THE SOCIO-ECONOMIC DIFFERENTIALS IN INFANT AND CHILD MORTALITY IN KENYA : EVIDENCED FROM THE 1993 KDHS DATA.

BY

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A PROJECT PAPER SUBMITTED IN PARTIAL FULFILMENT FOR THE POST-GRADUATE DIPLOMA IN POPULATION STUDIES AT THE UNIVERSITY OF NAIROBI

OCTOBER, 1997

DECLARATION

This project is my original work and has not been presented for a degree at any university.

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This project is dedicated to my father, late mother, brothers Dagne Wondimu and Bisenebit Endazezew, sister MuluGojjam Bayeh and intimate friend Temesgne Kebebew.

ACKNOWLEDGEMENT

I am grateful to the German Academic Exchange Service (DAAD) for the financial assistance that has enabled me to undertake a full time study for the post graduate diploma course in Population Studies.

I am greatly indebted to my supervisors/Director of Population Studies and Research Institute (PSRI) Prof. A.B.C Ocholla-Ayayo and Dr. B.O.K'Oyugi for their critical and constructive comment, guidance, advise, reading my work and correcting at various stage. Apart from this, their continuous help, special care and encouragement in the entire duration of my study at PSRI enabled me to complete this project.

I also thanks the co-operation and assistance given to me by all members of the staff of the PSRI, the Librarian of PSRI, especially to Mr. Isaac Lamba who is incharge of the computer service for his assistance in data extraction, to Miss Yamo P.A for going through my drafts for her helpful comment and typing some of the chapters.

I wish to thank also Dr. Lawrence D.E. Ikamari for his comment and expert advise. I would like also to thank Mrs. Priscilla Akwara for her contribution during the stage of the design of this study.

Last but not least many thanks go to my parents, brothers, sister and all my friends who provided constant source of emotional support and encouragement to complete this project.

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ABSTRACT

The objective of this study was to estimate infant and child mortality differential with the associated socio-economic factors at macro-level in Kenya. The variables utilized are maternal education, paternal education, working status and place of residence of mothers. Data analysis was based on Kenya Demographic Health Survey (KDHS) 1993. The study used the method of Trussell variant of the Brass child survival for estimating infant and child mortality and Coale Demeny regional North model life tables.

The findings are consistent with those from earlier studies. The education level of mothers and fathers as hypothesized were found to be inversely related to infant and child mortality. Most of the decline in infant and child mortality could be accounted for by increased education of both mothers and fathers. The study reveals that infant and child mortality is highest for rural residence mothers and lowest for those who reside in urban areas. The association of working status of mothers using the categories of non working and working mothers show inconsistency in the variable.

This study recommends that in order to reduce infant and child mortality, mothers' and fathers' education need to be accelerated to secondary level and above. The government could promote survival of infants and children of working lactating mothers by providing of breast feeding places, breaks, job security and paid maternity leaves.

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CHAPTER ONE

1.1 INTRODUCTION

In the post World War II period most developing countries have experienced a dramatic decrease in mortality. This has been brought about by the rise in the standard of living and advancement of medical technology people benefit selectively from such progress. Nevertheless,the international differences are as a result of unequal distribution of resources, skills and knowledge for the promotion of health the prevention and treatment of disease among social groups and geographical regions, often resultant from the national strategies for development and policy decision on welfare and health. The differentials also reflect variations in environmental conditions of places of residence and work.

A review of the works of Ewbank et. al. (U.N, 1986:33) indicated that Kenya is unique in sub-sahara Africa in the rich diversity of its demographic and epidemiologic data. Various researches have estimated the trends and geographic differentials, examined national-level data on cause of death or measured the importance of various diseases in clinic populations or in small study areas.

In addition to this, a number of studies have shown that there exist differentials in infant and child mortality in Kenya. These are majorly due to socio-economic, socio-cultural, environmental, demographic, biological and nutritional factors. Mortality in Kenya represent a wide range of mortality levels and levels of development.

The emphasis of this study will therefore be on socio-economic characteristics: such as rural-urban residence, mothers and fathers educational levels and working status of mothers that are observed to the national level.

1.2 STATEMENT OF THE PROBLEM

Infant and child mortality differentials in Kenya varies from one region to another due to the indirect effect of socio-economic factors. This leads to "a continuing existence of education, work status and residence inequalities in infant and child mortality."

In Kenya Mosley and Chen (1984) and Ocholla-Ayayo (1996:102) directed their investigation on socio-economic status and a few cultural factors to be responsible for high infant and child mortality. They have demonstrated how parents without education and those with low level of education have high child mortality rate.

A study carried out by Muganzi (1996:75) examined infant mortality rate and life expectancy varies from one district to another. The districts with the lowest mortality rates are Kiambu, Nyeri, Muran'ga and Nairobi while districts with the highest infant mortality rates include former South Nyanza, Kilifi, Busia, Kwale and Siaya. This he says, the estimates for the rest of the districts lie within these two extremes.

Several studies have now been done on infant and child mortality in Kenya show that there are distinct mortality differentials along regional as well as socio-economic variables

(Kibet 1981, Kitchamu 1986, Elsie 1988, Ondimu 1987, Oyoo 1991, K'Oyugi 1992, Eshetu 1995, Ikamari 1996). Even though the above studies have achieved considerable goals they did not study data obtained from 1993 on the possible socio-economic factors. They relied on data obtained from census and survey of 1969, 1979 and 1984. However, Eshetu (1995) analyzed infant and child mortality using the KDHS 1993 applying only one variable on the effect of maternal education on infant and child mortality by splitting mothers education into four categories.

This study was an extension based on 1993 Kenya Demographic and Health Survey (KDHS) in infant and child mortality taking selected socio-economic factors specifically four variables.

1.3 OBJECTIVES OF THE STUDY

1.3.1 GENERAL OBJECTIVE

The study aimed at investigating infant and child mortality differentials in Kenya. It is designed to analyze variations on infant and child mortality associated with socio-economic factors.

1.3.2 SPECIFIC OBJECTIVES

1) To estimate probabilities of dying from birth to ages 2, 3 and 5 years and life expectancy at birth.
2) To find out the relationships between mothers education, fathers education, rural-urban residence and working status of the mothers with respect to infant and child mortality.

1.4. JUSTIFICATION OF THE STUDY

Infant and child mortality differentials are considered as the most important components of mortality. The contribution of infant and child mortality to total loss of years of human life is substantial, the level being relatively high, particularly in developing countries because:

i) It provides information for assessing inequalities among people with respect to longevity and health.

ii) It helps to identify those under privileged segments of the population who experience higher mortality levels and programmes as a useful indicator of the state of health, standard of a society, ability to control incidence of disease and death (UN 1985, Akwara 1996).

The study would direct one's attention to the national differentials in infant and child mortality and how they are influenced by residence, education and working status of mothers. This would also help policy makers decide what steps to take in promoting equitable development.

1.5 SCOPE AND LIMITATIONS

The study covered all the areas of the provinces of Kenya except exclusion of all three districts in North Eastern province (Garrissa, Mandera and Wajir), four other Northern districts (Samburu and Turkana in Rift valley province) and in Eastern province (Isiolo and Marsabit). They were excluded from the survey because of the sparse population and semi-nomadic nature of the people which together account for less than 4 per cent of Kenya's population.

The study is concerned with socio-economic factors of mortality. Many other variables and factors including biological, behavioral, environmental, demographic and cultural determinants of mortality could have been used with cross-tabulation, multivariate and regression analysis but due to time and resource constraints this was not done.

CHAPTER TWO

LITERATURE REVIEW

2.1 FINDINGS IN THE WORLD

A number of studies on infant mortality in a historical Europe explains, a study in eight cities in the United States shows infant mortality rates among offsprings of mothers who worked away from home during pregnancy to be about twice the rate for those who were not employed during confinement(UN, 1985).

Furthermore(UN,1985) also expresses the opinion that peasants had higher child mortality than the landless possibly because ownership of land entailed more work for the wife.

Similarly the general studies have suggested that child mortality in developing countries is associated more closely with maternal education than any other socio-economic factors (UN, 1985).

The rural/urban differentials is an indication of socio-economic status of urban dweller and rural peoples. Since the higher the education levels, better jobs, better housing and higher socio-economic status are found in urban than rural areas these contribute lower mortality levels in town than the rural (UN, 1982).

There is general agreement among researchers in developing countries mortality is thought to be higher in rural than in urban areas. Place of residence in this societies differential life styles, perceptions of the world, access to health care and the availability of recent medical advances have been suggested as reasons for the urban advantage (UN, 1984).

Julie Da Vanzo (1988) using the logistic regression analysis on the variables increases in income and education. Improvements in sanitation, health care, nutrition and family planning the study on infant mortality in Malaysia found that increases in mothers' education and improvements in water and sanitation are the most important household level changes that accompany regional and temporal development and contribute to the inverse relationship between the infant mortality rate and development.

A study which was done in Matlab, Bangladesh among probability sample of 1519 and 4626 urban and rural respectively used several indicators such as education of household head, mother's education, size of dwelling and health practices. They found that an inverse relationship between mortality and parents' education, father's occupation and economic status (D' Sonza S. and A. Bhuiya 1982).

Research in Rural India identified the mother's education as an important determinant of the use of medical services together with the availability of those services as already stated, it is thought that the association of child mortality with maternal education operates mainly though this mechanisms (Jains, 1985).

Caldwell (1979,1987) suggested that increased maternal education gives women the power and the action to make critical decisions relevant to their children.

According to (UN, 1986) further suggest that the limited amount of time that could be devoted to breast feeding, in addition to the more general, lack of care that working mothers could give their children may have been a factor in the higher infant and child mortality of children of those mothers.

Okojie (1993) using three data sets and three states in Nigeria has examined some of the interrelationships between maternal education and child mortality. The household studies have shown that child mortality has an inverse relationship with maternal education. Furthermore, she explained child mortality is also lower in communities where the level of female education is higher. The main reason for that was that educated mother use modern health facilities to a greater extent than less educated mothers, especially prenatal care and place of delivery.

2.2 PATTERNS IN KENYA

Mott (1979) made use of Kenya Fertility Survey of 1079 to study infant mortality in Kenya. He found that further increases in educational attainment as well as improvements in rural health services will probably substantially reduce overall infant mortality.

In addition to, Kibet (1981) made similar study the correlation of infant and child mortality with other variables of urban population, total fertility rate, population density, kilometres of road using the 1979 census. He used the probability of dying at age 2, q(2) using Brass technique to estimate e(o), q(2) and total fertility rate. He further applied regression model for his data analysis and finds out malaria and the mother's education are the two major factors that influence infant and child mortality.

The place of residence influences the health of infant and child through many ways. For instance women residing in urban areas are more exposed to better water supplies and health facilities than in the countryside.

K'oyugi (1983) using data from 1979 census conducted mortality and morbidity in Siaya district found that mortality rate in the Siaya is heaviest during the first five years of life. His analysis found that infant and child mortality is higher in the rural than in the urban areas and argued that the $2q_o$ value for the rural area is lower than the whole districts figure possibly due to higher degree of misreporting or omissions of births and deaths of children for mothers in the rural particularly those in the age group 20-24 years. Furthermore he argued that the lower child mortality in the urban areas could be due to better sanitation, housing, shorter distances to health centres and higher income levels existing in the urban areas on the average.

