odds of death for an infant who was breastfed for a period of between 2-3 months was reduced by a factor of 0.0428 in reference to hose who were never breastfed or were breastfed for less than 1 month. Infants who were Wstfed for a period of more than 4 months had relatively lower odds of dying compared to [hose who were never breastfed or were breastfed for less than 1 month, i.e. the odds of dying of an infant breastfed for more than 4 months was reduced by a factor of 0.4703. This is to say that breastfeeding for more than 4 months reduces the odds of infant death by 75% compared to a case of no breastfeeding.

Infants born to mothers of age 20-39 had lower odds of death (the odds of death was reduced by a factor of 0.9455) compared to those born to mothers aged less than 20 years, while those born to mothers aged 40 years plus, had higher risk of death, i.e the risk of death for such infants was increased by a of 23.371, comparatively. Therefore infants born to mothers of middle ages (20-39 years) have lower risk of death compared to those born to mothers aged below age 20 and age 40 years plus. We also note that infants born with wider Preceding birth intervals had lower risks of death when compared to those with shorter preceding birth intervals - less than 2 years.

From the model, for every 1000 infants born to mothers aged 20-39 years, had preceding birth intervals of more than 4 years and were breastfed for more than 4 months, 121 were expected to die, relatively, 227 per thousand infants who had similar conditions except that were never breastfed were expected to die. Hence an excess of 106 infant deaths per thousand live births were expected in any condition of no breastfeeding while other conditions remained the same.

p.2.3. Environmental Factors Sub-model:

Rthis model, only environmental factors were fitted. The outcome equation was:

lability of infant death = 2.0905 - 0.0055(PIT) - 0.4546(FLUSH) - 0.0256(TAP).

fable 5.4: Results of the effects of Environmental Factors fitted alone.

Variable		Significance	Exp($
PIT	-0.0055	0.9186	0.9945
FLUSH	-0.4546	0.0004	0.6347.
TAP	-0.0256 " - ...	0.7619 -	0.9747
CONSTANT "2LL	2.0905 990.291		

Source: Study estimates.

In the model , Flush toilet is the most significant environmental factor in this case, followed by tap as a source of water. The use of Flush toilets decreases the risk of infant death by a factor of 0.6347 compared to the use of Bush as a sanitary facility. We observe that out of every 1000 live infants from households with no tapped water and are using pit latrines 109 are expected to die, i while those whose households have'tapped water,"107 per 1000 infants are expected to die.

5.2.3. Multivariate Analysis of Full Models:

In this section of analysis, factor interaction is examined in 4 different models.

2.3.1. Model 1:

his model is built with socio-economic factors - Maternal level of education. All the socio-^nomic factors, Primary education and Secondary education were introduced hence the summary of the equation is; - ... -

probability of infant death = 1.8833 - 0.0142(PRIM)- 0.2137(SECC>)

Secondary education, just as in model 1 of part 1, still exhibits higher significance and reduces the odds of infant death by a factor of 0.8076 referring to those with no education. In this model, Primary education - in reference to no education reduces the odds of an infant death by factor of 0.9859. A summary of these findings are given in table 5.5.

5.2.3.2. Model 2:

In this model, Demographic factors were introduced into the first model so as to establish any changes in the structure of the relationships when these factors are introduced - see table 5.5. The equation obtained from the model was:

Probability of an infant death = 2.1270 - 0.3777(PRIM) - 0.9tll(SECC>) - 0.2761(MEDI) - 0.1814(WIDE) - 0.3934(MAGE2) - 2.8858(MAGE3) - 3.0672(BREF2) - 0.3081(BREF3).

h this model, Secondary education still remained the most significant factor followed by preceding birth interval of 2-3 years. In this model secondary education gained strength in its Auction of risk of death, given the new structural relationships.

Relatively fitted with demographic factors, secondary education now reduced the odds of infant j^th by a factor of 0.3787 and gaining significance by 92% compared to the results of model 1 fthis

part. The importance of secondary level of education in reducing the. risk of infant death is earlý manifested in this model and it showed clearly how much education overshadowed other factors that have relationship with infant mortality. Of the demographic factors-introduced in this model, preceding birth interval of 2-3 years exhibited higher factors in reducing the odds of infant death compared to the rest of demographic factors in the model. Compared to when this factor was fitted with demographic factors alone, it now gains significance by 25 percent.

