CHAPTER 1

GENERAL INTRODUCTION

1.1 INTRODUCTION

Infant mortality rate (IMR) is considered – crucially - as the most important sensitive indicator for the socioeconomic and health status of a community and its description is very vital for evaluation and planning of the public health strategies. (Park, 2005).

One of the most important Millennium Development Goals (MDG); developed by the United Nations (UN), is to reduce infant and child mortality by two-thirds between 1990-2015, as children are the precious assets of a nation. (UNICEF, 2006). In Kenya, approximately, eight out of each 100 live births die before their first birthday, representing huge wastage of potential manpower. (CBS, 2004). So, achieving the MDG, means, simply, reduction in the Kenyan IMR to about 22.0 per 1000 live births by 2015.

There is a wide variation between countries and regions regarding the level of IMR. For the year 2004, the worldwide average for IMR has been estimated as about 54 per 1000 live births. The level varied from 5 per 1000 live births in developed countries to 59 per 1000 live births in the developing countries to about 98 per 1000 live births in the least developed world. (UNICEF, 2006). This wide variation has been attributed to the varied level of the medical and socioeconomic progress between these countries. The fact that IMR of the industrialized countries was around 200 per 1000 live births or even more 200 years ago, can further reinforce the association between infant mortality and social and economic development. (Park, 2005). However, this association was already documented

as early as 1824 through the use of survey data. (Villermé, 1830 quoted by Masuy-Stroobant, 2001).

Rather than generating causality conclusions, this study aims to arrive at a better understanding for the association between socioeconomic factors and infant mortality that could be plausible and consistent with the available information. Such results could be more useful in prioritizing the intervention policies so as to decrease the IMR.

1.2 BACKGROUND AND INFORMATION ON STUDY POPULATION

Kenya is an African country situated in the eastern part of the continent, stretching latitudinally from 5 degrees north to 5 degrees south and longitudinally between 24 and 31 degrees east. It is bordered in the north by Ethiopia and Sudan, in the south by Tanzania, in the west by Uganda and in the east by Somalia and Indian Ocean. The total area is 582,646 square kilometers, with total land area of 571,466. 80% of the land area is arid or semiarid and only 20% are arable. Apart from the highlands extending on both sides of the Great Rift Valley, most of the country lands are lowlands. The climate is not the same all over the country. It is influenced by the altitude and the proximity to water surfaces such as the ocean and the lakes. The main seasons are four; starting with dry period in January, to long rainy season from March, followed by long dry period from May and ends by a short rainy season from October to December. (CBS, 2004)

Politically, Kenya is divided into eight provinces (North Eastern, Eastern, Coast, Rift Valley, Central, Western, Nyanza and Nairobi) and 72 districts. The capital of the

country is Nairobi and within it is the main international airport of Kenya, while Mombasa, on the Indian Ocean, is considered as the main seaport for exports and imports. The country has about 42 ethnic groups; major tribes include Kalenjin, Kamba, Kikuya, Kisssii, Luhya, Luo, Meru, Mijikenda and Somali. English language is the official language in Kenya, while Kiswahili is the national one. The main religions in Kenya are Christianity and Islam. (CBS, 2004)

Kenya was colonized by Britain. The country achieved self-ruling in June 1963, and in December 12 the same year gained the independence. The country became a republic after one year of independence. Kenya was a multiparty state until 1981, and then changed into a one-party state, but from the early 1990s, the system was reverted back to a multiparty state. (CBS, 2004)

Kenya is, predominantly, an agricultural country. The main agricultural exports in 2002 were coffee, tea and horticulture. The agricultural sector contributes 25% of the Gross Domestic Product (GDP), while the manufacturing sector contributes 13% of the GDP. The tourism sector has attributed much to the improving living standards of Kenyan citizens. The GDP has declined from 7% per annum after the independence to 2% between 1996 and 2002. This poor performance of the growth has been attributed to many external shocks and internal structural problems. The poor growth performance led to deterioration in the welfare of the Kenyan population, creating problems of unemployment and increased the poverty such that over 50% of the Kenyans are living below the absolute poverty line. The number of poor people is estimated to be 17 million

in 2001. The deterioration in the living standards were reflected in the high child mortality rate, high illiteracy rate and increasing unemployment levels. Furthermore, HIV/AIDS pandemic had a potentiating impact on economy by reducing the production and labor force. The Kenyan government has launched in 2003 the Economic Recovery Strategy for Wealth and Employment Creation so as to restore the economic growth, to generate employment opportunities and to decrease levels of poverty. (CBS, 2004)

Demographically, the total population was 28.7 million with annual growth rate of 2.9% in the year 1999 compared to 10.9 million and annual growth rate of 3.4% in 1969. This decline in population growth has been attributed to the effects of National Population Policy for Sustainable Development (NPPSD) and to the decline in the fertility rate as well as the increase in the mortality rate which was due to the HIV/AIDS epidemic, widespread poverty and deterioration of health services. However, the estimated projection for the population was to be 32.2 in 2003. The crude birth rate has declined from 50 births per 1000 population in 1969 to 41 per 1000 in 1979, while the crude death rate has increased from 11 deaths per 1000 population in 1979 to 12 per 1000 in 1999. The infant mortality rate (IMR) had shown a fluctuating trend as it had decreased from 119 deaths per 1000 live births in 1969, to 88 in 1979 and further to 66 in 1989, but thereafter showed a sudden substantial increase in 1999 to be 77 deaths per 1000 live births. However, the population of the country is considered youthful, since 44% are younger than 15 years old and only 4% ages 65 years and older. (CBS, 2004)

In the year 2003, 88% of the pregnant women in Kenya had received professional medical antenatal care, which is considered to be less than that in 1998. In comparing between 1998 and 2003, there has been no change in utilization of health services for delivery, with 59% of births been delivered at home. There has been slight improvement (2%) in using contraceptives among married women since 1998 that it became 41% in 2003. It is assumed that one in every nine children born in Kenya dies before his/her fifth birthday; that is the under-five child mortality was 115 deaths per 1000 live births in 2003. (CBS, 2004). Although precise information on causes of child mortality for Kenya is deficient, it, probably, has the same structure as in other Sub-Saharan African in which diarrhea, malaria, measles and pneumonia constitute the major causes of under-five child mortality, and it is estimated to be responsible for about 60% of the disease burden the region. (Murray and Lopez, 1996). Furthermore, it is estimated that about 72 under-five children die of malaria everyday, malaria is more prevalent in Eastern, North Eastern and Central provinces. (WELL, 2005).

In 2003, the prevalence of HIV among the adults (15-49 years old) in Kenya was about 7% and about 100,000 children were assumed to be living with the disease. (HIV/AIDS Policy Fact Sheet, 2005). The table in (appendix 1.) showed the variation between the provinces regarding the prevalence of HIV positive adults. Nyanza province expressed the highest prevalence (15.1%).

The prevalence of breastfeeding is very high that it was 97% in 2003, with a median duration of 20 months. Fifty seven percent (57%) of children aged exactly between one

and two years were estimated to be fully vaccinated against the major childhood illnesses. (CBS, 2004). The government of Kenya has launched in 2002 the NPPSD, which among other goals, aims at improving health and welfare of the people health education especially among mothers and children so as to prevent premature deaths and illnesses in this group. (CBS, 2004).

1.3 PROBLEM STATEMENT

The level of IMR per 1000 live births for Kenya had shown a fluctuating trend in the last 40 years that it was 119 in 1969 and then reduced to 88 in 1979 and showed further decline in 1989 to be 66, but there was a sudden substantial increase in the year 1999 as it was 77.3. (CBS, 2004). This pattern was consistent for most of the Sub-Saharan African countries; some of the researchers (e.g. Amouzou, 2004) attributed the initial gains in the IMR to socioeconomic progress and implementation of low cost intervention programs for most of the childhood diseases. However, the subsequent increase is a matter of debate, but most of the researchers suggested the impact of the HIV/AIDS epidemic especially on this region. (Rutstein, 2000; Hill, 2001). Other factors suggested by Amouzou (2004) are the "continuous economic crisis, the widespread political instability and civil strife".

An important question need to be answered: which factors - among the socioeconomic factors that are associated with infant mortality – have the most impact? This is to have the priority in the interventions to achieve the policy target (reduction of child mortality).

1.4 JUSTIFICATION

Although the association between the infant mortality and the socioeconomic factors is well documented (Park, 2005; Masuy-Stroobant, 2001), there is no ranked - ordering in the impact of the socioeconomic factors on the infant mortality. Most of the previous studies – all over the world - concentrated on the significance of these associations, even though, they had shown conflicting results on the significance of some factors; for example Caldwell (1979) and Adetunji (1995) regarding their work on the relationship between child mortality and level of mother's education.

On the local aspects (Kenya), most of the studies have been concentrated on investigating the infant mortality or childhood mortality in certain parts of Kenya, and mainly on medical causes of death; for example (McElroy et al., 2001) studied the all- cause child mortality in the Western Kenya, the study demonstrated the relatively higher under five child mortality in the western part of the country compared to the national level, they attributed such a difference to the intensity of Malaria in that part. Another study (English et al., 2003) studied the causes of early infancy mortality in a hospital district, when they found that mortality in the first three months of age is disproportionate to the low admission rate at that age, and thus suggesting strategies to improve the basic supportive care facilities in these settings. Both studies conducted survival analysis of a birth cohort and they studied the child mortality in a clinical point of view.

Two unpublished studies had examined the factors associated with under-five child mortality in Kenya (Hill, 2001; Mutunga, 2004). None of these studies is purely on infant

mortality and at the same time none of them had used as many explanatory factors as will be in the intended study, which in addition to the variables used in those studies will adjust for other factors like: mother's occupation, ethnicity, religion, province of residence, age of mother at first birth, birth size, place of delivery and breastfeeding. Thus there is a deficiency in studying the phenomenon on the socioeconomic perspective.

This study intends to investigate the significance of the relationship between selected socioeconomic factors and infant mortality - using the Kenyan National Demographic and Health Survey dataset for 2003. The quantification of the associations between the socioeconomic variables and infant mortality will be in a ranked–order so as to identify the most critical factors necessary for intervention priorities and heath policies in Kenya and other developing countries.

1.5 OBJECTIVES

1.1 General

To ***examine*** the distribution and relationship between the selected socioeconomic factors and infant mortality in Kenya.

1.2 Specific

1- To ***identify*** the socioeconomic factors those are associated with infant mortality in Kenya.

2- To ***quantify*** the relationship between the selected socioeconomic factors and the infant mortality in Kenya with a view to rank – ordering of theses factors.

1.6 LITERATURE REVIEW

Universally, there is large literature that focused on the determinants of infant and child mortality. Most of the studies have shown significant association between child and infant mortality and other socioeconomic (for example, Caldwell, 1979; Debpuur, 2005; and Hosseinpoor, 2005), demographic (for example, Hobcraft, 1985), biological (for example, Forste, 1994) or environmental factors (for example, Mutunga, 2004) through making use of survey or censuses data.

Regarding the association between socioeconomic status and infant and child mortality, Caldwell (1979) was the first to report on the effect of mother's education on the reducing the child mortality by studying the relationship between many socioeconomic factors and child mortality through interviewing 6 373 women at the age of 15-55 years old in Yoruba, a Nigerian tribe. He had put a theory that mother's education works through changing feeding and care practices, leading to better health seeking behavior and by changing the traditional familial relationships. Caldwell's results were further supported by Hobcraft (1993) who used multivariate analysis for 25 DHS data to study the relationship between maternal education and child survival in the third world. The study added to Caldwell's theory the effects of education on women by making them more likely to marry and enter motherhood later and have fewer children, to utilize prenatal care and to immunize their children. The results also, however, showed mysterious conclusion that effect of maternal education on child survival is weaker in sub-Saharan Africa.