The evidence of the importance of education in relation to infant and child mortality comes from the study of Kenya experience by Ondimu (1988) using data from 1984 KCPS estimate the infant and child mortality. He found that infant and child mortality is low when a mother has achieved high level of formal education compared to when she has low or no education. Besides, the study also shows mortality is lower whose mothers are in urban residence, married in monogamous unions and currently working.

Oyoo (1991) using data from 1979 census investigated infant and child mortality in Kisumu district, found that lower infant and child mortality in urban than rural areas. The results for mortality estimates by education agrees with the general theory that mortality is inversely related to increase in mother education.

Ayehu (1993) using data from 1979 Kenya population census analyzed infant and child mortality in Nairobi considering three wards that is Mathare Valley, Harambee-Lumumba and Parklands-Spring Valley, found that the level of maternal education is inversely related with infant and child mortality in the three wards.

Eshetu (1995) using data from 1993 KDHS splitting mothers education into four categories found out that primary incomplete had the highest infant and child mortality followed by no education. But primary complete and secondary and above have the lowest infant and child mortality. The results compatible with the general theory that mortality is inversely related to increase mothers education.

As laid down by Prof. Ocholla-Ayayo (1995:94) argued that education was shown to reduce some socio-cultural factors on infant and child mortality as well as maternal morbidity and mortality. The mothers education was associated with water treatment that is boiling, storage and filtering. He concluded that the higher the mothers education the higher the survival of infant and child. In addition to, he explained fathers' education roles can affect child survival as housing condition and general sanitation and source of water.

A study carried out by Ikamari (1996:135-143) using data from 1989 KDHS a comparative study of high mortality zone and low mortality zone that mothers and fathers education on infant and child mortality with different categories of education have nearly the same influence compared to those whose fathers and mothers with no education. Better educated women were engaged in a good jobs and likely to have highly paid salaried that provided access to goods and services to maintain and improve the health of their children. At the same time paternal education also influenced child survival through good jobs that enables to engaged in better income generating activities for household income.

Besides he studied working status of mothers indicate that mothers who work has lower infant and child mortality than the children whose mothers were not working. He revealed that infant mortality whose mothers were not working was 41 per cent higher than working mothers. In the same findings child mortality for non-working was 70 per cent higher than the working mothers. This is due to the fact that mothers who were working were more likely to feed, clothing and educate their children than not working counter parts(Ibid.).

From the above discussion of the literature review it is quite clear that socio-economic factors education, residence and working status play an important role in the differentials of infant and child mortality. However, there are other factors that have an impact on infant and child mortality.

CHAPTER THREE

3.1 CONCEPTUAL FRAME WORK FOR THE STUDY

Several framework have been attempted by different scholars to analyze infant and child mortality. Among the various framework Mahadevan, Venkatacharya and Teklu. These models have their own limitations. Mahadevan incorporating too many determinants of mortality which makes hard to isolate the key mortality determinants (Venkatachary and Teklu, 1986 quoted in Akwara, 1994).

Venkatachary and Teklu model has ignored the socio-economic determinants(Ibd.). On this account, the study was based on the Mosley and Chen (1984) framework for the analysis of infant and child mortality. The framework is intended to conceptualize the theoretical notion to differentiate that child survival is influenced by mother's and father's education, residence and work status of mothers.

Mosley and Chen identified five grouped factors:

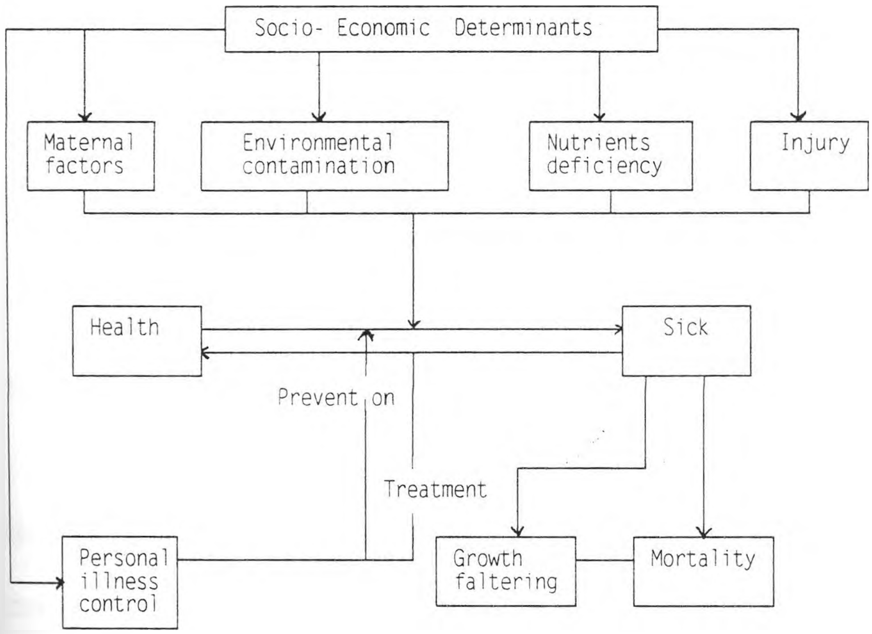
- Maternal factor
- Environmental contamination
- Nutrient deficiency
- Injury
- Personal illness control

On the other hand, the effects of social, economic, cultural and geographical variables are indirect in the sense that they operate through the above-mentioned biomedical factors. Thus the biomedical variables that exert direct influences on child mortality can be called intervening variables since they intervene between social, economic, cultural and geographical conditions and the events of death.

In addition, the socio-economic determinants must necessarily operate through these variables to affect child survival. These are grouped into three categories:

- Individual level variables
- Household level variables
- Community level variables

F.1 Operation of the five groups of proximate determinants on the health dynamics of a population are summarized in the following model by Mosley and Chen.



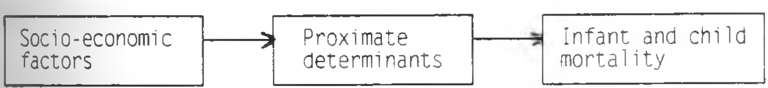
Source:- W. Henry Mosley Lincoln C. Chen(ed.) 1984. An Analytical Framework for the study of child survival in developing countries. In Child Survival Strategies for Research Population and Development Review. A supplement to Vol.10. p. 29

Using the above framework the socio-economic factors which determine infant and child mortality was studied. The variables that were measured are:

- Education
- Residence
- Working status

3.2 CONCEPTUAL MODEL

F.2 The conceptual model in the study is summarized as outlined below:



Source: adopted and modified from Mosley and Chen :1984

The general objective of the study aimed at investigating infant and child mortalit differentials in Kenya with the association of socio-economic factors.

Thus the Mosley and Chen (1984) analytical frame work adopted and modified was use because the social and economic factors are always operate through a common set of biologic: mechanisms or proximate determinants to exert stable state with end results being high or low infa: and child mortality. Background factors will always operate through proximate determinants in ord to cause infant and child mortality. This should shed further glance at how such variables as matern education, place of residence and work status bring into use such a profound effect on infant a child mortality.

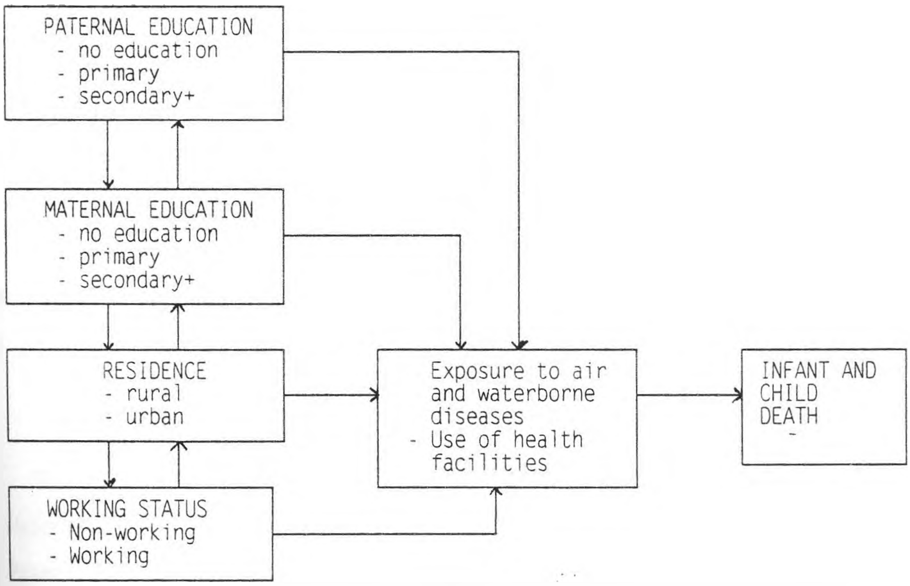
Among the socio-economic determinants which operate to influence the risk of infant a: child mortality through these intermediate variables are: age at marriage; age at first sexual unic desired family size; beliefs about use of fertility control practices; knowledge of,and access methods of contraception, postpartum abstinence, terminal abstinence (Mosely, 1983:278).

3.3. CONCEPTUAL HYPOTHESIS

Socio-economic factors are likely to affect the level of infant and child mortality in Kenya.

The above are high order concepts that can be subject to empirical investigation. For the purpose of this study the framework of Mosley and Chen modified below in Fig 3. The framework needs to be operationalized. Below is an operational model that may be derived from the above theoretical framework. This was done because the other factors were excluded in the study.

3.5. OPERATIONAL MODEL



Source: Adopted from Mosley and Chen framework for the study child survival .

In the above operational framework the variables have relationship and effect on infant and child mortality. In developing countries mortality is often thought to be higher in rural than urban areas because of differentials standards of living and health conditions in general and differential availability and access to public health facilities (Rosenzweig and Schultz. 1979 quoted in UN 1985:19).

It has been pointed out that urban populations usually benefit from more and better health resource and they are also better educated than rural dwellers. In much of the literature reviewed differences in infant and child mortality favouring urban areas and better educated. Life in urban areas is conducive to child survival. either from services the area renders or because residents of urban areas experience better socio-economic conditions. Baum and Arriaga (1981 quoted in UN. 1985:20) also show that as education increased. mortality rates dropped slightly faster for children born to urban residents. The better educated tend be concentrated in the urban areas. We would expect the effect of education on infant and child mortality to play an unseen part in maintaining urban-rural differential. In some sense the better educated and wealthier can be expected to be better nourished and to have better housing and to be more likely both to recognized illness requiring medical intervention and to have the wherewithal to afford medical attention.

The father's education should be greater in urban than rural because income returns from education are greater in urban areas. When husband and wife are both illiterate. mortality is very high. when the wife has an elementary level of education the husband's education does not seem to matter very much and when husband and wife are both very educated they belong to a privileged social class which has low mortality in comparison to the others. Ikamari (1996) observed that it was due to educated men being able to marry educated women. Further more. Ocholla-Ayayo (1991:71) pointed out traditional low level of education is also characterized by high rates of child mortality.

According to (UN.1985:150) the well educated women the benefits that employment may produce through increased income may counteract the disadvantages of working mothers being outside the home. On the other hand as well educated women usually work in the better paid occupation they can afford to replacement to take care of their children while they are engaged in economic activities that is. there might be an interaction between education. activity status and child mortality. Apart from this mother's working during pregnancy is highly correlated with mothers employment during the child's first year of life. Mothers working away from home during the first year also appeared to place an infant at greater risk. Woodbury (1925. quoted in UN 1985:149) suggests that the limited amount of time that could be devoted to breast-feeding.in addition to the more general lack of care that working mothers could give their children of those mothers.