Breastfeeding duration of more than 4 months also gains in the strength of risk reduction. It advances from 0.4703 to 0.7348. This indicates that mother's level of education (secondary) together with longer duration of breastfeeding have stronger effects in reducing the odds of infant death. This observation confirms Mosley and Chen's analytical framework.

From the model, those infants who had preceding birth interval of 2-3 years, were breastfed for more than 4 months and whose mothers had secondary education only 24 per 1000 were expected to die. In a similar scenario but with no secondary education, 62 per 1000 were expected to die. The excess 38 deaths out of the 1000 infants is estimated to be associated with lack of education among mothers. If the fitting was lapsed to infants having similar factors except not being breastfed, an excess of 59 infant deaths out of 1000 would be estimated to be associated with lack of breatfeeding. The risk of death for infants in the category whose mothers do not have secondary education relative to the risk of death for infants whose mothers have, is 2.6 while the risk of death for those who have not been breastfed relative to the breastfed ones becomes'3.5. from this analogy we observe that breastfeeding and secondary level of education are the leading actors

n determining infant mortality or survival. We also observe that they .work strongly in ^junction with one another.

5.2.3.3. Model 3:

In this model, environmental factors were introduced into the second model (table 5.5). The last **equation** obtained was:

The probability of infant death = 1.8908 - 0.1356(PRIM) - 0.0038(SECO) - 0.0501(MEDI) - **0**.1356(WIDE) - 0;0176(MAGE2) 3.6288(MAGE3) - 0.3141(BREF2) - 0.6622(BREF3)- **0**.3O78(FLUSH) - 0.0880(PIT) - 0.1436(TAP).

In this model by introducing the environmental factors, secondary education lost significance by 99%, it also gained in the factor by which it reduces the odds of death from 0.3787 to 0.9962. Breastfeeding duration of more than 4 months continued being one of the significant by achieving 85 percent increase in significance.

Preceding birth interval of 2-3 years gained significance at the introduction of the environmental actors. At the introduction of the environmental factors, the following demographic factors jained more significance; Breastfeeding period of more than 4 months and Preceding birth iterval of more than 4 years. Of the introduced environmental factors, Flush toilet became the lost significant followed by Tap as the source of drinking water and lastly Pit latrine. The use of 3pped water decreased the risk of child death by a factor of 0.8662 compared to those without, jhile the use of Pit latrines reduced the odds of infant death by a factor of 0.9157 compared to jOse using Bush. - Given this scenario the risk of'death of an infant whose household did not i lVe tapped water relative to that with tapped water was 3.05. This indicates the importance of ^d water as an environmental factor. The summary of model 3 is given in table 5- S.

Table 5.5: The three models (1,2 :md 3) showing all analytical Factors.

	MODEL 1			MODEL 2			_ ._.".MODEL 3		
VARIABLES	*6*	SiK	Exp(6)	*6*	Si«	Exp(6)	6	SiK	Exp(6)
EDUCATION									
None					*	*	-0.1356	0.1619	0.8732
	-0,0142	0.8152	0.9X59	-0.3777			-0.(1038	0.974X	1l.'» >62
Prim					0.1270	0.6854			
	-0.2137	0.0UK9	0.8076	-0.9711	0.0007	0.3787			
Seeo									
BREAST FEEDING.							-0.3141	<1.0233	0.7304
				*			-0.6622	0.0723	0.5257
						0.0465			
						0.7348			
Bret' 1				-3.067:	0.8203				
				•0.3081	0.4818				
Bret" 2									*
Bref 3							-0.0501	0.3011	0.95110.
							-0.1356	0.1341	8732
						0.7587			
						0.8341			
BIRTH INTERVAL				*	*				
							-	»	-
				-0.2761	0.1460				
Shot				-0.1814	0.5283		-0.0176	0.8564	0.9825
							3.6288	0.7038	0.6663
Medi						0.6747			
						0.0558			
Wide									
				-0.3934	0.3038				
MATERNAL AGE				-2.8858	0.8308				
							-0.0880	0.3661	0.9157
							•0.3078	0.0625	0.7350
Mage 1									
Mage 2									
Mage 3							-0.1436	0.1458	0.8662
TYPE OF TOILET									
Bush									
Pit									
Flush									
WATER SOURCE									
No Tap									
Tap									
CONSTANT	1.8833			2.1270			2.1338		
-2LL	986.642			981.478			980.286		
df	1341			1335			1332		

Source: Study estimates.