Furthermore, study done in Belgium (Devlieger, 2005) using hospital records of births for 50 796 newborn infants to mothers whose age was 25 years or more showed maternal education as the single most important determinant of infantile mortality and the lack of mortality differential by employment. Shoham-Yakubovtch (1988) in a study conducted in Israel, using a cohort of 18 715 singleton live births during the period 1977-1980, had suggested the effect modification of maternal education on the relationship between birth weight and child mortality as there was inverse relationship between maternal education and low birth weight. Out of 22 DHS data from different developing countries, 14 of them showed consistently significant inverse relationship between maternal education and infant mortality. (Desai, 1998).

Evidences from studies that used data of censuses (Tulasidhar, 1993) and DSS sites (Bhuiyat, 1991) showed the same mortality differential by maternal education. The only identified counterintuitive result on this association was brought by Adetunji (1995) who had examined the 1986-1987 Ondo State DHS using birth history data from 2 635 women aged 15-49. The results showed that infant mortality is higher in those born to secondary graduates compared to uneducated mothers. The suggested explanation was the lower maternal age at birth and less duration of breastfeeding which were associated with this group.

Per capita income, as a measure of national economic status, was used in an international cross-sectional survey using data for 56 countries to study the relationship between it and infant mortality. (Rodgers, 1979). The results had shown significant inverse relationship.

The same results were supported further by Amouzou (2004), who used data on per capita income, illiteracy, and urbanization for 34 sub-Saharan African countries to study their relationship with under-five child mortality. Results had shown stronger effect for per capita income, compared to other variable, on child mortality. Another study done using DHS and Living Standard Measurement Survey (LSMS) data for 60 countries; to investigate the determinants of child mortality both at both national level and separately for urban and rural areas, had used the individual income and health expenditure as well as wealth index and access to electricity and sanitation to measure the association between inequality and child mortality. (Wang, 2003). The results showed difference between determinants of child mortality between urban and rural areas; that is income, share of health expenditure, access to sanitation and electricity and vaccination coverage were the determinants at the national level, in urban areas; access to electricity, wealth index and health expenditure, while in rural areas; only the access to electricity.

Because of the difficulty of measuring the individual income in studies at individual level, most of the studies used wealth index as a measure for the economic status of the household. For example, a study conducted in Iran using the 2000 DHS, investigating the socioeconomic inequality of infant mortality at both national and provincial levels using wealth index as a measure of economic status, found reverse association between IMR and socioeconomic status at both national level and within most of the provinces. That study suggested the spatial distribution of IMR inequality within the countries. (Hosseinpoor, 2005). Poerwanto (2003), through the analysis of the 1997 Indonesian DHS data, used the Family Welfare Index (FWI), a very similar index to the wealth

index, in addition to other socioeconomic and demographic factors to study factors associated with infant mortality. The results showed that FWI and maternal education through their inverse relationship with infant mortality had the most significant associations, other factors found to give higher risk of infant mortality were; absence of contraception, short birth intervals (less than 2 years), young maternal age at first birth (less than 21), marriage longer than six years, divorced or widowed women, religion, women who gave birth at home, absence of antenatal TT immunization, and absence of prenatal care and small size at birth.

Interestingly, results from neighborhood, Tanzania, using the 1991/1992 DHS data had shown lack of infant and child mortality differentials by socioeconomic groups (maternal education, partner's education, urban/rural residence, and presence of radio in the household). However demographic factors like; Short birth interval (less than 2 years), teenage pregnancies (< 20 years) and previous child death were all significantly associated with increased risk of death. (Mturi and Curtis, 1995). This is further supported by evidence from Kassena-Nankana rural district, a north Ghanaian DSS site, where a study was conducted to explore the relationship between socioeconomic status and health service utilization and under-five child mortality. The results showed lack of child mortality differentials by economic status (wealth index), ethnicity and sex of the child, while factors like living at distance more than five kilometers of a health facility, those whose mothers were teenage, non-educated or unmarried were all associated with worse child survival. (Debpuur, 2005).

In the local aspects; Kenya, Hill (2001) used data from both 1993 and 1998 KDHSs to examine factors associated with child mortality after adjusting for the district level of HIV prevalence. Results showed significant inverse relationship between mother's educational level and economic status (wealth index) and child mortality. While for the relationship between urban/rural residence and child mortality; urban areas showed higher mortality risks than rural, but when adjusted for HIV prevalence, child mortality was lower in urban areas. Other factors found to had higher child mortality risk were; women under age of 20, parity births more than fifth ordered births, male sex and short birth interval (less than 18 months).

Another study conducted in Kenya using the 2003 KDHS to investigate the environmental determinants (source of drinking water, sanitation facility, type of cooking fuels and access to electricity) of under-five child mortality, Mutunga (2004) had adjusted for some other socioeconomic (mother's education, ownership of TV and radio, size of household and material used in building the dwelling unit) and biodemographic (mother's age, child gender, if child born twin, birth interval and birth order) factors. Survival was found better for those who were; birth order 2-3, birth interval more than 2 years, not outcomes of multiple births, living in wealthier households, had a access to drinking water and sanitation facilities, users of low polluting fuels as their main source of cooking. However maternal age, maternal education and gender of the child were all not having significant association with child mortality.

Other studies on determinants of infant and child mortality had supported the significance effect of some bio-demographic predictors on the phenomenon. For example; Hobcraft (1985) had used information on infant and child mortality from 39 World Fertility Surveys (WFS) to examine the child mortality experience. The analysis used all singleton births which occurred between 5 and 15 years before the survey. Child-spacing variables were the most important determinant of infant and early child mortality; that is, children with preceding birth space less than two years were at higher risk to die at early age, while other factors found to be significant were birth order and age of mother, but not the same significant. Mortality is generally higher for first-born children and for teenage mothers.

Using a sample of 5 982 single live births, a study utilized the 1989 DHS for Bolivia to examine the effects of breastfeeding practices and birth spacing on infant and child survival. The results showed that delaying the next conception for more than two years doubles the likelihood of the index child surviving to its second birthday, while stopping breastfeeding during the early months of life nearly doubled the risk of dying during the first two years of life compared to continued breastfeeding. Other significant factors were use of antenatal care and level of maternal education which was potentiated, beneficially, in urban areas. (Forste, 1994). In addition to low maternal education, unmarried marital status; the effects of maternal age out of the 24-34 years range, male gender, birth order greater than the third and having low birth weight and low gestational age were all found to have higher risk of infant mortality. Those were the results of a study done by Bobak (2000) to examine the association between infant mortality due to injuries and

socioeconomic characteristics of their mothers, using data from national birth and death registries of the Czech Republic for the period 1989–91.

Using both 1996 DHS and malaria mapping data of Mali, Gemperli (2004) found that mother's education, birth order and interval, infant's sex, residence, and mother's age at birth in addition to regional level of malaria endemicity were all had a strong impact on infant mortality risk. In Asia, evidence from Nepal, using the 1991 DHS showed that; place of residence, parity, ethnicity, and immunization are the main predictors of infant mortality in Nepal. (Suwal, 2001).

Infant and child mortality, in many studies, had shown significant unequal distribution by ethnic groups. (Hessol, 2005; Troe, 2006). Evidence from Africa showed that ethnic differences in infant mortality are mainly due to the socioeconomic disparities among ethnic groups. That was in a study used data for the 1998 Ghanaian DHS to investigate the relationship between ethnicity and infant mortality after adjusting for many socioeconomic, biodemographic and household factors. (Gyimah, 2002). Furthermore, one study used data from 11 sub-Saharan African counties - including Kenya - through DHS conducted between 1990 and 1995 to examine whether ethnic inequality in child mortality has been present in sub-Saharan Africa. Brockerhoff (2000) had revealed large disparities in early child survival chances among ethnic groups in wide range of African countries.

Furthermore there was close relationship between ethnic mortality differences and economic inequalities in many countries. In case of Kenya, the Kikuyu infants had experienced the least mortality risk compared to other ethnic groups. This had been attributed to their higher economic advantages; that is, their dwellings were much more likely than others to have electricity, and they are mainly concentrated in larger cities where health care facilities were much better.

These studies had reported the importance of maternal education, economic position and place of residence as the main socioeconomic factors that are associated with infant and child mortality. Moreover, other biodemographic factors (like: spacing between siblings, birth order, sex of the child, age of mother at birth and ethnicity) were found to have significant impact on the child survival. However, none of these studies rank-ordered the socioeconomic factors regarding their impact on infant mortality. Furthermore there is a deficiency of information about socioeconomic determinants of infant and postneonatal mortality in both urban and rural areas in Kenya. This study is aiming to identify and rank-order the socioeconomic factors with the most impact on infant and postneonatal mortality after adjusting for many biodemographic and other health outcome determining factors. The main target is to put recommendations that can support the efforts to decrease infant and thus child mortality in Kenya.

CHAPTER 2

METHODOLOGY

2.1 STUDY DESIGN

This study is an analytical cross-sectional study through secondary data analysis of the 2003 Kenyan Demographic and Health Survey (KDHS) dataset for children.

2.1.1 ABOUT THE 2003 KDHS

The 2003 KDHS was organized by the Central Bureau of Statistics (CBS) in Kenya in collaboration with the Kenyan Ministry of Health and the National Council for Population and Development (NCPD). Technical support was provided by the MEASURE/DHS program in collaboration with the Centers for Disease Control and Prevention (CDC) in USA. Financially, the support was obtained from the Government of Kenya and a coalition of donors including; the United States Agency for International Development (USAID), the United Nations Population Fund (UNFPA), Japan International Cooperation Agency (JICA)/ United Nations Development Program (UNDP), United Nations International Children's Emergency Fund (UNICEF), the British Department for International Development (DFID) and CDC. (CBS, 2004).

In addition to the detailed information obtained on the childhood mortality, the aim of the survey was to obtain other information on fertility, marriage, child and maternal health, maternal mortality as well as awareness and behavior with regard to HIV/AIDS and other STIs, so as to help policy makers and program implementers in monitoring, evaluating and designing programs and strategies for improving population and the health situation.

The 2003 KDHS is considered as a follow-up of the preceding 1989, 1993 and 1998 KDHS surveys. (CBS, 2004)

The following part will summarize the survey methodology as stated by the full report of the 2003 KDHS. (CBS, 2004).

2.1.2 DESIGN OF THE KDHS

The 2003 Kenya Demographic and Health Survey was a nationally representative probability sample survey of almost 10,000 households using a two-stage sampling design. In the first stage 400 clusters (129 urban and 271 rural) were selected from a master frame which was the list of enumeration areas covered in the 1999 population census, while in the second stage households were selected systematically from a list of all households in the clusters. (CBS, 2004).

There was a smaller number of households selected in the North Eastern province because of difficulties in traveling and interviewing in the sparsely populated, largely nomadic areas in that province. There was also over-sampling regarding the selection of urban areas. Because of the heterogeneous sample proportions, the analysis of this study will be based on the sample weights. (CBS, 2004).

2.1.3 SAMPLE SIZE

The women eligible to be interviewed in the survey were all women aged 15-49 years who were either usual residents or visitors present in the selected household on the night

before the survey. The number of the eligible women was 8,717, of those 8,195 were successively interviewed with a response rate of 94% (91.1% in urban and 95.5% in rural areas). The reported total number of births during the five years preceding the survey was 6,102, of these 4,495 were eligible for this study after excluding outcomes of multiple births (354 births) and those born less than one year before the survey (1,253 births). (CBS, 2004).

2.1.4 QUESTIONNAIRE DESIGN

There were three questionnaires used in the survey; the Household, the Woman's and the Men's Questionnaires, they were adapted based on the model developed by the MEASURE DHS+ program (designed by ORC Macro to assist developing countries to collect data on fertility, family planning and maternal and child health.). The CBS modified the questionnaires so as to enable reflecting the relevant population and health issues in Kenya. The questionnaires were translated from English into twelve (12) local languages including Kiswahili. The questionnaires were then refined after the pretest and the field training of the staff. (CBS, 2004).