Hence on the basis of the above operational model operational hypotheses were formulated.

3.6. OPERATIONAL HYPOTHESES

1) Maternal education is inversely related to infant and child mortality.
2) Paternal education has a significant effect on the infant and child mortality.
3) Rural/Urban residence has a significant effect on the infant and child mortality.
4) Working status has a significant effect on the infant and child mortality.

3.4. DEFINITION OF KEY CONCEPTS

3.4.1 Dependent Variable

Infant mortality- The probability of dying before the first birth day.

Child mortality- The probability of dying between the first and fifth birth day.

3.4.2 Independent Variable

Socio-economic factors

Education level: Measured in terms of the following: no education. primary. secondary and above residence: This is measured in terms of the following: rural and urban.

Working status: It is measured in terms of the following: Non-working and working.

Residence: This is measured in terms of the following: Rural and Urban.

CHAPTER FOUR

DATA AND METHODOLOGY

4.1 SOURCE AND QUALITY OF DATA

Demographic studies in Kenya have been done basically using various census and survey data. The first census conducted in Kenya was in 1948. The second in 1962, 1969, 1979 and 1989 the third, fourth and fifth respectively. Census in Kenya is carried out every ten years.

Mortality registration is unreliable in sub-sahara Africa countries and even when reliable death registration records include very little information. The non-existence of incomplete vital registration system in Kenya compel us to rely on census and sample survey.

Demographic surveys that have been conducted by the Central Bureau of Statistics (CBS) in the past include: The Kenya Fertility Survey (KFS 1977/78; the National Demographic Survey I (NDS I) in 1977; NDS II (1978); NDS III (1983); the Kenya Contraceptive Prevalence Survey (KCPS) (1984) and the Kenya Demographic and Health Survey (KDHS I) (1989).

The various sample surveys have provided even more detailed information not only on the number of births and deaths but also on birth histories of women use of contraception and other socio-economic and environmental related data.

The study used secondary data obtained from the Kenya Demographic and Health Survey (KDHS II) (1993) that was carried out by the National Council for Population and Development (NCPD) in collaboration with the Central Bureau of Statistics (CBS). The survey was carried out from mid-February to mid August 1993 during which time a total of 7540 ever married women and 2336 men were interviewed.

The survey not only provide planners and policy makers with data useful in making informed programme decisions but also used to evaluate Kenya's efforts to infant and child mortality. In the final analysis the picture that emerges shows significant determination have been made toward this goal.

The Kenya Demographic and Health Survey have been undertaken by NCPD. This survey findings provide the first evidence of a major decline in fertility and an increase in the use of family planning. It further reveals that the child mortality rate has declined between 1978 to 1987 and then rose in 1988-93 (KDHS 1993:84).

Thus the KDHS 1993 made it possible to apply indirect demographic methods in our analysis to estimate infant and child mortality rates. It also gives information on the impact of education, residence and working status of mothers on the infant and child mortality differentials in Kenya.

4.2 METHODOLOGY

4.2.1 OVERVIEW OF THE INDIRECT METHODS

It is very difficult to estimate data directly in survey means. Therefore, the indirect methods of estimation represent an important source of mortality estimates. These indirect methods which was developed first by William Brass in 1964 and later by Brass and in 1964 and later by Brass and others (1968). A number of authors propose useful developments of the original method. Sullivan (1972) and Trussell (1975) expand the range of mortality and fertility models for which relationships are estimated. Of particular importance the development of methods of estimating mortality trends under conditions of changing mortality. Feeney (1976,1980) and Coale Trussell (1978) propose methods for estimating reference dates for the child mortality estimates (UN, 1992:7).

Therefore, two indirect procedures for estimating infant and child mortality were applied. The first procedure involved adjusting reported proportions of children dead for age groups of women to obtain life table. The second the Brass and Trussell techniques for converting these proportions into probabilities of dying were applied.

A brief discussion on the Brass and Trussell techniques is presented as follows.

4.2.2 BRASS METHODS

The Brass method uses a fertility of polynomial which is fitted with one parameter a ratio of mean parties to the population and a one parameter mortality schedule. The Brass method requires three information: the number of children ever born, the number of children ever born who have died (children dead) and the total female population of reproductive age usually (15-49). The probability of a child dying between birth and exact age x is q(x) given by the formula.

$$q(x) = K(i) \times D(i)$$

for x = 1,2,3,5,10,15 and 20

while (i) = 1, 2, 3, 4, 5, 6 and 7

representing the age group 15-19, 20-24, 25-29, 30-34, 35-39, 40-44 and 45-49 age groups.

D(i) is the proportion dead in the i the age group

given by

$$D(i) = \frac{CD(i)}{CEB(i)}$$

K(i) is the adjusting factor which is a function of parity P(i) given by

$$P(i) = \frac{CEB\ (i)}{FPOP\ (i)}$$

According to Brass (1964)

$$K(i) = a(i) + b(i)[P(1)/P(2)]$$

where, P1 and P2 for the first and second age groups. a(i) and b(i) are regression coefficient according to Brass.

Nevertheless, Brass used models of mortality has limitations to establish the relationship between the proportion dead children. The probability of dying by an exact age of childhood under the assumption that fertility and childhood mortality have remained constant in the recent past. In the same way, cohort and period probabilities of dying were identical and the mortality risks of children of women who do not report their child bearing experience are the same as those of children whose mothers' do.

4.2.3 TRUSSELL TECHNIQUE

The Trussell method uses a range of fertility schedules from the Coale Trussell model system and a set of regression equations for each of the Coale - Demeny regional model life table system to estimate probabilities of dying (WHO, 1981 p.142).

The Trussell multipliers presented are a more recent and more satisfactory version originally proposed by Trussell in 1975. The assumption of constant mortality is replaced by an assumption of steadily changing mortality over time (UN, 1992).

This has an advantage of describing the fertility and mortality schedule more adequately. This is done by assuming that the data from women aged over 35 years may be affected from under reporting of dead children while data for women age 15-19 reflect relatively higher infant mortality of young mothers (UN, 1983).

The formula therefore required the information below:

i) Children ever borne (CEB) classified by sex and five year age groups of mothers.

ii) The number of children dead (CD) classified by sex and five year age groups of mothers.

iii) The total number of women (FPOP) aged between 15-49 classified by 5 year age groups.

According to Trussell, we have

$$k(i) = a(i) + b(i)\ [P_1/P_2] + C(i)\ [P_2/P_3]$$

where, a(i), b(i) and c(i) are regression coefficients obtained by Trussell.

As a result, the appropriate method selected among the various versions of the Brass method the study used the Trussell variant of the Brass child survival method using the Coale-Demeny regional North models life tables because the North model appear to be more consistent with the available data than the other models. The choice of the North model for Kenya, however, is supported by district indications from maternity histories (UN, 1992).

CHAPTER FIVE

INFANT AND CHILD MORTALITY DIFFERENTIALS IN KENYA

5.1 BRIEF DESCRIPTION OF THE DATA USED IN THE STUDY

The Kenya Demographic and Health Survey 1993 Data was used to analyze the socio-economic differentials on infant and child mortality.

Table 1 displays the breakdown of the total female population, children ever born (CEB) and children dead (CD) by educational level of the mothers and fathers, urban / rural residence and working status of the mother. A total of 23899 children were born and a total of 2676 children died from a female population of 7540.

Table 1

Variables	FPOP	Percentage	Children ever born (CEB)	Children dead (CD)
Mother's Education				
None	1297	17.2	7458	1088
Primary	4449	59	13027	1398
Secondary +	1794	23.8	3414	190
Total	7540	100	23899	2676
Father's Education				
None	649	12.8	3657	594
Primary	2668	52.6	12935	1531
Secondary +	1757	34.6	5858	414
Total	5074	100	22450	2539
Place of Residence				
Rural	6379	84.1	21590	2447
Urban	1161	15.9	2309	229
Total	7540	100	23899	2676
Working status of Mother				
Not working	3783	50.2	9728	986
Working	3751	49.8	14164	1690
Total	7534	100	23892	2676

Source: Primary Analysis of the KDHS 1993 data.

The table indicates that the mothers exposed to the risk of children dying were 24% with secondary and above level of education, 59% with primary level of education and 17% with no education.

The table further indicates that majority of the women (84%) resided in the rural areas whereas only 16% resided in the urban areas.

The variables children ever born (CEB) and children dead (CD) were not refined representatives of infant and child mortality. Hence further calculation of infant and child mortality is essential. As a result the data is further analyzed using the Trussell variant of the Brass Child Survival Method by the socio-economic variables to estimate the national levels of infant and child mortality.

5.2 NATIONAL LEVEL ESTIMATES OF INFANT AND CHILD MORTALITY

This study considered the estimates of infant and child mortality by socio-economic differentials at the national level. These socio-economic differentials are inferred indirectly from:

a) Educational levels of both the mothers and the fathers

This variable was split into three categories for the purposes of this study i.e:

i) No education

ii) Primary education

iii) Secondary education and above

b) Work status of the mother

This variable was classified into two categories i.e:

i) Non working

ii) Working

c) Place of residence of the mother

This variable was classified into two categories i.e:

i) Rural

ii) Urban

To estimate the national level of infant and child mortality, data limitations arise from the fact that accurate and precise information on infant and child mortality is not available for Kenya as well as other developing countries due to problems of data collection.

Nevertheless, the Indirect technique developed by Trussell variant of Brass Method was used in this study to estimate the infant and child mortality in Kenya. The classification used in this study is based on the KDHS Data of 1993.

In order to use the data, the North Model Life Tables was used in developing the methods. The parameters used are:

a) The probability of dying between the age zero(0) and one (1) is denoted by (1q0). When multiplied by 1000, it is referred to as the Infant Mortality Rate.

b) The probability of dying between the age of 1 and 5 denoted by (4q1) referred to as Child Mortality.

Table 2. Infant and Child Mortality Rate by five year periods preceding the survey, Kenya 1993

Years preceding the survey	Approximate reference period	Infant Mortality Rate (1q0)	Child Mortality (4q1)
0-4	1988-93	61.7	36.7
5-9	1983-87	63.4	28.1
10-14	1978-82	68.9	35.3

Source: 1993 KDHS (Table 7.1 P.84)

As shown in the above table 2, different mortality values were estimated using the 1993 Kenya Demographic and Health Survey Data. The table indicates that during the five year period preceding the survey (1988-1993), infant mortality rate was at 62 per 1000 infant deaths while the child mortality rate was 37 per 1000 children deaths. This implies that about 6% of the infants and 4% of the children born in Kenya do not live to reach their first year birthday.

The infant mortality rate (1q0), child mortality rate (4q1) and the life expectancy (e_0) are obtained from the model Life Table. The life expectancy (e_0) at birth is recognized as best summary measure of mortality conditions in a country. However, the estimates of q_2, q_3 and q_5 are taken from the computation of the data. Each of the $q(_x)$ values estimated from the reports of child survival can be considered as an estimate of infant and child mortality of a given time period preceding the survey. By using the estimation equations, an estimate can be made of the time period to which each $q(_x)$ applies (UN, 1983).

As each of these estimates applies to a different time period, they can be used to estimate mortality levels. The procedure used in this study is applying the North Model Life Tables is turning each of the $q(_x)$ estimates into an estimate of the infant and child mortality rate.