5.2.3.4. Model 4:

In this model, the multivariate analysis between breastfeeding and envfronmental factors was examined. A total of 4 equations were obtained from this model and the final equation found was:

The probability of infant death = 2.0702 - 0.4148(PIT)- 0.2431(TAP) -0.545 (FLUSH) - 3.1240(BREF2) - 0.3670(BREF3).

Breastfeeding duration of 2-3 months and Flush toilet facility were insignificant. When fitted together with environmental factors, breastfeeding duration of more than 4 months became significant. From the analysis, the risk of death for an infant who was breastfed and used bush as a disposal system relative to that who had similar conditions but used flush toilet, was 1.2. Breastfeeding duration of more than 4 months now lost some factors by which it reduced the odds of death from 0.5157 (when fitted with education) to 0.6925. This indicates the type of structural relationship between environmental factors and demographic factors.

Table 5.6: Model 4 - Breastfeeding and Environmental Factors

Variable	Ja	Sig.	Exp(p)
BREAST FEEDING			
Brefl	*	*	*
Bref 2	-3.1240	0.8170	0.0440
Bref 3	-0.3670	0.4004	0.6925
ENVIRONMENTAL			
Bush	*	*	*
Pit	-0.4148	0.0806	0.6605
Flush	-0.0545	0.9142	0.9469
No tap	*	*	*
Tap	-0.2431	0.4604	0.7842
CONSTANT	2.0702		
-2LL	-989.735		
	1338		

Source: Study estimates.

5.3. Summary

In this chapter, analysis of the effects of socio-economic, demographic and environmental factors on infant mortality was performed. The logistic regression analysis was done in 7 different Agression models in two parts of analyses. The first part analyzed the factors in 6 bivariate plytical models. In section 1 of part 1, 3 sub-models analyzed the independent variables j^parately. In sub-model 1 of part 1 section 1, secondary education emerged as the most rPortant socio-economic factor.

In sub-model 2 of the same section and part, two demographic factors were found to be very significant with the highest effect on infant mortality. These were breastfeeding for more than 4 nionths and preceding birth interval of 2-3 years. It was also found that infants born to mothers aged 40 years and above, had higher risks of death than those born to mothers 20-39 years. We also noted that infants born with larger preceding birth intervals, have higher chances of survival hence lower risks of death than those with shorter birth intervals. In the third sub-model, infants from household with no tapped water and are using bush or pit latrines have higher risks of death compared to their counterparts with tapped water and flush toilets.

In the multivariate analyses in part 2, it was found out that higher levels of maternal education together with longer durations of breastfeeding have greater effects of reducing the odds of infant deaths than the opposite cases. It was also found out that in the absence of secondary education and presence of bush or pit latrines, breastfeeding increased its significance in the risk of infant death and continued to lose the effects by which it reduced the odds of infant death.

5.4: Discussion of Results

In general, the results indicate that all the study factors have implications on infant mortality, but indifferent dimensions. The factor with a leading role on infant mortality is mother's education followed by breast feeding and the other factors in the study. The study generally set out to assess foe relative roles of socio-demographic and environmental factors on infant mortality in Kenya, ^e results therefore, indicate that all the study factors have very significant roles to play on •tfant mortality in Kenya, some positively and negatively. In the literature review we found out mortality during infant and early childhood are influenced by a complex of social, cultural, economic and health conditions that include the availability and quality of medical care, water supply, sanitation, food and housing, educational level of parents (particularly mothers) and the **quality** of child care.

The findings in this study also concur with findings in many studies that had been indicated in the literature review and strongly confirms the theoretical and conceptual models and the study hypotheses. In the theoretical framework, it was stated that socio-demographic and environmental factors may affect infant mortality, this postulate has been confirmed by the study results. Again the conceptual model was based on the premise that social conditions of life are major determinants of child survival, that these determinants make their impact through a set of intermediate mechanisms that can be decomposed analytically and that disease and health are direct consequences of a set of factors originating in the social conditions of life and behaviour of families. The study findings have confirmed these postulates.