2.1.5 FIELD WORK

The data collection was carried out over a five-month period, from April to September 2003 by seventeen (17) interviewing teams, each team consisted of one supervisor, one field editor, four female interviewers, one male interviewer, one health worker and one driver. There were five senior field supervisors. A total of 146 field personnel were selected depending upon their education level and their experience in such kind of

surveys. They were trained for three weeks by team officers from CBS, NCPD as well as ORC Macro International. The training started by the standard DHS training procedures though plenary sessions on special topics, and then all participants were trained on interviewing techniques and the contents of the KDHS questionnaires, and finally practical interviews training was done by visiting some households. (CBS, 2004).

2.1.6 DATA PROCESSING

The completed questionnaires were returned periodically from the field to be processed at the CBS offices in Nairobi. The processing (editing and entering data) began shortly after the field work started and done by specially-trained data processing personnel. The data were entered twice to obtain 100% verification using CSPro program. The concurrent data processing enabled advising the field workers of the detected errors. The data entry and editing phase was finished in October 2003. (CBS, 2004).

2.1.7 QUALITY CONTROL

The data quality was improved and ensured by: the refine selection and extensive training of the field workers, the pretest of the questionnaire, and the double entry of the data to ensure 100% verification as well as the concurrent data entry which enabled advising the field teams about the detected errors. (CBS, 2004).

2.2 STUDY POPULATION

Kenyan infants who were:

- Born between exactly one and five years preceding the 2003 KDHS.

- Were the outcomes of singleton deliveries.
- Their Mothers were in the reproductive ages (15-49) and had been interviewed during the KDHS 2003.
- Either survived the infancy period or did not.

2.3. KEY WORDS

- *Socioeconomic status* – in this study will be defined as the characteristics of economic, social and physical environments in which individuals live and work, as well as demographic and genetic characteristics. (Manitoba, 2006)
- *Infant mortality Rate* (IMR) - defined by the United Nations International Children's Emergency Fund UNICEF as "the probability of dying between birth and exactly one year of age expressed per 1,000 live births". (UNICEF, 2006).
- *Postneonatal mortality* (PNMR) – defined as "the probability of dying between one month age and exactly one year of age expressed per 1, 000 live births".

2.4. EXPLANATORY VARIABLES

This study uses variables available in the KDHS 2003 data, these variables include socioeconomic, demographic and health outcome predictor (biological) variables. The socioeconomic variables used in the study include maternal highest educational level, mother's occupation, type of place of residence (urban / rural) and wealth index (quintile). The demographic variables used are age of the mother at birth, age of the mother at first birth, sex of the child, province of residence, ethnicity and religion. While the health outcome predicting variables include birth order, birth size, breast feeding,

previous birth interval and place of delivery. Table 2.1 is showing definition and dummies used for these factors in the analysis.

Table 2.1: Variables of interest and their definition.

No.	Variable	Definition
Socioeconomic Variables		
1.	Maternal highest educational level	None (0), Primary (1), Secondary (2), Higher (3)
2.	Mother's occupation	Not working (0), Agriculture (1), Sales (2), Other (3)
3.	* Wealth index (quintile)	Poorest (1), Poorer (2), Middle (3), Richer (4), Richest (5)
4.	Type of place of residence	Urban (1), Rural (2)
Demographic Variables		
5.	Age at birth	Age of the mother at time of child birth
6.	Age at first birth	Age of the mother at her first birth
7.	Sex of the child	Male (1), Female (2)
8.	Province of residence	Nairobi (1), Central (2), Coast (3), Eastern (4), Nyanza (5), Rift Valley (6), Western (7), Northern Eastern (8)
9.	Ethnicity.	Kalenjin (1), Kamba (2), Kikuyu (3), Luhya (4), Luo (5), Somali (6), Other (7)
10.	Religion	Roman Christian (1), Other Christian (2), Muslim (3), Other (4)
Health outcome predictor variables		
11.	Birth order	The Birth order number of the child in the family
12.	Birth size	Average (1), Large/ very large (2), small/ very small (3)
13.	Breast feeding	Never (0), Ever (1)
14.	Previous birth interval	Time space in months between this and preceding child birth
15.	Place of delivery	Home (1), Public Health Sector (2), Private Health Sector (3)

* The wealth index is a method developed by the ORC Macro and the World Bank to measure the socioeconomic level for a household in a ranked order. It uses principal-component analysis on the basis of respondents' household assets, amenities, and services. Accordingly, the population is divided into five categories from the poorest fifth

to the richest fifth. (DHS+, 2002). In the 2003 KDHS, this variable covered information on ownership of many ownerships ranging from a television to a bicycle or a car, as well as dwelling characteristics like source of water, sanitation facilities and type of material used in flooring. (CBS, 2004). In low-income countries, because of the difficulty in measuring the income of the households, the wealth index is believed to be a good proxy for measuring the economic status of households. (Mutunga, 2004)

2.3.3 OUTCOME VARIABLE

The outcome variable used in the study was the log odds of dying in two particular age ranges of childhood. The age ranges used are infant (first year of life) and postneonatal (one month to one year). Children who died within the age interval were compared to those who survived the same period.

2.4 HYPOTHESES

In order to meet the study objects the following hypotheses are proposed:

1- The woman's highest educational level is the most important determinant for infant mortality in Kenya.

2- There is no difference between the socioeconomic determinants of infant mortality and those for postneonatal mortality in Kenya.

3- There is no difference in the infant and postneonatal mortality predictors between rural and urban areas.

2.5 SCOPE AND LIMITATIONS

- The reliability of the DHS data depends on the completeness with which births and deaths are reported.
- The sensitivity of the principal-component analysis might be different between urban and rural areas. That is, family income might be a more sensitive indicator in urban areas than in rural areas and vice versa. This is because of the availability of more payable jobs and the higher living standards in urban areas.
- Both the information on the explanatory and the outcome variables are collected at the same time, so it is unlikely to get the exact temporal association.
- The analysis will be restricted to the variables available in the dataset. Especially there is no available information on cause of death, HIV status and health service accessibility.
- Confounders, like health service utilization in terms of antenatal care and vaccination, the education, occupation and availability of the husband / father are not included in the analysis because of the high proportion of the missing values.
- Reporting bias especially on providing information on the size of the child at birth, age at death in months and respondent age. Furthermore, using size at birth as a proxy for birth weight may raise validity issues for the measure.

2.6 PLANS FOR UTILIZATION AND DISSEMINATION OF RESULTS

The study –after approval- will be presented for publishing to a specialized demographic or health related journal. Also there are plans to advice the relevant bodies in health policy makers about the results.

2.7 ETHICAL CONSIDERATIONS

This is a secondary data analysis. The data was collected by the Kenyan Central Bureau of Statistics (CBS) in 2003 through National Demographic and Health Surveys (DHS). Before the interview, an informed consent was taken from the respondent by trained interviewer.

The protocol was reviewed by the University of the Witwatersrand Ethical Committee and ethical clearance was then obtained.

2.8 DATA MANAGEMENT

The 2003 KDHS dataset was downloaded from Macro International Inc. website after getting the permission for downloading and using it. The rectangular format of the children data subset was then selected and opened by the software; Statistical Package for Social Scientists (SPSS) for windows (version 12.0) because it was the only available program for opening the data.

A total of 25 variables were selected from the dataset, including variables mentioned in sections 2.3.2 and 2.3.3 and other variables necessary for creating them or variables

necessary for the multivariate analysis. The number of observation at this level was 5,945 representing the number of live births born for the interviewed mothers in the period of five years preceding the date of the survey.

One hundred and ninety seven (197) live births were excluded because they were outcomes of non-singleton births, leaving behind 5,748 singleton live births. To allow at least one year of exposure for all the children, children born less than one year before the survey were excluded, they account for 1253 live births. This kind of exclusion was identified in the study on the association between infant mortality and mother's education in Nigeria. (Adetunji, 1995). Thus, at the end, the study used information for those who were born exactly one to five years preceding the survey who account for 4495 live births with 358 deaths before the first birthday giving IMR of 79.6 per 1000 live births. There were some incompleteness in the observations for some variables; this is mainly due to the response of "I do not know" or missing data. The completeness of those variables in percentages was; size at birth (99.3%), breastfeeding (99.1%) and place of delivery (98.8%).

2.9 DATA ANALYSIS

The dataset format was converted from SPSS into Intercooled Stata Release 9.0 before starting the analysis.

Some continuous variables were categorized before starting the analysis to ease the analysis and the interpretation of the final results. These include: age of mother at birth

was categorized into three age groups less than 20, 20 to less than 35 and 35 and more; age of mother at first birth was categorized into two groups less than 19 and 19 or more; duration of breast feeding was categorized into ever and never; the birth order was categorized into three groups first order, 2-4 and 5^{th} or more; the preceding birth interval was grouped into two groups: less than two years and two years or more. Because those whose first birth order do not have a preceding birth interval, preceding birth interval and birth order were combined in one variable of five categories: first order, 2-4 birth order with less than 2 years of preceding spacing, 2-4 birth order with 2 years or more of preceding spacing, 5^{th} or more birth order with less than 2 years of preceding spacing and 5^{th} or more birth order with two years or more of preceding spacing. The categorization method of birth spacing variables was brought from the study on the determinants of infant and child mortality in Tanzania. (Mturi and Curtis, 1995).

Some categorized variables were further edited by combining some of their groups in one or two groups either because of the small number observations in those categories or to make the analysis and the interpretation more meaningful. These variables include: mother's occupation, where occupations like professional, technical, managerial, clerical, services, domestic and manuals were all combined with sales occupation in one group because of the small number of observations in those occupational categories; ethnicity, where small ethnic groups (less than 500 observations) like: Embu, Kisii, Kuria, Mijikenda/Swahili, Taita/Tavate and Turkana were all combined with Others in one group; religion of the mother, where those with no religion are combined with those whose religion is other than Christianity and Islam; size at birth; where those being

considered as larger or very large than average were combined in one group and the same for those considered as smaller or very small compared to average birth size.

There were three levels of analysis. The first was the descriptive analysis to examine the distribution of the respondents in terms of the explanatory variables used in the study. This was achieved by conducting distribution table and calculating the frequency and proportion of live births in each category within the selected explanatory variables. The second was the bivariate analysis to examine the relationship between the selected socioeconomic, demographic and other health outcome-determining explanatory factors and the survival status at the first birth date. This was done through the calculation of the crude odd ratios using the bivariate logistic regression which adopts one of the categories in each variable as a reference group and then compares to it the other categories. At the third level, spontaneous selection of the variables found to be significantly associated with infant mortality was done using the backward stepwise technique through the fitting of multivariate logistic regression model.

The multivariate analysis was done separately for those living in urban areas and those residing in rural areas. This is because of the over-sampled urban areas in the 2003 KDHS. (CBS, 2004). The use of weighted sampling in the multivariate regression will hamper the automated stepwise selection method, since the STATA is deficient in achieving the technique in the presence of weighted option. Furthermore, disaggregated analysis for urban/rural was recommended by some researchers, because it is better

informative; that it will provide separate determinants of infant and postneonatal mortality at both urban and rural areas, instead of one national summary. (Wang, 2003).

To see the effect of excluding those who died in their fist month of age (neonates), another multivariate logistic regression model was fitted to select variables that have a significant association with post-neonatal mortality. The backward stepwise selection technique was used also in this analysis. At the end of fitting each model, the Wald's test was used to test the overall significance of the variables selected by the model. The p-value produced by the test was the measure used to rank-order the explanatory factors in term of their importance in determining the outcome, since the overall P-value for a factor is a measure for the relative need of that variable in explaining the variability in the outcome.

The main statistical model for this analysis is the logistic regression model. The model allows the estimation of the occurrence probability of an outcome due to the effect of several explanatory factors. This technique enables adjusting for many explanatory factors and controlling for many confounders at the same time as well as it enables easy detection of interactions between explanatory factors. The logistic regression is identified to be flexible, easy to use and usually gives meaningful interpretation by giving the magnitude and the direction of the association between explanatory and outcome variables.