5.2.1 DATA USED IN THE COMPUTATION ANALYSIS

As aforementioned, in this study infant and child mortality will be estimated at national level by socio-economic factors. These include:-

a) Level of education of both mothers' and fathers'

b) Work status of mothers'

c) Place of residence

However, before discussing differentials in Infant and child mortality by the various background factors at the national level, the procedures involved in the Trussell's variant of Brass Method will be explained.

Using the national data of all cases combined , the following results shown in table 3 are obtained.

Table 3. Application of the Trussell version of the Brass Method to Data on both sexes from the 1993 KDHS data

Age group	Age group Index (i)	FPOP	Children Ever Born (CEB)	Children dead (CD)	P(i)	D(i)
15-19	1	1788	364	44	0.2036	0.1209
20-24	2	1605	2193	189	1.3664	0.1862
25-29	3	1199	3774	326	3.1476	0.0864
30-34	4	1112	5115	532	4.5998	0.1040
35-39	5	743	4513	517	6.0740	0.1146
40-44	6	653	4553	578	6.9724	0.1269
45-49	7	440	3387	486	7.6977	0.1435

$\frac{P1}{P2} = 0.149005$ $\frac{P2}{P3} = 0.4341$

Multipliers Based on North Models
Sex Ratio at birth = 1.05

Source: Primary Analysis of the KDHS 1993 Data

5.2.2 COMPUTATIONAL PROCEDURES

Step 1. Calculation of average Parity per woman P(i)

Average parity is the average number of children ever born in a given five year age-group i.e:

$P(i) = CEB_{(i)}/FPOP_{(i)}$

Where:

i = 1, 2, 3..............7

$P_{(i)}$ is the average parity of women e.g $P_{(1)}$ is for women aged 15-19. $P_{(2)}$ for women aged 20-24. upto $P_{(7)}$ the parity for women aged 45-49 years.

CEB denotes the number of children ever born in age-group (i).

$FPOP_{(i)}$ is the number of women in the age-group (i) irrespective of their marital or reporting status.

For example: Parity for women in the age-group 15 - 19 and 20 - 24 years, i.e $P_{(1)}$ and $P_{(2)}$ for all cases combined is obtained as follows:

$$P_{(1)} = CEB_{(1)}/FPOP_{(1)}$$
$$= 364/1788$$
$$= 0.2036$$

$$P_{(2)} = CEB_{(2)}/FPOP_{(2)}$$
$$= 2193/1605$$
$$= 1.3664$$

Step 2. Calculation of Proportions Dead among the children ever born

This is obtained by the ratio of the total number of children dead to the total number of children ever born for each age-group of the mothers.

$$D_{(i)} = CD_{(i)}/CEB_{(i)}$$

Where:

$CD_{(i)}$ is the number of children dead reported by those women in that age-group.

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

For example the proportion children dead in age-group i=1, (15-19) and i=2 (20-24).

$$D_{(1)} = CD_{(1)}/CEB_{(1)}$$
$$= 44/364$$
$$= 0.1209$$

In the same way, the proportion of children born in age-group i=2 is given by:

$$D_{(2)} = CD_{(2)}/CEB_{(2)}$$
$$= 189/2193$$
$$= 0.0862$$

Step 3. Calculation of Multipliers

In the Trussell variant of the original Brass Method of estimating infant and child mortality. The North Model Life Table coefficient has been utilised to calculate $k_{(i)}$.

Table 4. Coefficient for estimation of child mortality multipliers and Trussell variant when data is classified by age of mother (North Model)

Age group	Index	a(1)	b(1)	c(1)	K(1)
15-19	1	1.1119	-2.9287	0.8507	1.0448
20-24	2	1.2390	-0.6865	-0.2745	1.0175
25-29	3	1.1884	0.0421	-0.5156	0.9709
30-34	4	1.2046	0.3037	-0.5656	1.0044
35-39	5	1.2586	0.4236	-0.5898	1.0657
40-44	6	1.2240	0.4222	-0.5456	1.0501
45-49	7	1.1772	0.3486	-0.4624	1.0284

Source: Indirect Technique for Demographic Analysis, Manual X. (UN. 1983:77)

The value of $k_{(i)}$ is used as an adjustment factor to the proportion of children dead and given by:

$$k_{(i)} = a_{(i)} + b\ {}^{p1}/_{p2} + c_{(i)}\ P_2/P_3$$

Where: $a_{(i)}$, $b_{(i)}$ and $c_{(i)}$ are all Trussell's coefficients estimated by the regression analysis of simulated model case which is provided for each of the four different families of model life tables in the Coale-Demeny system.

In this study, the Coale-Demeny 'North Model' is used because it appears to be the most appropriate consistent model and recommended as a first choice by (UN 1992, Kichamu 1986, Ayehu 1993, Akwara 1994, and Eshetu 1995) among others.

Table 4 shows the coefficients for the seven age-groups of women from ages 15-19 through ages 45-49 (i=1.2.3. . 7)

For example: k(1) for age group 15 - 19 applying the equation to data from KDHS 1993 all cases combined where p_1/p_2 =0.149 and p_2/p_3=0.4341

$$k_{(i)} = a_{(i)} + b_{(i)}\ (P_1/P_2) + c_{(i)}\ P_2/P_3$$

$$= 1.119 + -2.9287(0.149) + 0.8507(0.4341)$$

$$= 1.0448$$

Step 4. Calculation of the Probabilities of dying $q_{(x)}$

Estimates of $q_{(x)}$ are obtained by the following equation:

$$q_{(x)} = k_{(x)} \times D_{(i)}$$

Where:

$q_{(x)}$ takes values 1, 2, 3, 5, 10, 15, 20 respectively, as it is related in broad terms to the average age of the children of women in age-group (i). Where i= 1, 2, 3,............7

For example

$q_{(1)}$ for women aged 15-19 will be:

$$q_{(1)} = k_{(1)} \times D_{(1)}$$

$$= 1.0448 \times 0.1209$$

$$= 0.1263$$

Step 5. Calculation of the Reference Period $t_{(x)}$

One of Trussell's Indirect Technique calculates the reference period. This is a situation where mortality is changing smoothly in an estimate of the number of years before the survey date to which the child mortality estimates $q_{(x)}$ in step 4 is referred to. The value of $t_{(x)}$ can be estimated by means of an equation whose coefficients were estimated from simulated cases by using linear regression given by:

$$t_{(x)} = d_{(i)} + e_{(i)} (P_1/P_2) + f_{(i)} (P_2/P_3)$$

Where:

P_1, P_2 and P_3 are the parities of women in the age-groups 15-19, 20-24 and 25-29 respectively. While $d_{(i)}$, $e_{(i)}$ and $f_{(i)}$ are coefficients used in calculating $t_{(x)}$ and are given below in table 5.

Table 5. Coefficients for estimating the reference period $t_{(x)}$ to which the values $q_{(x)}$ estimates from data classified by age refer, North model.

Age-group	Index	Coefficients d(i)	e(i)	f(i)	Reference Time t(x)	Date
15-19	1	1.0921	5.4732	-1.9672	1.1	1992.2
20-24	2	1.3207	5.3751	0.2133	2.2	1991.1
25-29	3	1.5996	2.6288	4.3701	3.9	1989.4
30-34	4	2.0779	-1.7908	9.4123	5.9	1987.4
35-39	5	2.7705	-7.3403	14.9352	8.2	1985.1
40-44	6	4.1520	-12.2448	19.2349	10.7	1982.6
45-49	7	6.9650	-13.9160	19.9542	13.6	1979.7

Source: Indirect Technique for Demographic Analysis, Manual X, (UN 1983 P. 78).

To estimate the Reference period t(x)

For example,

$$t_{(3)} = d(i) + e(i) [P_1/P_2] + f(i) [P_2/P_3]$$

$$= 1.5996 + (2.6268 \times 0.149) + (4.3701 \times 0.4341)$$

$$= 3.88805361$$

The estimate of $q_{(3)}$ obtained from the proportion of children dead among those ever born by women aged 25-29 would refer to a period approximately 4 years before the survey. Since the survey's field work was carried out mid-February to mid-August 1993, the survey reference data can be taken to be 1993.25 - 15 May corresponds to day number 91 in the year which divided by the total number of days in a year is 91/365 = 0.25. Therefore, the reference date for the estimated $q_{(3)}$ is:

$$1993.25 - 3.9 = 1989.35$$

$$= 1989.4$$

The other values of $t_{(i)}$ and the reference dates calculated from them are shown in column 6 and 7 of table 5.

Step 6. Conversion to a common Index

This is an important index for the study of trends in infant and child mortality. The $q_{(x)}$ value obtained in Step 4 needs to be converted to a common index. Under Five mortality, $q_{(5)}$ will be used here as the common index. The conversion is carried out by interpolating between the $q_{(x)}$ values of the Coale Demeny life tables presented. The table used for interpolation is the North Model and both sexes combined with a sex ratio at birth of 1.05

For example, considering the conversion of the estimated $q^e(1)$ to a $q^c(5)$ according to the North Model. The estimated value of $q^e(1)$ is 0.1263, according to the table this value falls between q(1) of level 12, $q^{12}(1)$ = 0.12744, whose $q^{12}(5)$ equivalent is 0.21533 and that of level 13 is $q^{13}(1)$ = 0.11503, whose $q^{13}(5)$ equivalent is 0.19235. Substituting the $q^j(1)$ and of $q^e(1)$ values to find h, in the interpolation factor, the results are thus:

$$h = \frac{0.1263 - 0.12744}{0.11503-0.12744} = \frac{-0.00114}{-0.01241}$$

$$= 0.09186$$

The estimated $q^c(5)$ equivalent for the estimated $q^e(1)$ = 0.1263 is derived as follows:

$$q^c(5) = (1-0.09186) \times [(0.21533 + (0.09186)(0.19235)]$$

$$= 0.213219057$$

That is in the North model life tables, the $q^c(5)$ corresponding to a $q^e(1)$ of 0.1263 is 0.2132. The complete set of q^c (5) values equivalent to the estimated q(x) values is shown in column 7 of table 6 below.