The significance of the results in this study is that the more mothers become educated, the longer the duration of breast feeding and the better the sanitation facilities are used, the lower will be infant mortality. This implies that more effort should be put in ensuring education for all jmothers in particular), encouragement of breastfeeding programmes and the formulation of Policies and programmes on environmental health.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6,0. Introduction

In this conclusive chapter of the study, a summary of findings is done while re-inspecting the stated study objectives and hypotheses". We also seek to appraise the objectives to see how far they have been met. The methods of data analysis are also evaluated on their exactitude to the study and the results obtained. Subsequently, conclusions are made, then basing our argument on the offered conclusions we offer feasible recommendations to policy makers and for further researches.

6.1. Summary of findings

This summary is given as per the stated study objectives and the main hypotheses for analysis. Therefore the following summary of findings are made;

Maternal education was found to be the most portentous **socio**-economic factor with a resolute on infant mortality in Kenya. Our findings indicate that children born to educated mothers jW very iow risks of death compared to those born to un educated mothers. Higher levels of Nation had greater reducing effects on the risk of infant death and children born to mothers such kind of educational levels had the lowest probabilities of death. Death before age 5 was f^eragely more than twice as much among children whose mothers had no education as among those whose mothers had secondary level of education. Therefore an infant born to a mother with no education is 2 times likely to die at infancy.

Life expectancy at birth for infants whose mothers have secondary education was 63 years which is 1.3 times higher than those of non educated mothers which was only 49 years. This finding confirms studies by Bicego and Ahmad (1996), CaIdwelU1979,~1989),~Cochraine et al (1980) among others.

Another finding was that when maternal education as a factor was fitted together with demographic factors, some change in significance was recorded. It gained more significance and achieved strengths as far as the. odds of an infant death was concerned. On the contrary, some decrease was recorded when environmental factors were introduced into the models. This is an indication that a discreet addition of the impact of maternal education on infant mortality was interceded by these environmental factors, which in this case are considered as proximate factors. This corroborates the conceptual framework adopted for this study. Ceteris paribus, educated mothers are expected to have a parallel to piped water and flush toilets. The study also revealed that given different levels of maternal education, 82 per 1000 infants would be expected to die from infants born to mothers with no education compared to 33 per 1000 for infants born to bothers with secondary education. Maternal education has a key role to play in reducing infant Mortality in Kenya.

findings on demographic factors reveal that, breastfeeding and preceding birth interval are the, most significant demographic factors in infant mortality. Breastfeeding for longer duration exhibited positive effects on infant survival and negative effects on infant death. Infants that were breastfed for longer durations had very low risks of death compared to those breastfed for shorter durations. On the same note, infants born with longer preceding birth intervals also had higher chances of survival compared,to those with shorter preceding birth intervals...Age of mother at birth also had an indicative effect on infant mortality such that infants born "to mothers aged 20 years and below plus those infants born to mothers 40 years and above had higher risk of death compared to those of ages 20 to 39 years.

We also noted that infants who were never breastfed had higher mortality rate (111/1000) compared to those who were breastfed. This figure is three times those who were breastfed which was 37 per 1000. For preceding birth interval, those infants with preceding birth intervals of more than 4 years had relatively low mortality rates of 29 per 1000 compared to those with shorter preceding birth intervals of less than 2 years, which was 60 infant death per 1000. .Life expectancy at birth was also found to increase with an increase in the preceding birth interval, rhis ranged from 53 years for those with shorter preceding birth intervals to 61 years for those with longer birth intervals.

j^hen the demographic factors were introduced into the models together with maternal education,- hey tended to lose significance sparsely even though they still maintained and increased in the •ffects to which they reduced the odds of infant death. We find out that longer preceding birth Nerval, longer durations of breastfeeding and mother's age at child birth have greater impacts on infant mortality and have immense roles to play on the same.

Our findings on the environmental factors reveal that source of drinking water and type of toilet facility are very significant factors in determining infant mortality. It was found out that the use of bush, pit latrines and un-piped water increase the odds of infant death or reduce the chances of infant survival. It was found that for every 1000 infants from household which had no tapped water and were using pit latrines, 137 were expected to die, while those from households with piped water, only 63 per 1000 were expected to die. Therefore infants from household using bush as a disposal system had mortality rates 3 times higher than those whose households used flush toilets.

6.2. Conclusion

The general objective of this study was to systematically assess the relative roles of socio-demographic and environmental factors on infant mortality in Kenya, while the specific objectives were based on the effects and significance of mother's education, birth interval, duration of breast feeding, mother's age at child birth, the use of piped water and improved toilet ; sanitation on infant mortality in Kenya.