In this analysis; the outcome variable, infant mortality, is coded as one if the child died before his/her birth date (infancy period) and zero if survived the same period. The

statistical packages used the following Generalized Linear Model (GLM) for the logistic regression:

$$\text{Log odds of outcome} = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_p x_p \ldots..(1)$$

$$\text{Log odds of outcome} = \text{Log}\,[p/(1-p)] \ldots..(2)$$

Where β_0 is the intercept term (constant), $x_1 \ldots x_p$ represent the given explanatory variables, while $\beta_1 \ldots \beta_p$ represent their related regression coefficients. In the second equation p is the probability of deaths in the first year of life. (Kirkwood & Sterne, 2005).

CHAPTER 3

RESULTS

3.1 CHARACTERISTICS OF RESPONDENTS

The main objective in the study was to examine the distribution and relationship between the selected socioeconomic factors and infant mortality in Kenya. Out of 4 495 single live births that took place between exactly one and five years before the survey, there were 358 deaths before the first birth date giving IMR of 79.6 per 1000 live birth. The IMR of the study sample is higher than the IMR of 77 per 1000 live births reported by the 2003 KDHS, which implies the live births took place in the five years preceding the survey and whether the birth tone was single or not. This can suggest a lower IMR for the year 2003.

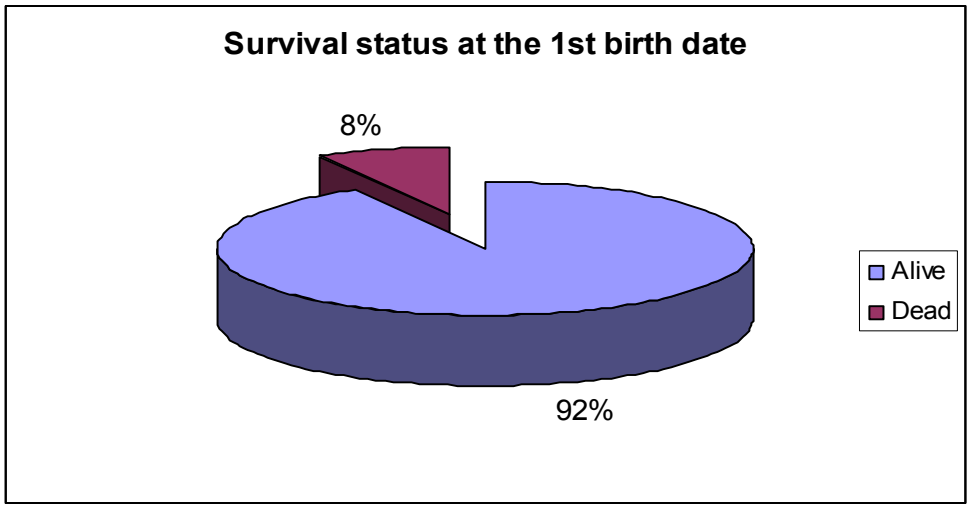

Fig. 3.1 Survival status of the 4 495 live births at the first birth date

Table 3.1 below shows the distribution of the 4 495 respondents by some of their socioeconomic, demographic as well as health outcome determining factors. The results are disaggregated by urban / rural residence.

Table 3.1: Percentage distribution of live births by some of the selected explanatory factors disaggregated by urban /rural residency (KDHS, 2003)

No.	Variable	Category	Urban		Rural	
			Frequency	(%)	Frequency	(%)
1.	**Mother's highest educational level**	No Education	166	14.5	745	22.2
		Primary	552	48.2	2064	61.6
		Secondary and Higher	427	37.3	541	16.2
		Total	**1145**	**100**	**3350**	**100**
2.	**Mother's occupation**	Not working	459	40.1	1166	34.8
		Agriculture	124	10.8	1487	44.4
		Sales and Other	562	49.1	697	20.8
		Total	**1145**	**100**	**3350**	**100**
3.	**Wealth index**	Richest	836	73.0	156	4.7
		Richer	139	12.1	562	16.8
		Middle	68	5.9	751	22.4
		Poorer	44	3.9	808	24.1
		Poorest	58	5.1	1073	32.0
		Total	**1145**	**100**	**3350**	**100**
4.	**Religion**	Roman Christian	218	19.0	712	21.2
		Other Christian	679	59.3	2021	60.3
		Muslim	223	19.5	491	14.7
		Other	25	2.2	126	3.8
		Total	**1145**	**100**	**3350**	**100**
5	**Place of delivery**	Home	371	32.6	2231	67.6
		Public health sector	452	39.8	721	21.8
		Private health sector	314	27.6	351	10.6
		Total	**1137**	**100**	**3304**	**100**
6.	**Gender of the child**	Male	587	51.3	1717	51.3
		Female	558	48.7	1633	48.7
		Total	**1145**	**100**	**3350**	**100**
7.	**Size at birth**	Average	700	61.7	1944	58.4
		Larger than average / v. large	271	23.9	859	25.8
		Smaller than average / v. small	164	14.4	525	15.8
		Total	**1135**	**100**	**3328**	**100**
8.	**Age of mother at birth**	20- less than 35 years	840	73.4	2339	69.8
		Less than 20 years	231	20.2	569	17.0
		35 years or more	74	6.4	442	13.2
		Total	**1145**	**100**	**3350**	**100**
9.	**Age of mother at 1st birth**	Less than 19 years	455	39.7	1667	49.8
		19 years or more	690	60.3	1683	50.2
		Total	**1145**	**100**	**3350**	**100**
10.	**Birth order and Preceding birth interval**	First Order	415	36.2	742	22.2
		2-4 / 2 years or more	403	35.2	1164	34.7
		2-4 / < 2 years	147	12.9	382	11.4
		5+ / 2 years or more	141	12.3	825	24.6
		5+ / < 2 years	39	3.4	237	7.1
		Total	**1145**	**100**	**3350**	**100**
11.	**Breast feeding**	Ever	1064	94.7	3183	95.9
		Never	71	6.3	137	4.1
		Total	**1135**	**100**	**3320**	**100**

As shown in the table; more women had at least attended the primary school in rural areas (83.8%) compared to urban areas (62.7%). The main occupation among the respondents was sales and other related jobs in urban areas (49.1%) while agricultural related occupations are the main in the rural areas (44.4%). In urban areas 91% of the respondents were regarded as not poorer or poorest, while it is far less in rural areas (43.9%). The main religion among the respondents was Christianity followed by Islam and no big difference in their distribution between respondents from either urban or rural areas.

In rural areas, most of the births took place at home (67.6%), while half of that is the case in urban areas. The number of male and female babies in the study sample is almost the same in both areas. Most of the respondents, in both urban and rural areas, reported that their baby's size at birth was average. The percentage of teenage deliveries is about 20% in both areas, while for those who gave birth at age of 35 and above was almost doubled (13.2%) in rural compared to urban areas. However, almost 40% and 50% of the mothers from urban and rural areas, respectively, reported that they gave their first birth before age of 19 years old. In rural areas, more respondents reported the index child as their fifth order or more with preceding birth interval of less than two years (7.1%) compared to 3.4% in urban areas. In both areas, about 5% of the mothers reported that their child never received breastfeeding.

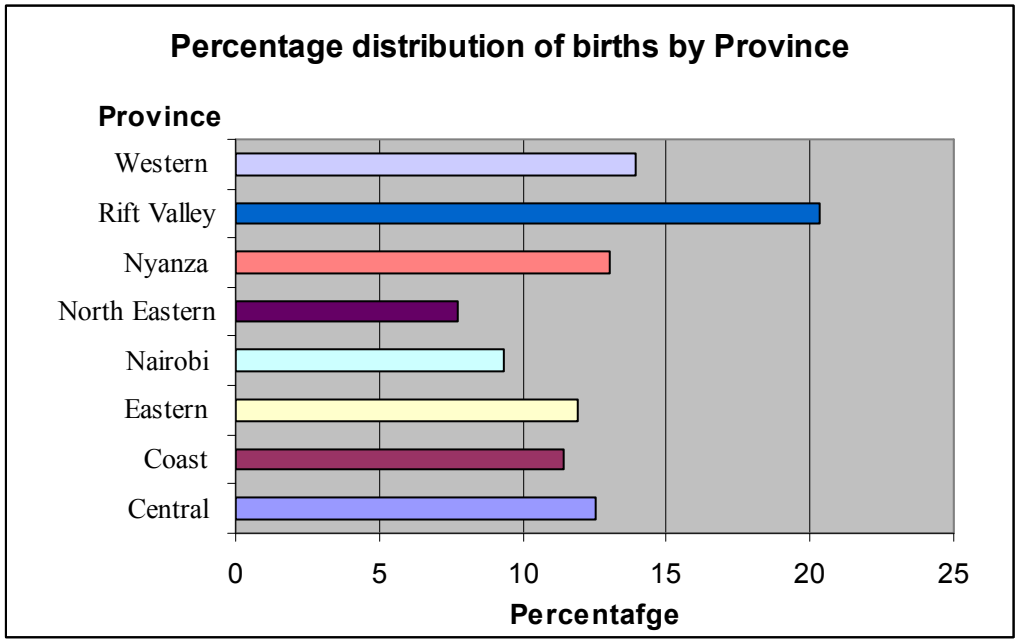

Fig. 3.2 Percentage distribution of births by province of delivery

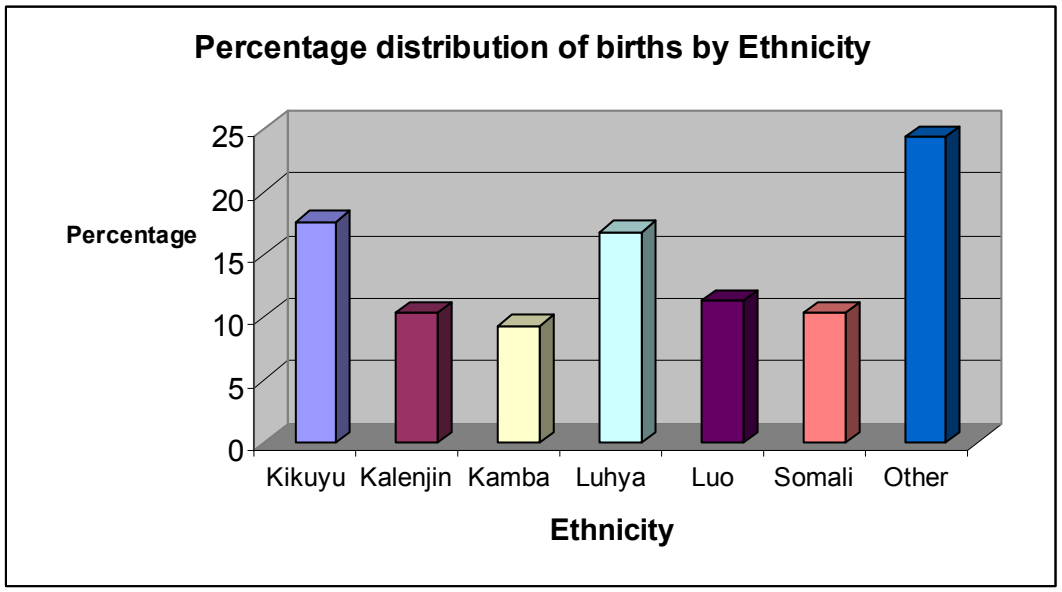

Fig. 3.3 Percentage distribution of births by Ethnicity

Figure 3.2 shows the distribution of respondents by province of residence. 12.55 were from Central province, 11.4% Coast, 11.9% Eastern, 9.3% Nairobi, 7.7% North Eastern,

13% Nyanza, 20.3% Rift Valley and 13.9% were living in Western Province. As shown in figure 3.3, 17.6% of the respondents were from Kikuyu tribe, 10.3% Kalenjin, 9.3% Kamba, 16.8% Luhya, 11.3% Luo, 10.3% Somali and 24.4% were from other tribes.