Table 6. Application of Trussell version of the Brass Method of conversion of a common index using data on both sexes from the 1993 KDHS data

Age-group	Index (i)	$q_{(x)}$	Age (x)	Time Reference	Reference Date	Common Index $q_{(5)}$
15-19	1	0.1263	1	1.05	1992.2	0.213
20-24	2	0.0877	2	2.21	1991.1	0.113
25-29	3	0.0839	3	3.89	1989.4	0.096
30-34	4	0.1045	4	5.90	1987.4	0.105
35-39	5	0.1221	5	8.16	1985.1	0.106
40-44	6	0.1333	6	10.68	1982.6	0.295
45-49	7	0.1476	7	13.55	1979.7	0.738

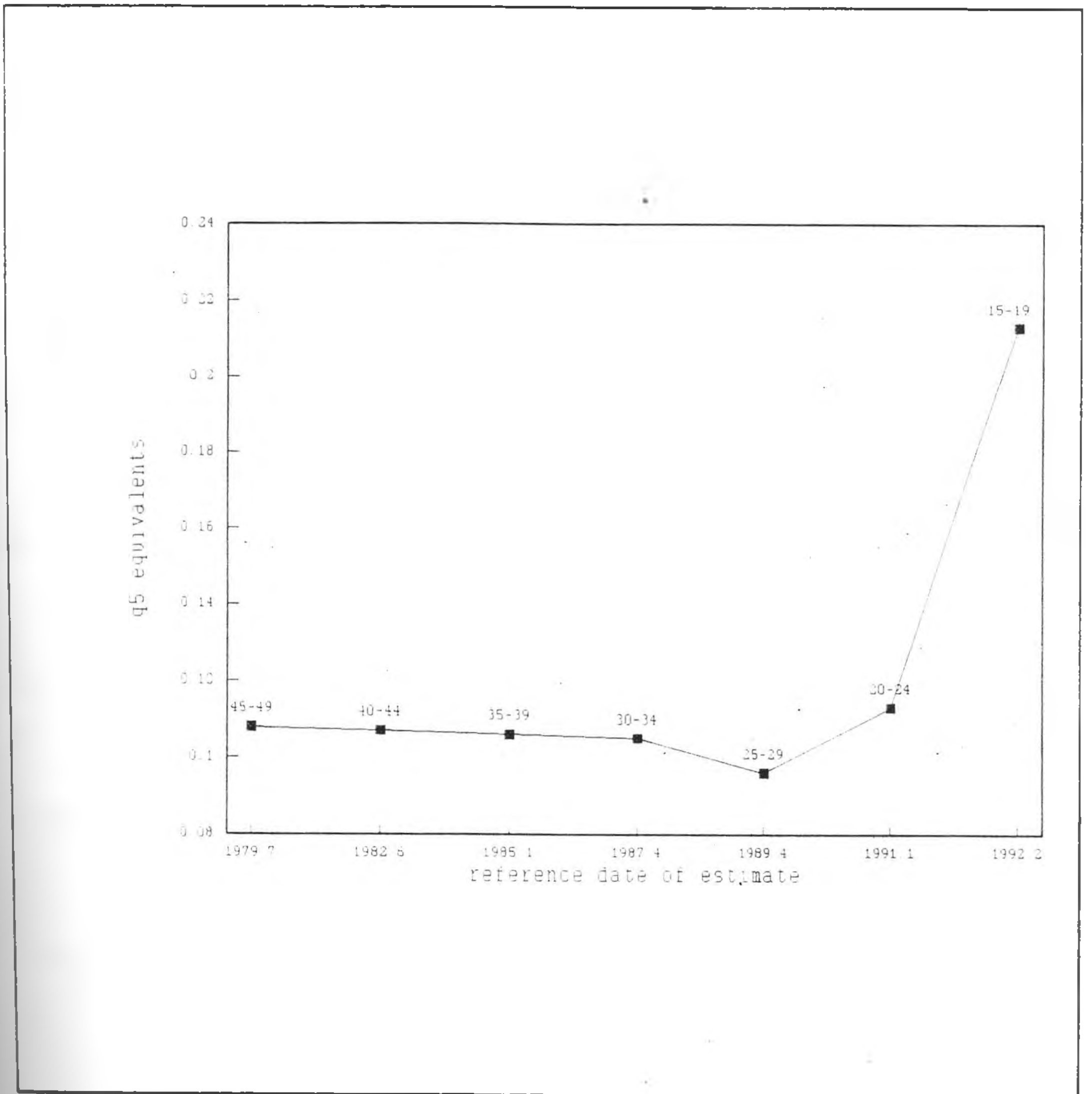
Source: primary Analysis of the 1993 KDHS Data

Step 7. Results of the Common Index

For interpretation, the common Index is plotted against the

Figure 4. Under five mortality (q5). for both sexes in Kenya. 1993

National level estimates



reference date for each estimate as shown in figure 4. Figure 4 depicts that the estimated q(5)values are fairly similar for most of the period 1979-1991 and increase after 1991. It further indicates that the estimates referring to a recent period 1991 onwards are those derived from reports of younger women in age groups 15-19 and 20-24 and hence reflect higher than average risks of their infants dying. As a result the figure fails to reflect the actual trend of under five mortality. But we can establish with a high degree of confidence that during the period 1985-1989 under five mortality was nearly 0.096 i.e one out of every ten children born could die before reaching the fifth birthday.

Furthermore, we can draw another conclusion from the estimates available that mortality in childhood in Kenya probably changed much during the 1978's.

5.2.3 Calculation of mortality levels and construction of the Life Tables

The Life Table is an important tool of demographic analysis that describes the mortality experience of a birth cohort as it is diminished through specific schedule of Age Specific Mortality. According to the UN Manual X V.2. 1983. the probability of surviving from birth to exact age x. i.e the component q(x) is denoted as l(x).

The number of survivors to age exact age x in a stationary population is denoted by l(x) with radix l(o). The Trussell version of the Brass Method of q(x) values corresponding to the model life table family being considered can be used to construct the life table.

In the construction of the life table, the computation P(x) is the probability of a person aged x surviving through the interval x to x+n years. i.e Px = 1 - q(x), where q(x) values are Trussell version of the Brass probability of a person aged x dying at age x. Hence the study makes use of the values q(2), q(3) and q(5) of which a life table for the division can be constructed.

a) Step 1. Calculation of P(x) values

P(x) is the probability of surviving at a certain age. The formula is given by:

$$P(x) = 1 - q(x)$$

For example,

$$P(1) = 1 - q(x)$$
$$= 1 - 0.1263$$
$$= 0.8737$$

P(x) values for all the age-groups in the age range 15-49 are calculated using the formula above i.e P(x) = 1 - q(x).

Table 7. Actual P(x) values for all cases, 1993 KDHS

x	q(x)	P(x) = [1 - q(x)]
2	0.0877	0.9123
3	0.0839	0.9161
5	0.1045	0.8955

Table 8. The Lower and Upper values of P(x) used in calculating Mean Mortality level for all the combined cases, 1993 KDHS

x	Actual P(x)	Lower Level	Upper Level	Lower P(x)	Upper P(x)	Implied Level
2	0.9123	17	18	0.91162	0.9246	17.05239
3	0.9161	18	19	0.91585	0.92985	18.01786
5	0.8955	19	18	0.88633	0.90354	17.53283

The implied level is calculated by the Interpolation as shown below:

$$\text{Implied Level} = \text{Lower Level} + \frac{\text{Actual } P(x) - \text{Lower } P(x)}{\text{Upper } P(x) - \text{Lower } P(x)}$$

For example for q(2), the implied Level is thus:

$$17 + \frac{0.9123 - 0.91162}{0.9246 - 0.91162} = \frac{0.00068}{0.01298}$$

$$= 17.05239$$

The Mean Mortality Level is calculated by dividing the implied levels of q(2), q(3) and q(5) by 3 as follows:

$$\text{Mean Mortality Level} = \frac{17.05239 + 18.01786 + 17.53283}{3}$$

$$= 17.53436$$

b) Step 2. Calculation of P(x)

The Interpolation is achieved by obtaining levels from Coale and Demeny North Models for five year survivorship probabilities from Manual X, UN 1983.

The formula below is used:

$$\text{Interpolation } P(x) = \text{Lower } P(x) + [\text{Upper } P(x) - \text{Lower } P(x)] \frac{[\text{Average Level} - \text{Lower Level}]}{\text{Upper Level} - \text{Lower level}}$$

For example, for all the cases combined from KDHS data 1993.

When x=1, interpolated P(x) is:

$$= 0.92764 + \frac{(0.93737 - 0.92764)(17.53436 - 17)}{18 - 17}$$

$$= 0.932839322$$

Table 9. Interpolated values of P(x) for the construction of the Life tables (All cases combined 1993. KDHS)

Age (x)	Lower P(x) value	Upper P(x) value	Interpolated P(x) value
1	92764	.93737	.932839322
5	.88633	.90354	895526335
10	.86868	.88879	.879425979
15	.85853	.88008	.870045458
20	.84564	.86855	.857882187
25	.82851	.85307	.841633881
30	.81027	.83656	.824318324
35	.79063	.81877	.80566689
40	.76884	.79897	.784940266
45	.74319	.77531	.760353643
50	.71346	.74747	.731633583
55	.67473	.71031	.693742528
60	62635	.66353	.646217504
65	.56009	.59829	.580502552
70	.47082	.50874	.491082931
75+	.35709	39234	.367155306

c) Step 3. Construction of Life Table

Using the actual P(x) values obtained in Table 8 above. the other values of the Life table are obtained.

1) lx

This denotes the number of survivors of a cohort of live born babies to the exact age x. The initial value of the survivors column is l(o) also known as the Radix. It can be conveniently taken as 1000. 10 000 or 100 000. The Radix is arbitrarily assumed. P(x) is the interpolated value in table 8.

for example:

Suppose l_0 = 100 000. then $l_1 = l_0 \times P(1)$

= 100 000 X .932839322

= 93283.9322

2) nPx

This denotes the probability of a person aged x surviving through the interval x to x+n years given by:

$$nPx = l_{x+n}/l_x$$

For example:

$$5P_5 = l_{10}/l_5$$

$$= \frac{87942.598}{89522.634}$$

$$= .982021344$$

3) nqx

This denotes the probability of a person aged x dying within the interval x to x+n.

$$nqx = 1 - nPx$$

For example:

$$5q_5 = 1 - .982021344$$

$$= 0.017978656$$

4) ndx

This denotes the deaths experienced by the life table cohort within the interval x to x+n years and is given by:

$$ndx = l_x - l_{(x+n)}$$

For example:

$$5dx = 89552.634 - 87942.598$$
$$= 1610.036$$

5) nLx

This denotes the number of person years lived by the cohort during the interval x to x+n years:

$$nLx = \frac{n}{2} (l_x + l_{(x+n)})$$

For example:

$$5L_5 = 2.5 [(89522.634) + (87942.598)]$$
$$= 443738.08$$

However, for developing countries the probability of dying in the first year of life (1q0) is calculated for the estimation of the nLx column for under 1, we have:

$$L_0 = 0.3l_0 + 0.7 l_1$$

For example:

$$L_0 = (0.3 X 100 000) X [0.7 (93283.932)]$$
$$= 95298.752$$

For age 1-4 age-group.

$$4L_1 = 1.3l_1 + 2.7l_5$$

For example $4l_1 = 1.3(93283.9322) + 2.7(89552 634)$
$$= 363061.224$$

For age group 75 years.

$$L_{75} = L_{75} \log 10 L_{75}$$

For example:

$$L_{75} = 36715.531 (4.564849814)$$
$$= 167600.885$$

6) Tx

This denotes the total number of years lived by the life tables cohort from age x to the end of the life span. It is derived directly from the nLx column by summation of the nLx starting with the beginning or at the terminal of the stationary population. It is thus a cumulative type of distribution of the nLx column

$$Tx = T_{(x+n)} + nLx \text{ and } T_{75} = L_{75}$$

For example:

$$T_{70} = T_{75} + 5L_{70}$$
$$= 16700.885 +214559.56$$
$$= 382160.445$$

7) e_x

• This denotes the expectation of life remaining to persons who have attained the exact age x i.e the average period in years lived beyond age x by persons attaining exact age x.

e_0 is the life expectancy at birth.

$$e_x = \frac{T_x}{l_x}$$

For example:

$$e_0 = \frac{T_x}{l_x} = \frac{T_0}{l_0}$$

$$= \frac{5825354.134}{100\ 000}$$

$$= 58.2535$$

The value e_0 is of special interest. It is frequently used as a convenient summary of mortality experience depicted by the life table. The table below gives the complete Life Table for 1993 KDHS data for all cases combined.