Hn regard to the first objective, it was hypothesized that the level of mother's education has ^significant effects on infant mortality in Kenya. Our finding regarding this demonstrates that children born to educated mothers have higher chances of survival compared to those born to uneducated mothers- Higher-levels of education have greater reducing.effects on the risk of infant death and children born to mothers with such kind of educational levels have the lowest probabilities of death. Therefore an infant born to a mother with no education is likely to die at infancy compared to that of an educated mother.

From the above observations improvement in mother's education in Kenya has greater effects in reducing infant mortality. It is therefore expected that if many mothers were to attain at least secondary level of education, then infant mortality levels would substantially rescind.

Secondly we examined the effects of birth interval, duration of breast feeding and the effect of mother's age at child birth and their significance on infant mortality in Kenya. The hypotheses on these objectives were that; wider birth interval has significant effects on infant mortality in Kenya, that longer duration of breastfeeding has significant contributions to infant mortality and that mother's age at birth has significant contributions to infant mortality in Kenya. Our findings regarding these suggest that breastfeeding and preceding birth interval are significant demographic factors in infant mortality. Age of mother at birth also has a significant effect on infant mortality such that infants born to mothers aged 20 years and below plus infants born to jnothers 40 years and above had higher risk of death compared to those of ages 20 to 39 years, theses findings indicate that there is need to promote breastfeeding practices and mothers to be jncouraged to have wider intervals between births (birth spacing) and younger and very old ages birth to be discouraged so as to reduce mortality risks for infants.

"hirdly the effects of the use of piped water and improved toilet sanitation on infant mortality were examined and whether these contribute significantly to infant mortality in Kenya! On this objective, we hypothesized that the type of toilets facilities has significant effects on infant mortality in Kenya and that the use of piped water has significant contribution to infant mortality in Kenya.

Our findings confirmed these hypotheses. The source of drinking water and type of toilet facility are very significant factors in determining infant mortality. Improvements in these environmental factors therefore should be given grater priority in policy formulation and planning in Kenya so as to effectively reduce infant mortality in the country.

6.3. Recommendations

The findings from this study have got cogent policy implications that will require implicit action as it draws attention to very significant issues regarding policy formulation in Kenya. The findings lead towards a need for precise policy formulation on maternal and child health in Kenya. As per the results of this study, stringent improvement on promotive and preventive health care systems so as to ensure improvement on infant, child and maternal health so that infant mortality can be further reduced to very low levels. .

We therefore offer the following recommendations that will lead to the achievement of the Squired actions:

6.3.1 Policy Recommendations:

1: As regards maternal education, it is critical that basic education programmes be largely expanded to reach majority of mothers. This implies that maternal literacy should be a priority in policy formulation and programme designs. Adult education should also be considered as a means through which majority of parents (both mothers and fathers) should be reached so as raise literacy levels in the country. For mothers who are already in school, there should be programmes to encourage them to at least attain secondary level of education. These are in line with the findings that higher education of mothers has a tendency of reducing the risk of infant death and that education opens ways to at least better living standards that is a prerequisite for good health both for the parents and the children.

2: Breastfeeding programmes in Kenya should be encouraged as one of the preventive and promotive facet of child health. It suffices to say that incentives to lengthen breastfeeding periods should be prioritized. Working mothers who have the tendency to shorten breastdfeeding durations should be provided with creches to encourage breastfeeding. MCH/FP programmes should include promotion of birth delays so as to lengthen birth intervals to ensure healthy infants hence a remarkable reduction in infant mortality. Mothers should also be encouraged to give birth at appropriate ages like between age 20 and 39 years.

Policies and programmes on environmental health need .to be formulated to intensify higher environmental health standards in the country. As the study has indicated that source of drinking water and the type of toilet facilities used by-households have a great implications on infant and child mortality, households with no tapped water should be encouraged to practice boiling of water before use and to practice general hygiene whenever they do not have flush or pit toilets. This implies that intensive promotive and preventive-health education should be promoted at local levels.

6.3.2 For Future Researchers:

The study recommends that studies should be done to establish the best procedures that can be employed to ensure that those factors that positively correlate with infant mortality - those factors that increase infant mortality - are either eradicated, contained- or improved in the context of cultural, social and economic perspective. This will therefore ensure a sustained reduction in infant and child mortality in Kenya.

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