The table in the appendix shows the percentage distribution of some explanatory factors among the live births by their ethnicity. The result shows co-linearity between province of residence and ethnicity; that is, specific ethnic groups are concentrated in specific provinces, for example the Kikuyu are more in the Central province. The level of urbanization shows the almost complete rural concentration of the Kalenjin (96%), while Luo, Kikuyu and Luhya are – relatively – more in urbanized areas.

Somalia children have the highest level of uneducated mother (91%); the level is the least for Kikuyu mothers (1%), who at the same time the most mothers who have secondary or higher qualifications (35%). Level of poverty (wealth index poorer to poorest) is highest among the Somali and the Kalenjin (68%, 66% respectively), while the Kikuyu are the most wealthy group (86%). Somali have the highest level of nonworking mothers (81%), whilst Kalenjin, Luo and Kikuyu mothers have the lowest level. Somali mothers have the highest level of home deliveries (81%), however, while the level is the lowest for the Kikuyu (30%) who at the same time the most group utilizing private sector for giving birth (20%).

Fifty to sixty eight percent (50-68%) of born children are reported as having average size at birth, however, smaller than average size is reported much more for Somali (19%), and larger than average size is much higher in Luhya (36%). The Luo mothers show the

highest level (67%) of teenage deliveries regarding their first birth, and also for the index child (26%) followed by the Luhya (19%). Somali children are more exposed to being never breastfed (14%). Somali and Luo are the most groups that have birth order of fifth or above (34%. 33% respectively) while Kikuyu have the least one (16%), and Somali mothers have the highest level of births of less than 2 years preceding birth interval (32%) and again Kikuyu have the least one (10%).

3.2 LEVELS AND DIFFERENTIALS

Table 3.2 is showing the levels and differentials of infant and post-neonatal mortality by some socioeconomic and demographic factors. Nyanza province has the highest level of IMR and PNMR, while Central province has the least one. Again, Luo children are expressing the highest IMR and PNMR, while it is the least in the Kikuyu group. Urban and rural areas are showing almost the same level of both IMR and PNMR.

While mothers with no education are showing the highest level of IMR among their children, those with primary education are showing the highest PNMR. People classified as poorest show the highest level of IMR, while, interestingly, those in the middle class have the highest PNMR. Males have higher IMR and PNMR compared to females.

Table 3.2: Levels and differentials of Infant and Postneonatal mortality rate by selected socioeconomic factors (KDHS, 2003)

No.	Variable	Category	IMR (per 1000)	PNMR (per 1000)
1.	**Province**	Central	40.9	18.2
		Nairobi	71.6	44.3
		Coast	72.1	30.7
		Eastern	59.9	31.3
		Nyanza	**135.3**	**121.4**
		Rift Valley	63.5	30.7
		Western	102.7	89.6
		Northern Eastern	100.9	52.5
2.	**Ethnicity**	Kikuyu	35.4	16.8
		Kalenjin	75.8	29.6
		Kamba	64.3	37.2
		Luhya	90.1	75.1
		Luo	**169.6**	**155.0**
		Somali	105.6	46.7
		Other	59.3	32.0
3.	**Place of residence**	Urban	79.5	48.2
		Rural	79.7	53.4
4.	**Highest educational level**	No Education	**90.0**	48.8
		Primary	86.8	**61.6**
		Secondary and Higher	50.6	29.6
5.	**Respondent's occupation**	Not working	81.2	44.6
		Agriculture	75.7	55.7
		Sales and Other	**82.6**	**56.9**
6.	**Wealth index**	Richest	76.6	45.0
		Richer	61.3	38.3
		Middle	80.6	**60.2**
		Poorer	79.8	54.8
		Poorest	**92.8**	58.8
7.	**Gender of the child**	Male	**91.1**	**58.6**
		Female	67.5	45.2
	Total		79.6	52.0

3.3 BIVARIABLE ANALYSIS

To have an idea about the individual effects of the different selected expletory variables on both infant and post-neonatal mortality, logistic regression was plotted separately for each variable and the analyses were disaggregated by urban and rural residency.

In the case of infant mortality in urban areas (Table 3.3), the factors: mother's occupation, wealth index, religion, and place of delivery were all having nonsignificant association with infant mortality. However, children with maternal education level less than secondary, living in provinces other than Central province, ethnic group other than Kikuyu, mother's age at birth more than 35 years old or giving the first birth at the age of less than 19 years old, being a male, less than 2 years birth interval or never breast fed babies were at a significant higher risk for dying before their first birthday.

For respondents from rural areas, there were no significant association between infant mortality and mother's occupation, wealth index, province of residence, religion, age of mother at birth or her first birth, size of the child at birth and place of delivery. Moreover, children with maternal education level less than secondary, being from ethnic group other than Kikuyu, being a male, those of fifth or more birth order with less than 2 years birth interval and never breast fed babies were all at a significant higher risk for not surviving their first year of age.

On the other hand, results for factors associated with post-neonatal mortality (Table 3.4) showed the same trend in urban areas except for the nonsignificance of the mother's highest educational level, mother age at birth, gender and size at birth. While for rural areas, the significant effect of mother's highest educational level and breastfeeding in the previous table had vanished.

Table 3.3: Bivariate analysis by Un-OR for the association between the selected explanatory factors and infant mortality disaggregated by urban/rural residency (KDHS, 2003)

No.	Variable	Category	Urban			Rural		
			OR	95% CI	P-value	OR	95% CI	P-value
1.	**Mother's highest educational level**	No Education	1.00	-	-	1.00	-	-
		Primary	0.80	0.45 – 1.42	0.446	1.00	0.74 – 1.35	0.978
		Secondary & Higher	0.49 *	0.26 – 0.93	0.029	0.52 *	0.32 – 0.83	0.006
2.	**Mother's occupation**	Not working	1.00	-	-	1.00	-	-
		Agriculture	1.00	0.48 – 2.07	0.999	0.92	0.69 – 1.22	0.557
		Sales & Other	0.97	0.61 – 1.53	0.892	1.06	0.76 – 1.49	0.728
3.	**Wealth index**	Richest	1.00	-	-	1.00	-	-
		Richer	0.90	0.45 – 1.80	0.776	0.91	0.44 – 1.89	0.802
		Middle	1.34	0.59 – 3.04	0.486	1.24	0.62 – 2.49	0.536
		Poorer	0.85	0.26 – 2.83	0.796	1.28	0.64 – 2.54	0.486
		Poorest	1.10	0.43 – 2.85	0.843	1.50	0.77 – 2.94	0.237
4.	**Province**	Central	1.00	-	-	1.00	-	-
		Nairobi	1.60	0.55 – 4.66	0.389	#	#	#
		Coast	1.96	0.63 – 6.09	0.246	1.67	0.89 – 3.13	0.113
		Eastern	0.90	0.10 – 8.47	0.928	1.55	0.87 – 2.79	0.140
		Nyanza	3.00	0.94 – 9.56	0.064	3.82 *	2.25 – 6.47	< 0.001
		Rift Valley	1.19	0.34 – 4.20	0.786	1.67	0.97 – 2.86	0.063
		Western	2.18	0.68 – 7.01	0.189	2.80 *	1.63 – 4.82	< 0.001
		North Eastern	2.52	0.75 – 8.54	0.137	2.62 *	1.42 – 4.83	0.002
5.	**Religion**	Roman Christian	1.00	-	-	1.00	-	-
		Other Christian	0.87	0.50 – 1.50	0.615	1.15	0.83 – 1.60	0.395
		Muslim	1.03	0.53 – 1.99	0.925	1.24	0.81 – 1.90	0.312
		Other	#	#	#	0.88	0.41 – 1.90	0.742
6.	**Ethnicity**	Kikuyu	1.00	-	-	1.00	-	-
		Kalenjin	#	#	#	2.37 *	1.34 – 4.20	0.003
		Kamba	1.93	0.67 – 5.58	0.227	1.87	0.99 – 3.53	0.054
		Luhya	2.21	0.97 – 5.04	0.058	2.93 *	1.70 – 5.03	< 0.001
		Luo	3.76 *	1.71 – 8.30	0.001	6.78 *	3.97 – 11.59	< 0.001
		Somali	2.85 *	1.19 – 6.86	0.019	3.38 *	1.90 – 6.00	< 0.001
		Other	2.57 *	1.15 – 5.74	0.021	1.49	0.86 – 2.59	0.153
7.	**Age of mother at birth**	20- less than 35 years	1.00	-	-	1.00	-	-
		Less than 20 years	0.71	0.39 – 1.28	0.257	1.34	0.97- 1.86	0.073
		35 years or more	1.15	0.51 – 2.60	0.738	1.59 *	1.14 – 2.24	0.007
8.	**Age of mother at 1st birth**	Less than 19 years	1.00	-	-	1.00	-	-
		19 years or more	0.83	0.54 – 1.28	0.392	0.71 *	0.55 – 0.91	0.007
9.	**Gender of the child**	Male	1.00	-	-	1.00	-	-
		Female	0.63 *	0.41 – 0.98	0.042	0.75 *	0.59 – 0.97	0.029
10.	**Size at birth**	Average	1.00	-	-	1.00	-	-
		Larger than average	0.96	0.56 – 1.66	0.882	1.35 *	1.01 – 1.82	0.044
		Smaller than average	1.47	0.83 – 2.62	0.190	1.60 *	1.15 – 2.23	0.006
11.	**Birth order and Preceding birth interval**	First Order	1.00	-	-	1.00	-	-
		2-4 / 2 years or more	1.32	0.78 – 2.24	0.295	0.69 *	0.47 – 0.99	0.045
		2-4 / < 2 years	1.16	0.56 – 2.41	0.685	1.61 *	1.07 – 2.43	0.022
		5+ / 2 years or more	1.12	0.59 – 2.52	0.599	0.92	0.64 – 1.35	0.684
		5+ / < 2 years	3.71 *	1.55 – 8.85	0.003	2.32 *	1.50 – 3.59	< 0.001
12.	**Place of delivery**	Home	1.00	-	-	1.00	-	-
		Public health sector	0.86	0.53 – 1.39	0.529	1.05	0.77 – 1.42	0.766
		Private health sector	0.55	0.30 – 1.00	0.051	0.70	0.43 – 1.12	0.138
13.	**Breast feeding**	Ever	1.00	-	-	1.00	-	-
		Never	26.73 *	15.43 – 46.31	< 0.001	39.48 *	26.65 – 58.49	< 0.001

* significant association (P-value <0.05)
\# failed prediction

Table 3.4: Bivariate analysis by Un-OR for the association between the selected explanatory factors and postneonatal mortality disaggregated by urban/rural residency