Table 10. An abridged Life table for Kenya 1993 KDHS Data for all cases combined- North Model

Age-group	nqx	nPx	lx	ndx	nLx	Tx	E_x
0	06716068	.93283932	100 000	6716.068	95298.752	5825354.134	58.2535
1	039999364	960000635	93283.932	3731.298	363061.224	5730055.382	61.14259
5	017978656	982021344	89552.634	1610.036	443738.08	5366994.158	59.931170
10	010666639	989333360	87942.598	939.052	437367.86	4923256.078	55.982609
15	013980039	986019960	87004.546	1216.327	431981.9125	4485888.218	51.55923942
20	018940024	981059975	85788.219	1624.831	424879.0175	4053906.306	47.25481369
25	020573744	979426256	84163.388	1731.556	416488.05	3629027.288	43.11883557
30	022626489	977373510	82431.832	1865.143	407496.3025	3212539.238	38.9720713
40	.025726041	974273958	80566.689	2072.662	397651.79	2805042.935	34.81641073
45	031322931	968677068	78494.027	2458.663	386323.4775	2407391.145	30.66973676
50	037771976	962228023	76035.364	2872.006	372996.805	2021067.668	27.89580475
55	051789654	948210345	73163.358	3789.105	356344.0275	1648070.863	22.5290515
60	068505285	931494714	69374.253	4752.503	334990.0075	1291726.835	18.6196864
65	101691690	898308309	64621.75	6571.495	306680.0125	956736.8275	14.80518289
70	154038289	845961710	58050.255	8941.962	267896.37	650056.815	11.19817329
75+	252355788	.747644211	49108.293	12392.762	214559.56	382160.445	7.781994072
	1	0	36715.531	36715.531	16700.885	167600.885	4.564849818

5.3 DIFFERENTIALS BY MATERNAL EDUCATION

As shown in the table 11 below, mortality levels differ with the level of education of the mothers. Infant mortality rate in column 2 is high for those infants whose mothers had no education at all. These infants have a life expectancy at birth of 55.27 years. Likewise, the level of mortality drops for those infants whose mothers had primary level of education and have a life expectancy at birth of 57.75 years, displaying a gain of 2.48 years.

Table 11. Mortality Estimates by Maternal Education 1993

Education Level	*1q0	*4q1	*q2	*q3	*q5	e_0
No Education	80	51.48	82.9	106.4	155.3	55.27
Primary	69	42.05	95.3	93.1	96.8	57.75
Secondary	45.06	21.61	60.3	51.5	63.1	63.82

* Expressed per 1000
Source: Primary analysis of the KDHS 1993, Data

The infant mortality rate (1q0) for those infants whose mothers have no education is almost double that of those infants whose mothers have attained secondary education. The life expectancy at birth is 63.82 compared to 55.27 for infants born to mothers with no education. This displays a gain of 8.55 years.

Moreover, the child mortality rate 4q1 as shown in column 3 is highest for infants whose mothers had no education compared to those whose mothers had secondary education and above.

Infant and child mortality decreases with the increase in the level of education of the mothers. The children with mothers of higher level of education have a better chance of survival than those whose mothers have lower level of education. These results are consistent with the analysis of Ocholla-Ayayo (1995:94). He concludes that the higher the level of education, the higher the survival of the infants and children.

The information presented confirms the hypothesis that an infant and child's probability of dying is inversely related to the mother's years of schooling.

In addition, the inverse association of mother's education to infant and child mortality has been confirmed by K'Oyugi (1983), Ondimu (1988), Oyoo (1991), Ikamari (1996) among others.

Education plays a great role where health care systems are uncommon since the knowledge of basic and curative procedures may be more readily achieved. Apart from this, the schooling undermines their belief in traditional remedies. The educated mothers are less fatalistic and able to deal with the modern world and are more aware of simple hygienic measures (Ocholla-Ayayo, 1991 p 71).

When we consider q2, q3 qnd q5 value, the patters are similar to those obtained, except the q2 value for primary education which is 95 per 1000 while that for no education is 83 per 1000. Primary level of education has a relatively higher estimate than no education by 12 per 1000. This indicates that not only education has a great influence on infant and child mortality but environmental factors, income and wealth, ethnicity and religion sometimes also play a significant role.

5.4 DIFFERENTIALS BY HUSBAND'S EDUCATION

Husband's education as a variable has great influence on infant and child mortality. The estimate is 89.81 per 1000 and 45.96 per 1000 for infant whose fathers had no education and secondary education respectively. This is approximately double that of infants those fathers had no education compared to that of those infants whose fathers had secondary level of education.

Table 12. Mortality estimates by Husband's Education 1993

Education level	1q0*	4q1*	q2*	q3*	q5*	e_0
No education	89.81	60.78	108.2	99.8	184.3	53.22
Primary	48.94	24.75	77.6	97.5	113	62.41
Secondary	45.96	22.34	49	61.3	71.3	63.56

*Expressed per 1000
Source: Primary analysis of the KDHS Data 1993

It can be observed from the table above that life expectancy at birth is 53.22 for infants whose fathers had no education and 63.56 for those whose fathers had secondary level of education. This shows an increase of by 10 years with an advance on no education to secondary education.

The decline in infant and child mortality and an increase in life expectancy is achieved greatly by secondary education than primary education. This implies that secondary education is an important factor for infant mortality

A similar general tendency is also observed for q2, q3 and q5. As shown q2 for no education and secondary and above is 108.2 per 1000 and 49 per 1000 respectively.

One clear pattern noted is that infant and child mortality is low for those infant whose fathers attain higher educational level. The possible explanation to support this result is asserted by Ikamari (1996) who found that due to selective marriage, the better educated men were more likely to marry the better educated women.

However, the difference in the q3 value between no education and primary education is very small and insignificant. At the same time the life expectancy at birth for those infants whose fathers had primary level of education and those with secondary level of education are almost the same, the difference being a year.

Education is one of the socio-economic factors that affect infant and child mortality. Besides, it is indicative that what really influences infant and child mortality estimates is the educational level of both the mothers and fathers. The interplay of the characteristics imply that the educated are wealthier, can be expected to be better nourished and are more likely to have recognized that the medical interventions are essential for the survival of their children. These results are in agreement with those from the study of Ikamari (1996).

5.5 DIFFERENTIALS BY THE PLACE OF RESIDENCE

The table below reflects that infant and child mortality in column 2 and 3 is lower in urban and higher in rural areas, i.e 58.92 per 1000 and 70.28 per 1000 respectively. While the life expectancy at birth is 62.55

and 56.48 for urban and rural areas respectively, showing a difference of 6.07 years.

Table 13. Mortality estimates by Place of Residence 1993

Place of Residence	*1q0	*4q1	*q2	*q3	*q5	e_0
Urban	58.92	32.98	70	77.8	91.6	62.55
Rural	70.28	42.71	90.6	85.8	106	56.48

*Expressed per 1000
Source: Primary Analysis of the KDHS 1993

The results of q2, q3 and q5 show the same pattern with high child mortality in the rural areas and low in the urban areas.

One of the major causes of all the differentials in infant and child mortality is the resource allocation in the urban and rural areas. For example in the National Development Plan (1996:158) it is reflective that there is an over concentration of essential medical personnel in urban areas with over 80% of the physicians being based in the urban areas which account for 20% of the total population.

In addition, the Plan explains that out of every projected 67% expenditure, the distribution for rural preventive health care accounted 21% of the total expenditure. This implies that medical expenditure is low for rural areas, thus the distribution of health expenditure favours the urban areas.

Based on these results a number of observations can be made. The results are consistent with the analysis of K'Oyugi (1983) and Ikamari (1996) that there is lower infant and child mortality in the urban areas as compared to the rural areas. This further suggests that the low infant and child mortality can be as a result of better sanitation, housing, shorter distances to health centres higher income levels.

5.6 DIFFERENTIAL BY WORK STATUS OF MOTHER

As shown in the table below, infant and child mortality is low for infants and children whose mothers are not working. The values of 1q0 is estimated at 65 per 1000 and 71 per 1000 for infants whose mothers were not working and those whose mothers were working respectively. Furthermore, the life expectancy at birth estimates are nearly the same for the infants with working mothers i.e 57.47 and 58.83 for infants with non-working mothers.

Table 14
Mortality estimates by Work status of the mother

Work Status	*1q0	*4q1	*q2	*q3	*q5	e_0
Not working	64.98	38.11	105.1	90.1	70	58.83
Working	70.71	43.09	93.5	93.7	104.7	57.47

*Expressed per 1000
Source: Primary analysis of KDHS Data 1993

The values of q3 and q5 follow the same trend as that of 1q0 and 4q1. These results are consistent with the suggestion of UN (1986) that the limited amount of time that could be devoted to breast-feeding and lack of care that working mothers could give to their children may have been a factor in the higher infant and child mortality of the infants of these mothers.

But the value for q2 is different from the results of the others. It is estimated at 94 per 1000 and 105 per 1000 respectively for those infants whose mothers were working and those whose mothers were not working.

From the observations, it is indicative that there is inconsistency in the infant and child mortality differentials for those infants whose mothers were not working and those with working mothers.

5.7. TRENDS IN CHILDHOOD MORTALITY

The common index q(5) is used to determine the trends of child mortality at national level using the variables educational level of fathers and mothers, rural/urban residence and work status of mothers.

Each variable has experienced estimated q(5) values fairly similar for most of the period 1983-1991 and increased after 1991 for majority of the variables. The estimates in the 1991 period are not wholly accurate as the reports derived the women in the age-groups 15-19 and 20-24 reflect higher than average risk of dying of infants and children born to these women (Appendix 5).

The mortality rate of the children whose mothers have secondary and above education showed a general decline compared to their counterparts born to mothers who had no education and those born to mothers with primary education. Besides, during the 1986-1991 period, under five mortality was approximately 0.0582 i.e during late 1984 slightly more than one out of every 20 children born could die before reaching the fifth birthday (Appendix 5 - Fig.5).

The most interesting observation is that in the variable- rural/urban residence, there is very small and negligible difference in the estimates during the period 1985-1989 (Appendix 5 - Fig.6).

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 SUMMARY

The objective of this study was to estimate infant and child mortality differential with the associated socio-economic variables in Kenya during the period covered by the data sources. In the underlying conceptual framework, individual level, household and community level variables as determinants operate in their own right as well as indirectly through variables that are social and economic factors. The operational model consisting of four variables used to formulate the operational hypothesis and the results used to assess the contribution of each variable in Kenya to the declines in the level of infant and child mortality.

The mortality measures used in the study was Trussell version of the Brass method to derive estimates of various values of q(x) the probability of dying between birth and exact age x - from the observed proportions of children dead. The study population consisted of education of mothers and fathers, working status of mothers and rural/urban mothers residence extracted from 1993 Kenya Demographic Health Survey (KDHS) data. The differentials of infant and child mortality by the most important parameters discussed in the previous chapter are summarized as follows.

Table 15 INFANT AND CHILD MORTALITY DIFFERENTIALS IN KENYA BY DIFFERENT VARIABLES.

VARIABLES	PARAMETERS					
	1q0*	4q1*	q2*	q3*	q5*	e
ALL CASES COMBINED	67.16	39.99	[illegible]	83.9	104.5	58.25
EDUCATION OF MOTHERS						
NONE	80	51.48	82.9	106.4	155.3	55.27
PRIMARY	69.52	42.05	95.3	93.1	96.8	57.75
SECONDARY+	45.06	21.61	60.3	51.5	63.1	63.82
EDUCATION OF FATHERS						
NONE	39.81	60.78	108.2	99.3	184.3	53.22
PRIMARY	48.94	24.75	77.6	97.5	113	62.41
SECONDARY+	45.36	22.34	49	61.3	71.3	63.56
PLACE OF RESIDENCE						
RURAL	70.28	42.71	98.6	85.8	106	56.48
URBAN	58.92	32.98	70	77.3	91.6	62.55
WORKING STATUS OF MOTHERS						
NON WORKING	64.98	38.11	105.1	90.1	70	58.83
WORKING	70.71	43.09	93.5	93.7	104.7	57.47

Note: * Expressed per 1000
Source Primary analysis of the 1993 KDHS data

6.2 CONCLUSIONS

Although the results obtained are not peculiar from earlier finding that have established; the main conclusions about these differentials are as follows:-

That education of mothers and fathers had the greatest total effect on differences in infant and child mortality.

The results got for child mortality by proportion of children dying from birth to age two for whose mothers belonging to no education and secondary education was found the level of child mortality decreased from a high of 82.9 per 1000 among whose mothers with no education to a low of 60.3 per 1000 among whose mothers with secondary and above. Life expectance at birth rises from 55.2 to 63.8 for whose mothers no education and secondary level respectively.

As hypothesized this was inversely related to infant and child mortality. This portrays child mortality decrease with increase in education level of mothers. This is consistent with the analysis of K'Oyugi (1992:115).

Our main findings, for child mortality by proportion of children dying from birth to age 2 for fathers belonging to no education and secondary was found 108.2 per 1000 and 49 per 1000 respectively. This is more than doubled contributing to the decline in their infant and child mortality. In addition, the beneficial effect of fathers' education on child survival appears to have become stronger. Therefore, further advances in education should lead to further improvements in child survival prospects. Similarly the analysis of Ikamari (1996: 135-143) found that education of fathers more influential in affecting child mortality in low-mortality. The life expectancy at birth rises from 53.2 to 63.5 for fathers belonging to no education and secondary level respectively.

As indicated that most of the decline in infant and child mortality could be accounted for increased education of both mothers and fathers playing a prime role and place of residence play a secondary role. The importance of knowledge about the influence these variables exert on infant and child mortality is essential for formulating and implementation of development policies designed to improve conditions of health.

As hypothesized rural/urban residence has a significant effect on infant and child mortality. The proportions of children dying from birth to age two were 90.6 per 1000 and 70 per 1000 for rural and urban resident mothers respectively. As was pointed out in chapter two this confirm the results of the study done in Kenya by (K'Oyugi, 1983 and Ikamari, 1996) and others.

The other variable was found to be working status of mothers. The probability of children dying from birth to age two were 105 per 1000 and 93.5 per 1000 for non working and working mothers respectively. It explained as the non working mothers increase in child mortality than the working mothers. This q2 values varies from the other results. On this account, there is inconsistency in the variable.

6.3 RECOMMENDATIONS

Several research studies have demonstrated that the education of a mothers is one of the most important determinants of infant and child welfare and survival. The overview of this study provide mothers education need to be accelerated to secondary and above level to achieve this aim. The exclusion of important factors in the modelling such as cultural, demographic and environmental factors affects the strength of the results. Thus the study recommended further investigation by considering this factors on the infant and child mortality.

The limitation of Trussell were mentioned in chapter four. Apart from this. Trussell does not give a good estimate of infant and child mortality since it assumed constant fertility and mortality in the preceding survey. Therefore, the study recommends other statistical tools and regression methods on the infant and child mortality.

Last but not least in order to ease child mortality the government should advance child survival improvements of working status for lactating mothers is paramount importance, for example providing of breast feeding places, breaks, job security and paid maternity leaves for mothers.

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APPENDIX 1 Estimation of Infant and child mortality and the life table paternal Education A No Education

Age group	POP	CEB	CD	Age group Index(i)	Average Parity P(i)	Proportion dead(I)	Multiplier K(i)	Age of Children	q(x)
15-19	18	14	1	1	0.7778	0714	3751	[illegible]	0268
20-24	53	103	16	2	1.9434	1553	6965	2	1082
25-29	87	330	35	3	3.7931	1061	9410	3	0998
30-34	119	613	109	4	5.1513	1778	1.0363	5	1843
35-39	105	671	107	5	6.3905	1595	1.1259	10	1796
40-44	141	980	162	6	6.9504	1653	1.1134	15	1840
45-49	126	946	164	-	7.5079	1734	1.0798	20	1372

P1/P2 = 4002 [illegible] 5124

Age group	qx	nPx	lx	ndx	Lx	Tx	ex
0	08981191	91018809	100000	3981.191	93713 166	5322785.70	53.2278570
1	060783019	939216981	91018 809	5532.398	349137 762	5229072.53	57.4504609
5	026718410	973281589	85486.411	2284 061	42171.9025	4879934 77	57 0843332
10	015150701	984849298	83202.35	1260 574	412860.315	4458212.37	53 5827758
15	018461242	981538757	81941 776	1512.747	405927 013	4045352 55	49 3686188
20	024568890	97543109	80429.029	1976 052	397205.015	3639425 54	45.2501489
25	026800997	973199003	78452 977	2102 618	387008.34	3242220.52	41.3269279
30	003328026	996671973	76350.359	254 096	381116.555	2855212.19	37.3961855
35	058965497	941034502	76096 263	4487 054	369263.68	2474095 63	32.5127087
40	039905733	960094266	71609 209	2857 618	350902	2104831 95	29.3933138
45	047069383	952930616	68751 591	3236.095	335667 717	1753929 95	25.5111180
50	062052449	937947550	65515.496	4065 397	317413 988	1418262.24	21 6477371
55	081621886	918378113	61450 099	5015 673	294711.312	1100848 24	17 9145073
60	118357932	881642067	56434 426	6679 462	265473 475	806136 936	14 2844889
65	175471054	824528945	49754 964	8730.556	226948 43	540663 461	10 8665230
[illegible]	262676599	737323400	41024 408	10776 152	178181 66	313715.031	7 64703371
[illegible]			30248 256	30248 256	135533 371	135533 371	4 48070034

B. Primary Education

Age group	FPOP	CEB	CD	Age group Index(i)	Average Parity P(i)	Proportion Dead D(i)	Multiplier K(i)	Age of children (x)	q(x)
15-19	163	133	20	1	3160	1504	3311	1	0498
20-24	307	394	95	2	1.9606	0956	8119	2	0776
025-29	456	1736	180	3	3.8070	1037	9404	3	0975
30-34	527	2751	299	4	5.2201	1087	1.0397	5	1130
35-39	392	2564	314	5	6.5408	1225	1.1312	10	1386
40-44	378	2742	341	6	7 2540	1244	1.1182	15	1391
45-49	245	2015	282	7	8.2245	1400	1.084	20	1518

P1/P2 = .162 P2/P3= .5150

Age group	qx	nPx	lx	ndx	[illegible]	Tx	ex
0	048947	95105353	100000	4894 647	95154 986	6241840 67	62.4184067
1	024752486	975247513	93078.551	2354.094	361813.402	6145266.93	64.6153632
5	011448599	988551400	89189 365	1061.872	461101.615	5771201.57	62.2223529
10	007231774	992768225	87518.116	663.077	456789.243	5310099 96	57 9140087
15	010401772	989598227	86549 668	946.835	452764 463	4853310 71	53.3176695
20	014422430	985577569	85304 634	1299.165	447149.463	4400546.25	48.8518195
25	015563743	984436256	83644 976	1381 754	440447.165	3953396 79	44 5301079
30	017058233	982941766	81876 903	1490.865	433265.617	3512949 62	40.1945957
35	019386890	980613109	79972 71	1665.483	425374.743	3079684 01	35.8487757
40	024246183	975753816	77858.04	2042.552	416104.66	2654309 26	31 5080685
45	029982692	970017307	75357 375	2464 567	404836.863	2238204 60	27 2288803
50	042979170	957020829	72445.475	3426 948	390108.075	1833367 74	22 9932362
55	.057229817	942770182	68623 23	4367.101	370622 953	1443259.66	18.9135738
60	087222328	912777671	63836.955	6274 365	344018.037	1072636 71	14 9099416
65	135155915	864844084	57243.93	8875.172	306142.945	728618 674	11 0957989
70	209507252	790492747	48307.873	11398 127	254209 697	422475 729	7 43913131
75		0	36848.562	44892.376	168266.031	168266 031	3 74816777

SECONDARY AND ABOVE

Age group	POP	CEB	CD	Age group Index(i)	Average Parity P(i)	Proportion Dead D(i)	Multiplier K(i)	Age of children (x)	q(x)
15-19	94	74	10	1	.7872	1351	3071	1	0415
20-24	446	779	50	2	1 7466	0642	7634	2	0490
25-29	501	1445	99	3	2 8842	0685	8952	3	0613
30-34	371	1484	106	4	4.0000	0714	9990	5	0713
35-39	196	1096	62	5	5 5918	0566	1.0923	10	0618
40-44	96	639	53	6	6.6563	0829	1 0839	15	0899
45-49	53	341	34	[illegible]	6.4340	0997	1 0543	20	1051

P1/P2 = 450 [illegible] = 5056

Secondary and above

Age group	qx	nPx	lx	ndx	Lx	Tx	ex
0	04596411	95403589	100000	4596.411	96782 512	6356092 38	63 5609238
1	022338509	97766149	95403.589	2131.174	375860.187	6259309 87	65.6087463
5	010411320	989588679	93272 415	971 089	463934 353	5883449 69	63.0781317
10	006679828	993320171	92301 326	616 557	459965.237	5419515.33	58 7154656
15	016429642	983570357	91684 769	1506.348	454657 975	4959550 10	54 0935005
20	00706251	99293749	90178.421	636 886	449299 89	4504892.12	49 9553227
25	.014751768	985248231	89541 535	1320 896	444405 435	4055592.23	45 2928602
30	016148466	983851533	88220 639	1424 628	437541 625	3611136.30	40.9335823
35	018359484	981640515	86796 011	1593 53	429996.23	3173645.17	36 5644127
40	023088963	976911036	85202 481	1967.237	421094 313	2743648.94	32.2015146
45	028696714	971303285	83235 244	2388 578	410204 775	2322554.63	27 9034999
50	041519040	958480959	80846 666	3356.676	395841 54	1912349 85	23.6540348
55	055354659	944645340	77489 990	4289 432	376726.37	1516508.21	19 5703756
60	084816675	915118332	73200.558	6208 628	350481 22	1139781 84	15 5706715
65	131994376	868005624	66991 930	8842 558	312853 255	789300 62	11.7820254
70	205341718	794658281	58149.372	11940.492	260895 63	476447 37	8 19350840
75	1	0	46208 88	46208 88	215551.74	215551.74	4 66472544

APPENDIX 2

Estimation of Infant and Child Mortality and life tables: Mothers Education

A No Education

Age group	FPOP	CEB	CD	Age group Index(i)	Average Parity P(i)	Proportion Dead D(i)	Multiplier K(i)	Age of children (x)	q(x)
15-19	60	30	3	1	5000	1000	7585	1	1759
20-24	82	156	14	2	1 9024	0897	9243	2	0829
25-29	142	552	62	3	3.8873	1123	9472	3	1064
30 34	235	1246	192	4	5 3021	1541	1.0076	5	1553
35-39	262	1622	211	5	5 1908	1301	1.0813	10	1407
40-44	269	1878	267	6	6 9814	1422	1 068	15	1519
45-49	247	1974	339	7	7 9919	1717	1.0425	20	1790