No.	Variable	Category	Urban			Rural		
			OR	95% CI	P-value	OR	95% CI	P-value
1.	**Mother's highest educational level**	No Education	1.00	-	-	1.00	-	-
		Primary	1.13	0.51 – 2.50	0.771	1.32	0.89 – 1.95	0.162
		Secondary & Higher	0.63	0.26 – 1.53	0.308	0.54	0.29 – 1.01	0.056
2.	**Mother's occupation**	Not working	1.00	-	-	1.00	-	-
		Agriculture	2.09	0.94 – 4.65	0.071	1.17	0.81 – 1.68	0.394
		Sales & Other	1.14	0.61 – 2.11	0.683	1.45	0.96 – 2.20	0.079
3.	**Wealth index**	Richest	1.00	-	-	1.00	-	-
		Richer	1.47	0.69 – 3.11	0.318	0.79	0.30 – 2.03	0.620
		Middle	1.70	0.64 – 4.47	0.285	1.52	0.64 – 3.64	0.346
		Poorer	0.50	0.07 – 3.77	0.505	1.46	0.61 – 3.48	0.397
		Poorest	0.40	0.05 – 2.96	0.368	1.58	0.67 – 3.71	0.296
4.	**Province**	Central	1.00	-	-	1.00	-	-
		Nairobi	3.85	0.51 – 29.24	0.192	#	#	#
		Coast	3.15	0.37 – 26.62	0.292	1.44	0.57 – 3.68	0.442
		Eastern	3.61	0.22 – 59.94	0.371	1.61	0.70 – 3.71	0.266
		Nyanza	7.55	0.92 – 61.64	0.059	7.52 *	3.69 – 15.36	< 0.001
		Rift Valley	4.08	0.48 – 34.53	0.197	1.46	0.66 – 3.21	0.351
		Western	6.67	0.83 – 53.67	0.075	5.22 *	2.52 – 10.80	< 0.001
		North Eastern	4.55	0.50 – 41.61	0.180	2.81 *	1.19 – 6.68	0.019
5.	**Religion**	Roman Christian	1.00	-	-	1.00	-	-
		Other Christian	0.64	0.33 – 1.24	0.186	1.47	0.97 – 2.22	0.070
		Muslim	0.78	0.34 – 1.76	0.545	0.97	0.54 – 1.75	0.910
		Other	#	#	#	0.76	0.26 – 2.21	0.617
6.	**Ethnicity**	Kikuyu	1.00	-	-	1.00	-	-
		Kalenjin	#	#	#	1.86	0.79 – 4.40	0.156
		Kamba	2.88	0.70 – 11.77	0.141	2.10	0.86 – 5.13	0.103
		Luhya	3.36 *	1.07 – 10.56	0.039	5.39 *	2.60 – 11.18	< 0.001
		Luo	6.71 *	2.24 – 20.09	0.001	13.52 *	6.58 – 27.79	< 0.001
		Somali	3.00	0.83 – 10.84	0.094	2.82 *	1.21 – 4.02	0.017
		Other	2.20	0.65 – 7.39	0.204	1.87	0.87 – 4.02	0.109
7.	**Age of mother at birth**	20- less than 35 years	1.00	-	-	1.00	-	-
		Less than 20 years	0.59	0.26 – 1.32	0.199	1.44	0.98 – 2.12	0.061
		35 years or more	1.10	0.38 – 1.17	0.856	1.33	0.86 – 2.07	0.201
8.	**Age of mother at 1st birth**	Less than 19 years	1.00	-	-	1.00	-	-
		19 years or more	1.00	0.57 – 1.75	0.991	0.57 *	0.41 – 0.78	< 0.001
9.	**Gender of the child**	Male	1.00	-	-	1.00	-	-
		Female	0.52 *	0.29 – 0.93	0.028	0.85	0.63 – 1.16	0.306
10.	**Size at birth**	Average	1.00	-	-	1.00	-	-
		Larger than average	0.93	0.47 – 1.83	0.837	1.23	0.86 – 1.76	0.256
		Smaller than average	0.80	0.33 – 1.93	0.613	1.22	0.79 – 1.88	0.364
11.	**Birth order and Preceding birth interval**	First Order	1.00	-	-	1.00	-	-
		2-4 / 2 years or more	2.13 *	1.05 – 4.31	0.037	0.80	0.51 – 1.27	0.342
		2-4 / < 2 years	1.66	0.64 – 4.30	0.297	1.74 *	1.04 – 2.91	0.034
		5+ / 2 years or more	1.49	0.55 – 4.05	0.436	1.08	0.68 – 1.72	0.747
		5+ / < 2 years	4.30 *	1.31 – 14.15	0.016	2.42 *	1.40 – 4.18	0.001
12.	**Place of delivery**	Home	1.00	-	-	1.00	-	-
		Public health sector	0.70	0.37 – 1.32	0.268	0.91	0.62 – 1.34	0.623
		Private health sector	0.51	0.24 – 1.10	0.088	0.73	0.41 – 1.28	0.272
13.	**Breast feeding**	Ever	1.00	-	-	1.00	-	-
		Never	1.33	0.31 – 5.71	0.704	3.43 *	1.59 – 7.14	0.002

* significant association (P-value <0.05)
\# failed prediction

3.4 MULTIVARIATE ANALYSIS

Tables 3.5 to 3.8 below present the four different models fitted for infant and postneonatal mortality in rural and urban areas separately. The results show the adjusted odds ratios, 95% confidence interval and associated p-values of the critical predictors of infant and postneonatal mortality in this study. The overall p-value for each predictor as measured by the Wald's test is also presented.

Table 3.5: Results of multivariate analysis for factors associated with infant mortality in the urban areas (Model 1.)

No.	Variable	Adj. Odds Ratio	95% CI	P-value	Wald's test (p-value)
1.	**Breast feeding**				**(>0.0001)**
	Ever	1.00	-	-	
	Never *	34.46	18.47 – 64.28	< 0.001	
2.	**Ethnicity**				**(0.0135)**
	Kikuyu	1.00	-	-	
	Kalenjin	--	--	--	
	Kamba	2.42	0.74 – 7.90	0.143	
	Luhya *	2.62	1.04 – 6.61	0.041	
	Luo *	4.66	1.90 – 11.46	0.001	
	Somali	1.25	0.45 – 3.49	0.669	
	Others*	2.52	1.01 – 6.26	0.047	
3.	**Gender of the child**				**(0.0406)**
	Male	1.00	-	-	
	Female *	0.59	0.35 – 0.98	0.041	

* significant association (P-value <0.05)

Table 3.5 showed the first model which was fitted to select the significant determinants of infant mortality in urban areas. Out of all explanatory factors investigated, breast feeding, ethnicity and gender of the infant were the only significant predictors in urban areas. That is infant deaths were more likely [AOR=34.46, CI= 18.47 – 64.28] among never breastfed relative to ever breastfed children. Risk of infant mortality is the highest [AOR=4.7, CI= 1.9-11.5] among Luo ethnic group compared to the Kikuyu, which, also

have a lower infant death likelihood compared to the Luhya and the (Other) ethnic group. Deaths before the first birth date is lower [AOR=0.59, CI=0.35 – 0.95].

Table 3.6: Results of multivariate analysis for factors associated with infant mortality in the rural areas (Model 2.)

No.	Variable	Adj. OR.	95% CI	P-value	Wald's test (p-value)
1.	**Breast feeding**				**(<0.0001)**
	Ever	1.00	-	-	
	Never *	469.97	53.92 – 4096.05	<0.001	
2.	**Ethnicity**				**(<0.0001)**
	Kikuyu	1.00	-	-	
	Kalenjin	1.60	0.69 – 3.71	0.268	
	Kamba	1.94	0.83 – 4.57	0.127	
	Luhya *	4.43	2.19 – 8.96	< 0.001	
	Luo *	10.77	5.37 – 21.61	< 0.001	
	Somali	2.26	0.97 – 5.27	0.059	
	Other	1.38	0.65 – 2.95	0.401	
3.	**Birth order & Preceding birth interval**				**(0.0063)**
	First Order	1.00	-	-	
	2-4 / 2 years or more	0.95	0.62 – 1.47	0.816	
	2-4 / < 2 years *	1.71	1.04 – 3.41	0.014	
	5+ / 2 years or more	0.95	0.61 – 1.49	0.825	
	5+ / < 2 years *	1.98	1.15 – 3.41	0.014	
4.	**Ethnicity * Breast feeding**				**(0.0005)**
	Ever, Kikuyu	1.00	-	-	
	Never, Kikuyu	1.00	-	-	
	Ever, Kalenjin	1.00	-	-	
	Never, Kalenjin	0.48	0.04 – 6.04	0.566	
	Ever, Kamba	1.00	-	-	
	Never, Kamba	0.42	0.20 – 8.94	0.578	
	Ever, Luhya	1.00	-	-	
	Never, Luhya	0.02	0.00– 0.27	0.002	
	Ever, Luo	1.00	-	-	
	Never, Luo	#	#	#	
	Ever, Somali	1.00	-	-	
	Never, Somali	0.05	0.00 – 0.48	0.010	
	Ever, Other	1.00	-	-	
	Never, Other	0.12	0.01 – 1.41	0.095	

* significant association (P-value <0.05)
\# failed prediction
There is an interaction between ethnicity and Breast feeding

As shown in Table 3.6 for the determinants of infant mortality in the rural areas; breast feeding and ethnicity have the same significance in determining the outcome of interest. However, instead of gender of the child in the first model, fertility variable (birth order

and preceding birth interval) show the third factor in the ladder of importance. The effect of breast feeding on infant mortality shows the same pattern as in the urban model, and even more in magnitude. Likelihood of infant deaths is still the highest [AOR=10.77, CI= 5.37 – 21.61] for Luo as well [AOR=4.43, CI=2.19 – 8.96] for the Luhya ethnic groups compared to the kikuyu infants. Other ethnic groups show no significant difference from the Kikuyu.

Dying before one year of age has no statistical significant difference between first order birth and those born after space of two years and more. However, the likelihood is higher [AOR=1.71, CI=1.04 – 3.41] for those who were born after less than two years of spacing and their birth order was second to fourth compared to first order births, the association is even more higher [AOR=1.98, CI=1.15 – 3.41] for those who were born after the fourth birth. The model shows significant interaction between ethnicity and breastfeeding variables, which means that the relationship between breastfeeding and mortality is affected by the level of a third factor which is ethnicity (effect modifier), that is in each tribe, the magnitude of the effect of breast feeding on the infant survival is different from it in another tribe. Thus, we can not generalize the effect of breast feeding on mortality without specifying the tribe we are dealing with. The model concluded that breast feeding and ethnicity are the most important determinants of the outcome followed by the fertility variable.

Model number three (Table 3.7) shows determinants of postneonatal mortality in urban Kenya. Ethnicity is most important determinant of the outcome in these areas.

Postneonatal deaths is more likely for the Luo [AOR=8.33, CI= 2.73 – 25.39], Luhya [AOR=3.19, CI=1.01 – 10.11] and Somalia [AOR=3.97, CI=1.05 – 14.95] compared to Kikuyu infants. Deaths before the first birth date (excluding neonatal) is less by 54% [CI=17 – 75%] in the females live births compared to males. The death outcome is more [AOR=3.09. CI=1.29 – 7.42] for those whose mothers work in agriculture compared to those whose mothers are not working. There is no significant difference between other jobs and not working in postneonatal mortality differentials.

Table 3.7: Results of multivariate analysis for factors associated with post-neonatal mortality in the urban areas (Model 3.)

No.	Variable	Adj. Odds Ratio	95% CI	P-value	Wald's test (p-value)
1.	**Ethnicity**				**(0.0027)**
	Kikuyu	1.00	-	-	
	Kalenjin	--	--	--	
	Kamba	3.43	0.83 – 14.23	0.090	
	Luhya *	3.19	1.01 – 10.11	0.049	
	Luo *	8.33	2.73 – 25.39	<0.001	
	Somali *	3.97	1.05 – 14.95	0.042	
	Other	2.49	0.73 – 8.45	0.145	
2.	**Gender of the child**				**(0.0106)**
	Male	1.00	-	-	
	Female *	0.46	0.25 – 0.83	0.011	
3.	**Respondent's occupation**				**(0.0395)**
	Not working	1.00	-	-	
	Agriculture *	3.09	1.29 – 7.42	0.012	
	Sales & Other	1.35	0.71 – 2.58	0.361	

* significant association (P-value <0.05)

As shown in Table 3.8, predictors of postneonatal deaths in rural areas were leaded by ethnicity followed by breast feeding, fertility factors and mother's educational level, respectively. Deaths in this period is, consistently, higher for the Luo [AOR=11.70, CI=5.64 – 24.25] and Luhya [AOR=4.57, CI=2.19 – 9.54] compared to the Kikuyu which has no statistically significant differences from all other ethnic groups. Never breastfed

were 3.83 [CI=1.67 – 8.75] more likely to die in the postneonatal period compared to ever breastfed. Being born after the fourth birth and at the same time less than 2 years of interval from the preceding birth is more [AOR=1.83, CI=1.02 – 3.31] likely to die in this period compared to first order born children. Although being born after two years whatever the birth order shows less likelihood of dying compared to first order, but the results are not statistically significant.

Babies for mothers who had secondary or higher level of education are 58% [CI=10 – 80%] less likely to die in this period compared to those born to non educated women, while there is no statistical significant difference between primary and non-education. There is significant interaction between ethnicity and educational level factors, which means that the relationship between educational level and mortality is affected by the level of a third factor (effect modifier) which is ethnicity. That is, for each tribe the magnitude of the effect of the highest level of maternal education on postneonatal mortality is completely different from the other tribes. Thus, we can not generalize the effect of maternal education on mortality without specifying the tribe we are dealing with. The interaction has been adjusted for by including the interaction term in the logistic regression model.

Table 3.8: Results of multivariate analysis for factors associated with post-neonatal mortality in the rural areas (Model 4.)

No.	Variable	Adj. Odds Ratio	95% CI	P-value	Wald's test (p-value)
1.	**Ethnicity**				**(< 0.0001)**
	Kikuyu	1.00	-	-	
	Kalenjin	1.67	0.70 – 3.96	0.245	
	Kamba	1.83	0.74 – 4.49	0.188	
	Luhya *	4.57	2.19 – 9.54	< 0.001	
	Luo *	11.70	5.64 – 24.25	< 0.001	
	Somali	1.56	0.56 – 4.34	0.396	
	Other	1.45	0.65 – 3.24	0.366	
2.	**Breast feeding**				**(0.0015)**
	Ever	1.00	-	-	
	Never *	3.83	1.67 – 8.75	0.001	
3.	**Birth order & Preceding birth interval**				**(0.0125)**
	First Order	1.00	-	-	
	2-4 / 2 years or more	0.84	0.53 – 1.35	0.482	
	2-4 / < 2 years	1.56	0.92 – 2.67	0.100	
	5+ / 2 years or more	0.86	0.53 – 1.41	0.560	
	5+ / < 2 years *	1.83	1.02 – 3.31	0.044	
4.	**Highest educational level**				**(0.0262)**
	No Education	1.00	-	-	
	Primary	0.91	0.53 – 1.58	0.745	
	Secondary & Higher *	0.42	0.20 – 0.90	0.025	
5.	**Ethnicity*Education (**Interaction term**)**				**(< 0.0001)**
	Kikuyu, No Education	1.00	-	-	
	Kikuyu, Primary	1.00	-	-	
	Kikuyu, Secondary & Higher	1.00	-	-	
	Kalenjin, No Education	1.00	-	-	
	Kalenjin, Primary	3.75^{e-07}	#	#	
	Kalenjin, Secondary & Higher	#	#	#	
	Kamba, No Education	1.00	-	-	
	Kamba, Primary *	$1.05e^{-07}$	$5.24e^{-09}$ – $2.11e^{-06}$	< 0.001	
	Kamba, Secondary & Higher	0.71	#	#	
	Luhya, No Education	1.00	-	-	
	Luhya, Primary *	$1.28e^{-07}$	$1.33e^{-08}$ – $1.23e^{-06}$	< 0.001	
	Luhya, Secondary & Higher	0.29	0.02 – 4.72	0.386	
	Luo, No Education	1.00	-	-	
	Luo, Primary *	$3.64e^{-07}$	$2.70e^{-08}$ – $4.91e^{-06}$	< 0.001	
	Luo, Secondary & Higher	0.60	0.03 – 13.3	0.744	
	Somali, No Education	1.00	-	-	
	Somali, Primary	#	#	#	
	Somali, Secondary & Higher	#	#	#	
	Other, No Education	1.00	-	-	
	Other, Primary *	$3.43e^{-07}$	$3.60e^{-08}$ – $3.27e^{-06}$	< 0.001	
	Other, Secondary & Higher	1.27	0.07 – 21.8	0.867	

* significant association (P-value <0.05)
\# failed prediction
There is an interaction between Ethnicity and education

CHAPTER 4

DISCUSSION

The main objective of this study was to examine the distribution and relationships between the selected socioeconomic factors and infant mortality in Kenya. Specifically, the study intended to identify the socioeconomic determinants of infant mortality as well to quantify their impact with a view to rank-ordering them. The study used series of logistic regression models to identify these factors for two different settings; urban and rural. Then, the analysis had been expanded further by conducting another logistic regression models for identifying determinants of postneonatal deaths (infant excluding neonatal deaths) to get the factors that determine the infant mortality once the child has survived the first month of age.

4.1 LEVELS AND DIFFERENTIALS

There was a very wide variation in the level of IMR and PNMR between the different provinces in Kenya. That is, the IMR for Nyanza province was almost the triple of that for Central province. This can be due to socioeconomic inequality between these provinces; that is, for example, the availability or the utilization of health care facilities and social services in these provinces which might be also influenced by the economic position and people's attitude in these areas. Another explanation might be the very high prevalence of HIV in Nyanza province. (See appendix 1.). Such variability between provinces in terms of level of IMR was reported by a study conducted in Iran. (Hosseinpoor, 2005).

The same phenomenon could be observed for the levels of IMR and PNMR regarding the different ethnic groups. That is, whilst the Kikuyu had the least IMR and PNMR, the Luo group had the highest levels for the same inferences. Both results were consistent with the concentration of these groups (Kikuyu and Luo) in certain provinces (Central and Nyanza province, respectively). Interestingly, there was no difference in the levels of IMR between rural and urban areas, but the urban PNMR level was lower than that for the rural areas. This needs more research to figure out the missed link.

While the women with no education had the highest IMR level, the women with primary school qualifications showed the highest PNMR level. This can be due to the outgoing of women with primary qualifications for work after the expiry of their maternal leave, and thus decrease their time for caring of their children. This was not the case for women with secondary education, either due to their relatively high income jobs or due to that they used to have less manual exhausting jobs. Thus, the results combined the contradicting results of both Desai (1998) and Adetunji (1995). Furthermore, there was no big difference in the levels of IMR between working and nonworking women, however, nonworking women had lower PNMR compared to working women, and this again supports that maternal leave assumption.

The results showed vague socioeconomic differentials of IMR and PNMR that while poorest people had the highest IMR; richest people had higher IMR level than richer people. Again, for the PNMR levels, middle class people had the highest one. This is difficult to explain and need more detailed examination about the data collection and the wealth index as a valid tool for measuring socioeconomic status. However, a study in

Malawi (Doctor, 2004) suggested the excess child mortality in rich households might be attributed to the high AIDS related mortality in these households. Regarding the mortality differentials by gender, the males had 50% higher IMR compared to females. Then, the difference decreased to 25% higher compared to females in the case of PNMR. This is consistent with many studies that have reported the decrease of the females' advantage while ascending in the child age. (Bhuiyat, 1991)

4.2 PREDICTORS OF INFANT MORTALITY

Regarding the relationship between socioeconomic factors and infant mortality; the results from bivariate analysis showed that apart from maternal education, all other selected socioeconomic factors (mother's occupation, and wealth index) had no significant relationship with infant mortality at both urban and rural levels. The results have implied very high p-value, thus, excluding even the presence of weak association. The effect of maternal education brought out the no significant difference between primary education and no education regarding their impact on infant deaths, secondary school education had decreased the probability of dying before the first year of life significantly by 51%, 41% in urban and rural areas, respectively, compared to mothers with no education. This inverse relationship is consistent with many studies (Desai, 1998 and Devlieger, 2005).

However, adjusting for all explanatory factors in the multivariate analysis (Tables 3.5 and 3.6) showed lack of socioeconomic differentials for infant mortality both in urban and rural areas. The determinants of death at this age seemed to be explained by other

biodemographic factors. This lack of association, even for maternal education, had been seen in one study conducted in Tanzania in 1995. Mturi and Curtis had found that socioeconomic factors like: maternal education, partner's education, urban/rural residence and presence of radio (as a marker for family wealth) all had no association with infant or child mortality. The author explained this as a result of the successful government polices on developing the rural areas through provision of health, primary education and clean water supply; at the same time suggested underreporting of deaths as a possible factor.

Moreover, Gubhaju et al. (1991), using data from Nepal, argued that at early stages of development, less developed areas (where IMR is usually high) tend to show higher importance of demographic rather than socioeconomic factors in determining infant mortality. In addition to all these possible explanations for lack of anticipated socioeconomic differentials of infant mortality; the overwhelming significance of association between ethnicity and infant mortality could be the key, as supported by evidence from Brockerhoff study on sub-Saharan African counties. (2000). That is, in Kenya, the effect of socioeconomic inequalities between the different ethnic groups undermines the effect of maternal education.

However, the model fitted for urban and rural areas showed a slight difference, that is for urban areas; breastfeeding, ethnicity and gender of the child having significant impact on the probability of infant of deaths, while it is breastfeeding, ethnicity and fertility variable (birth order and birth interval) in the case of rural areas. Such a difference is supporting the Wang's (2003) theory that factors affect child mortality differ between urban and

rural areas. Breastfeeding as the most important determinant for infant deaths is subject to many reasons, especially for its very high OR (34.46, 469.97 for urban and rural models, respectively). Because the first four months of infancy period is usually a period of exclusive breastfeeding, the stopping of breastfeeding for any illness (especially gastro-intestinal illnesses) could affect the survival of the infant. (Forste, 1994). Furthermore, those neonates with congenital anomalies or prematurity usually have problems with breastfeeding and thus apart from its effect they are prone to more risk of dying.

The effect of ethnicity on infant mortality could be explained by many factors, the most important of which is the socioeconomic inequality between the groups. The results on the distribution of the selected explanatory variables by the ethnic groups (see appendix 2) can explain the least probability of infant dying among the Kikuyu infants, that is their tribe had experienced several advantages: they are concentrated in richer provinces (Central and Nairobi); more urbanized; have the least proportion of non-educated women (1%) and the highest in secondary and higher education; the wealthiest group (86% not poor); they have the least percentage of home deliveries and the highest in using private health sector for delivery, as well as they have the better health practices manifested by they are the least having teenage deliveries, their better child spacing (more than 2 years) and they are the least (10%) to have five or more children. The latter health practices could be a reflection of the - former - better socio-economic status. These results are consistent with Brockerhoff's (2000).

Anyhow, such argument can not explain alone the significantly highest infant mortality experienced by the Luo group, because they are not the worst socio-economically unlike Somali infant who at the same time have no significant association with infant mortality at both urban and rural areas. The solution of the puzzle can be in the concentration of this tribe in Nyanza province, which at the same time showed the higher level of IMR (Table 3.2). Such spatial differential was reported in two previous studies elsewhere. For example a study done in Mali (Gemperli, 2004) which had related the spatial distribution of infant mortality to the regional level of malaria endemicity, while the other done in Iran suggested the unequal distribution of socioeconomic and health services between the provinces. (Hosseinpoor, 2005). On the other hand, the high HIV prevalence in Nyanza province compared to other districts (see appendix 1.) may give a clue about HIV as a major potential confounder. The mystery of Luo and Nyanza needs more investigation and research.

The lower probability of dying in infancy period for females compared to males was consistent with many studies all over the world including Kenya (Bobak, 2000; Hill, 2001; Gemperli, 2004). It has been reported that for biological causes, males are more prone to die in the first months of life, then, the probability is almost the same after overcoming the exclusive breastfeeding period (the first four months), that was also evident in Matlab DSS site in Bangladesh (Bhuiyat, 1991). Interestingly, Mutunga (2004) who used the same 2003 KDHS to examine the relationship between child mortality and some environmental factors found no sex differential in child mortality; this

is probably because for under-five children the risk has to be the same. However, the lack of sex differential in rural areas raises a big question.

The model for rural areas on the other hand has shown a third significant factor, that is spacing and birth order variable. Close inspection revealed that within the variable, the only significant covariates are those for short preceding birth interval (less than two years). That is, whatever the birth order, infants born with shorter birth interval were at higher risk of dying before the first birth date compared to firth order birth or others (birth interval of two years or more). Moreover, the higher OR for the category for those with fifth (1.98) or above birth order compared to that for who had 2-4 birth order (1.71), can give a tiny clue about the additional risk facing this group. The result for fertility factors' association with infant mortality was plausible with known knowledge and consistent with evidence from other studies, which put the siblings' competition and the theory of maternal depletion syndrome (consecutive short spaced pregnancies tends to exhaust mothers' biological resources and potentials) and as explanations. (Gyimah, 2002). The model showed significant interaction between ethnicity and breastfeeding, indicating that for each of the different ethnic groups there is a different magnitude for the effect of breastfeeding on infant survival.

4.3 PREDICTORS OF POSTNEONATAL MORTALITY

After exclusion of neonatal deaths, models were fitted for identifying determinants of postneonatal mortality in urban and rural areas separately. In the urban areas; breastfeeding was no longer significant and replaced by the occupation of the mother,

giving the first appearance of a socioeconomic factor. The main determinant of death in this age group was ethnicity followed by gender of the child and mother's occupation respectively according to the Wald's test results. The results for ethnicity and gender of the child were consistent with the model fitted for infant mortality in urban areas. There was no significant difference in likelihood of dying in the postneonatal period between those whose mothers are not working and those whose mothers work in sales and other jobs, but mothers who worked in the agriculture sector (manual workers) had experienced a significant worse outcome (OR 3.09; CI: 1.29 – 7.42). The main explanation for this can be that working women do not give better attention for their children's health, but on the other hand one can argue that working mother is a source of income for the family and thus suggesting more improvement in the children's health. (Tulasidhar, 1993). This conflict can be deeply assessed if we assumed that those mothers who work in agricultural sectors as manual workers gained less money than those who worked in other sectors, and thus, women with better income (occupation group: sales and others) had the same experience of non working women.

Although the model for postneonatal mortality in rural areas did not show no significance for breastfeeding, but at the same time the impact of this factor had much decreased compared to model for predictors of infant mortality in the same cluster. Again this model showed the ascendance of a socioeconomic factor as a significant predictor, that is level of maternal education. The determinants of death in this age group are: ethnicity; breastfeeding; birth order and preceding birth interval; and maternal educational level, respectively. The appearance of maternal education in this age period was plausible with

Cleland and van Ginneken's theory, which states that the strength of such association is higher in older age child groups compared to young infants where mortality is determined more likely by biological factors. (Quoted by: Tulasidhar, 1993). The figures for strength of association between maternal education and postneonatal mortality were compatible with that in the bivariate analysis; that is although those whose mothers' highest educational level was primary school had a less likelihood of death compared to those to non-educated women, however the results were not significant. On the other hand, women with secondary school or higher qualifications had a significantly less likelihood of postneonatal deaths compared to the non-educated women. These results were consistent with Caldwell (1979) work that explained such inverse relationship by the triad of better child care and feeding, improved health seeking behavior and the evolution in familial relationships.

Interestingly, although the model for infant mortality in rural areas (Table 3.6) had shown an entire dominance of birth interval on birth order factor, the postneonatal mortality model (Table 3.8) in the same areas had demonstrated the only significance in the combination between the two factors; that is, those who were born with less than two years birth interval and at the same time born after four siblings have the only significance more likelihood to die in the postneonatal period compared to first order births. The model also showed a significant interaction; that is, the relationship between maternal education and probability of postneonatal survival was different in magnitude among the different ethnic groups.

CHAPTER 5
CONCLUSIONS AND RECOMMENDATIONS

5.1. CONCLUSION

This study has examined the socioeconomic determinants of infant and postneonatal mortality in Kenya at both urban and rural settings. Results from the fitted logistic regression models show lack of socioeconomic differentials in infant mortality in both urban and rural Kenya. On the other hand, results for postneonatal mortality show that mother's occupation is the main socioeconomic predictor in rural areas while level of maternal education is the main in urban areas. This can be due to the nature of the occupations available in rural areas which is usually manual (like agriculture), so women are not available for long time to care for their children. While in the urban areas, because of the assumed availability of health services, the survival of the child is determined by his/her mother's awareness and thus educational level.

The lack of association between the socioeconomic factors and infant mortality can be attributed to the socioeconomic inequality between Kenyan ethnic groups demonstrated in the analysis. However, the predictors of the survival probability are dominated by the biodemographic factors, namely ethnicity and breast feeding in both urban and rural areas. In addition to that gender of the infant in the urban areas is the third factor; that is female infants have better survival likelihood than males. Fertility factors are the third most important factors in rural areas, and even within it the birth spacing between siblings is the main predictor. This mean that infants born in less than two years

preceding birth interval are at higher risk to die before their first birth date compared to first order infants and those born after two years from the birth of their preceding sibling.

Exclusion of neonatal deaths gives the first appearance of socioeconomic factors. Level of maternal education is the single most important socioeconomic determinant of postneonatal mortality in urban Kenya, while mother's occupation is the single most important predictor of postneonatal mortality in rural areas. Women with secondary school or higher qualifications compared to non-educated women show better survival for their infants after their first month of age, while women who work manually in agricultural sector show higher postneonatal deaths compared to non-working women. Generally, the two models show decreased significance of biodemographic factors in comparison to models for infant mortality for the advantage of socioeconomic factors.

There are differences in the overall determinants of infant and postneonatal mortality between rural and urban areas. However, these determinants are not mutually exclusive; that is, ethnicity and breast feeding are constant predictors for infant mortality in both settings, except in regard to association between socioeconomic factors and postneonatal mortality. The difference between infant and postneonatal mortality regarding their socioeconomic determinants may encourage the use of postneonatal mortality as a more sensitive indicator for socioeconomic comparison between regions and countries.

The study showed that socioeconomic and biodemographic variables are both important determinants of infant and postneonatal mortality. However, for infant mortality; the

biodemographic variables tend to dominate over the socioeconomic variables as predictors of survival in this period. Thereafter, when the child survived the first month of age; the socioeconomic variables take the lead and start to dominate over the biodemographic ones. And hence, for the government of Kenya, to decrease the child mortality, a special attention has to be paid for these factors.

For infant mortality, the most important determinant of mortality is breast feeding followed by ethnicity, then fertility factors and the least is the gender of the child. Once the child has survived the first month, ethnicity becomes the most important determinant of mortality in both urban and rural settings, then, followed in sequence by breast feeding, gender of the child, fertility factors, and the least significant ones are the mother's occupation and her highest level of education.

The findings suggest for improving breast feeding practices and family planning interventions in Kenya through widespread health education campaigns and strengthening the health centre facilities and capabilities. Moreover, the ethnic inequalities in terms of socioeconomic and health services disparities have to be removed or minimized. Moreover, policies and efforts have to be put to improve women education and occupation environment.

5.2. RECOMMENDATIONS

This study is an attempt to examine socioeconomic factors associated with infant and postneonatal mortality in Kenya and to determine the key factors in ranked order to aid policy planning. Using the 2003 KDHS data and a series of logistic regressions, the study found an IMR of 79.6 deaths per 1,000 live births. In addition to that, there is no significant association between socioeconomic factors and infant mortality in both urban and rural Kenya. However, for postneonatal mortality, the level of maternal education is the main predictor in urban areas while mother's occupation is the main predictor in rural areas.

The study results recommend that female education has to be facilitated in order to make at least the secondary qualifications obtainable, especially in urban areas which show significant association with child mortality. Furthermore, the occupational environment for the mothers has to be improved in terms of working load, working hours and salaries. Such policy might, substantially, decrease the postneonatal mortality, especially for the mothers who work in agricultural field in the urban areas.

Thus, women education and occupational environment are the main socioeconomic factors that need to be improved by the Kenyan government to achieve the National Population Policy for Sustainable Development in regards to decrease of child mortality.

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APPENDIX 1.

Percentage HIV positive among adults aged 15-49 years who were tested, by province, KDHS 2003

No	*Province*	*Percent HIV positive*
1.	*Nairobi*	9.9
2.	*Central*	4.9
3.	*Coast*	5.8
4.	*Eastern*	4.0
5.	*Nyanza*	15.1
6.	*Rift Valley*	5.3
7.	*Western*	4.9
8.	*North Eastern*	0.0

Source: CBS, 2003

APPENDIX 2.

Percentage distribution of the selected explanatory variable by Ethnic groups:

Explanatory variable	Ethnicity						
	Kikuyu	Kalenjin	Kamba	Luhya	Luo	Somali	Other
Province							
Central	64.7	0.2	3.3	0.8	1.2	0.2	2.0
Nairobi	13.4	1.7	13.3	10.2	17.2	9.3	3.8
Coast	2.8	0.4	4.6	1.6	2.8	11.0	35.8
Eastern	1.3	0.9	76.4	0.2	0.0	3.0	16.8
Nyanza	0.2	1.1	1.0	4.1	70.0	0.0	17.1
Rift Valley	16.8	87.5	1.4	13.4	4.3	1.9	21.7
Western	0.8	8.2	0.0	69.7	4.3	0.0	2.8
Northern Eastern	0.0	0.0	0.0	0.0	0.2	74.6	0.0
Place of residence							
Urban	31.1	3.9	20.9	30.7	37.9	28.7	21.5
Rural	68.9	96.1	79.1	69.3	62.1	71.3	78.5
Highest educational level							
No Education	1.2	9.3	4.3	7.4	3.2	90.8	31.7
Primary	63.8	68.4	74.8	65.0	76.1	7.9	51.3
Secondary and Higher	35.0	22.3	20.9	26.6	20.7	1.3	17.0
Wealth index							
Middle to richest	85.8	34.2	61.9	52.7	63.1	32.3	49.9
Poorer to poorest	14.2	65.8	38.1	47.3	36.9	67.7	50.1
Respondent's occupation							
Not working	26.9	19.3	58.8	30.9	25.2	80.6	31.1
Agriculture	42.7	61.0	13.8	41.6	31.0	2.8	41.0
Sales and Other	30.4	19.7	27.4	27.5	43.8	16.9	27.9
Place of delivery							
Home	29.5	66.7	66.5	63.9	54.9	80.5	61.9
Public health sector	50.8	18.8	20.8	21.5	29.1	10.8	22.9
Private health sector	19.7	14.4	12.7	14.6	16.0	8.7	15.2
Size at birth							
Average	57.4	56.2	63.6	49.6	61.1	67.5	62.5
Larger than average / v. large	26.4	28.6	19.4	36.0	27.4	13.2	22.1
Smaller than average / v. small	16.2	15.2	17.0	14.4	11.5	19.3	15.4
Age of mother at 1st birth							
Less than 19 years	31.6	48.5	37.4	48.7	67.1	52.8	49.1
19 years or more	68.4	51.5	62.6	51.36	32.9	47.2	50.9
Age of mother at birth							
20- less than 35 years	74.0	72.3	75.9	70.6	62.7	70.7	69.5
Less than 20 years	15.9	16.2	12.4	18.9	26.0	16.4	17.9
35 years or more	10.1	11.5	11.7	10.5	11.3	12.9	12.6
Breast feeding							
Ever	97.5	94.5	96.9	96.7	96.8	86.0	95.8
Never	2.5	5.5	3.1	3.3	3.2	14.0	4.2
Birth order and Preceding birth interval							
First Order	33.8	23.8	23.3	26.1	26.0	15.9	25.5
2-4 / 2 years or more	42.2	35.1	38.3	33.8	31.2	22.0	36.0
2-4 / < 2 years	8.2	12.8	9.3	14.4	10.1	17.9	11.2
5+ / 2 years or more	13.4	23.1	22.2	19.7	25.4	30.0	22.2
5+ /< 2 years	2.4	5.2	6.9	6.0	7.3	14.2	5.1