P1/P2 = 1628   P2/P3= 4894

B No education

Age Group	qx	nPx	lx	ndx	Lx	Tx	ex
0	08000106	91999894	100000	8000.106	94399 926	5527035 53	55.270355
1	0514817	94851830	91999 894	4736 311	349811.536	5432635 61	59 050455
5	022837235	977162764	87263.583	1992.859	431335.767	5082824 06	58.246795
10	013177418	986822581	85270 724	1123 628	423544 5	4651488 30	54.5496517
15	01651992	983480079	84147076	1390.103	417260.123	4227943.80	50.2446906
20	02213965	977860343	82756973	1832.211	409204 338	3810683.68	46 0466779
25	024105798	975894201	80924 762	1950 756	399746.92	3401479 34	42.0326147
30	026550407	973449593	78974.006	2096.792	389628.05	30017332.4	38 0091193
35	030179189	96982081	76877 214	2320 092	378535.84	2612104 37	33 9776148
40	036244947	963755052	74557 122	2702.319	366029 81	2233518.53	29.9577145
45	043107654	956892345	71854 303	3097 492	351530.285	1867488.71	25.9897549
50	057722181	942277818	68757 311	3968 822	333864 5	1515958 43	22.0479598
55	07609452	923905479	64788.489	4930.049	311617 322	1182093 93	18.2454314
60	111324735	888675264	59858 440	6663 725	282632.888	870476 612	14 5422533
65	166540886	833459113	53194 715	8859 095	243825 838	587843 724	11.0507918
70	250921696	749078303	44335 620	[illegible] 769	193866 178	344017.886	7 75940172
75	1	0	33210 351	33210 351	150151 709	150151 709	4 52116415

B. Primary Education

Age group	FPOP	CEB	CD	Age group Index(i)	Average Parity P(i)	Proportion Dead D(i)	Multiplier K(i)	Age of children (x)	q(x)
15-19	1350	294	37	1	0.2178	0.1259	1.1012	1	.1386
20-24	1005	1618	151	2	1.6100	0.0933	1.0217	2	.0953
25-29	636	2259	219	3	3.5519	0.0969	.9604	3	.0931
30-34	593	2842	278	4	4.7926	0.0978	.9893	5	.0968
35-39	363	2314	282	5	6.3747	0.1219	1.0485	10	.1278
40-44	330	2381	282	6	7.2152	0.1193	1.0338	15	.1233
45-49	172	1319	147	7	7.6686	0.1114	1.0148	20	.1130

P1/P2 = .1353 P2/P3 = .4533 sex ratio at birth = 1.05

B. Primary

Age group	qx	nPx	lx	ndx	Lx	Tx	ex
0	.06952341	.93047659	100000	6952.341	95133.361	5775672.77	57.7567277
1	.04205303	.95794697	93047.659	3912.936	361625.708	5680539.41	61.049783
5	.018852989	.981147010	89134.723	1680.456	441472.475	5318913.70	59.672746
10	.011126043	.988873956	87454.267	973.03	434838.785	4877441.22	55.771335
15	.014446507	.985553492	86481.247	1249.352	429282.355	4442602.44	51.3707028
20	.019533732	.980466267	85231.895	1664.897	421997.232	4013319.59	47.087062
25	.021223282	.978776717	83566.998	1773.566	413401.075	3591322.36	42.975366
30	.02335232?	.976647672	81793.432	1910.067	404191.992	3177921.28	38.85301
35	.026551022	.97344897	79883.365	2120.985	394114.362	2773729.29	34.7222338
40	.032239059	.967760940	77762.38	2506.986	382544.435	2379614.93	30.6011072
45	.0387733	.961226699	75255.394	2917.9	368982.22	1997070.49	26.53724
50	.05290797	.947092029	72337.494	3827.13	352119.395	1628088.27	22.5068381
55	.069936309	.93006369	68510.264	4791.355	330572.932	1275968.88	18.624492
60	.103521295	.896478704	63718.909	6596.264	302102.385	945395.944	14.836976
65	.156420068	.843579319	57122.644	8935.163	263275.317	643292.056	11.261594
70	.23763098	.762369011	48187.482	11450.839	212310.313	380016.741	7.88621289
75		0	36736.643	36736.643	167706.429	167706.429	4.565099467

Secondary and above

Age group	FPOP	CEB	CD	Age group Index(i)	Average Parity P(i)	Proportion Dead D(i)	Multiplier K(i)	Age of children (x)	q(x)
15-19	378	40	4	[illegible]	0.1058	0.1000	1.0296	[illegible]	1030
20-24	518	419	24	[illegible]	0.8089	0.0573	1.0521	2	0603
25-29	421	963	49	3	2.2874	0.0509	1.0116	3	0515
30-34	284	1027	62	4	3.6162	0.0604	1.0443	5	0631
35-39	118	[illegible]	24	5	4.8898	0.0416	1.1054	10	0460
40-44	54	294	27	6	5.4444	0.0918	1.0863	15	0997
45-49	[illegible]	94		[illegible]	4.4762	0	1.0593	20	0

2 = 1308 P2/P3 = 3536

C Secondary

Age group	qx	nPx	lx	ndx	Lx	Tx	ex
	0.04506221	95493779	100000	4506.221	96845.645	6382318.49	63.8231849
	.02161146	.978388539	95493.779	2063.76	376402.964	6285472.85	65.8207572
	010099912	989900087	93430.019	943.635	464791.008	5909069.88	63.2459454
0	006514742	993485257	92486.384	602.525	460925.607	5444278.88	58.8657339
5	009648321	990351678	91883.859	886.525	457202.983	4983353.27	54.2353502
0	013468471	986531528	90997.334	1225.595	451922.682	4526150.29	49.7393724
5	014508942	985491057	89771.739	1302.493	445602.463	4074227.60	45.3843008
0	015876669	984123330	88469.246	1404.597	438834.737	3628625.14	41.0156671
5	018052906	981947093	87064.649	1571.77	431393.82	3189790.40	36.6370328
0	022744128	977255871	85492.879	1944.461	422603.243	2758396.58	32.2646356
5	028314096	971685903	83548.418	2365.598	411328.095	2335793.34	27.9573616
0	041085355	958914644	81182.829	3335.425	397575.537	1923965.24	23/6991674
5	054798802	945201197	77847.395	4265.944	378572.115	1526389.71	19.6074603
0	084105395	915894605	73581.451	6188.597	352436.763	1147817.59	15.5992791
5	131062783	868937217	67392.854	8832.695	314882.532	795381.83	11.8021686
0	204120057	795879942	58560.159	11953.303	262917.537	480499.30	8.20522528
5		0	46606.856	46606.856	217581.76	217581.76	4.66844964

APPENDIX 3

Estimation of Infant and Child Mortality and life tables. Mothers place of Residence

A Rural

Age group	FPOP	CEB	CD	Age group Index(i)	Average Parity P(i)	Proportion Dead D(i)	Multiplier K(i)	Age of children (x)	q(x)
15-19	1542	325	37	1	0.2108	0.1138	1.0612	[illegible]	1208
20-24	1286	1393	168	2	1.4720	0.0887	1.0217	2	0906
25-29	969	3291	291	3	3.3963	0.0884	09709	3	0858
30-34	936	4524	478	4	4.8333	0.1057	1.0030	5	1060
35-39	545	4052	461	5	5.2822	0.1138	1.0637	10	1210
40-44	596	4280	547	6	[illegible]1812	0.1278	1.0480	15	1339
45-49	405	3225	465	[illegible]	[illegible]9630	0.1442	1.0267	20	1481

P1/P2 = 1432 P2/P3 = 4334

A Rural Residence

Age group	qx	nPx	lx	ndx	Lx	Tx	ex
0	07028751	.92971249	100000	7028.751	95079.874	5648699 35	56.4869935
1	0427194	957280599	92971 249	3971.676	252381 471	5553619 47	59.7348055
5	019137507	980862492	88999 563	1703.23	40739.79	5301238.01	59 5647577
10	011275707	988724292	87296 343	984 328	434020.895	4860498 22	55.6781223
15	014598570	985401429	86312.015	1260.032	428409 995	4426477 32	51.2846018
20	019727406	980272594	85051 983	1677 855	421065 278	3998067 33	47 0073382
25	021435318	978564681	83374 128	1787.151	412402.763	3577002 05	42.9030220
30	023589487	976410512	81586 977	1924.595	403123.398	3164599.28	38.7880444
35	026820852	973179147	79662.382	2136.613	392970.377	[illegible]75.89	34.6647416
40	032539025	967460974	77525 769	2522.613	381322 313	[illegible]505 51	30 5512030
45	039101594	960898405	75003 156	2932.743	367683.922	1987183.20	26.4946611
50	053275107	946724892	720770.413	3839 559	350753.167	1619499 28	22.4710697
55	070406857	929593142	68230 854	4803.92	329144 47	1268746 11	18.5949030
60	104124124	895875875	63426 934	6604 274	300623 985	939601.639	14 3139218
65	157207775	842792224	56822 66	8932 964	261780.89	638977 654	11.2451204
70	238670777	761329222	47889 696	11429 371	210873 803	377196 764	7 87636579
75	1	0	36459 825	36459 825	166322.961	166322.961	4.56181457

B Urban

Age group	F-POP	CEB	CD	Age group Index(i)	Average Parity P(i)	Proportion Dead D(i)	Multiplier K(i)	Age of children (x)	q(x)
15-19	246	39	-	[illegible]	0.1585	0.1795	.9993	[illegible]	.1794
20-24	319	300	[illegible]	[illegible]	0.9404	0.0700	1.0004	[illegible]	.0700
25-29	230	483	39	3	2.1000	0.0807	.9646	3	.0778
30-34	176	591	54	4	3.3580	0.0914	1.0025	5	.0916
35-39	98	461	56	5	4.7041	0.1215	1.0659	10	.1295
40-44	57	273	31	6	4.7895	0.1136	1.0508	15	.1194
45-49	35	162	21	[illegible]	4.6286	0.1296	1.0288	20	.1333

P1/P2 = .1685 [illegible] = .1478

B Urban Residence

Age group	qx	nPx	lx	ndx	Lx	Tx	ex
0	.0589275	.9410725	100000	5892.75	95875.075	6255452.30	62.55
[illegible]	.0329817	.9670183	94107.25	3103.83	368048.686	6159577.23	65.45
5	.0149846	.9850154	91003.43	1363.65	451608.025	5791528.54	63.64
10	.0090955	.9909045	89639.78	815.32	670260.05	5339920.52	59.57
15	.0123628	.9876372	88824.46	1098.12	44137	4669660.46	52.57
20	.0168932	.9831068	87726.34	1481.98	434926.75	4228283.47	48.20
25	.0183133	.9816867	86244.36	1579.42	427273.25	3793356.72	43.98
30	.0201151	.9798849	84664.94	1703.04	419067.1	3366082.96	39.76
35	.0228645	.9771355	82961.90	1896.88	410067.3	2947015.86	35.52
40	.0281416	.9718584	81065.02	2281.30	399621.85	2536948.57	31.30
45	.0342873	.9657127	78783.72	2701.28	387165.4	2137326.72	27.13
50	.0478695	.9521305	76082.44	3642.03	371307.13	1750161.32	23.00
55	.0634956	.9365044	72440.41	4599.55	350702.93	1378854.19	19.03
60	.0952753	.9047247	67840.76	6463.55	323044.93	1028151.27	15.16
65	.1456938	.8543062	61377.21	8942.28	294530.35	705106.34	11.49
70	.2234758	.7765242	52434.93	11717.94	232879.8	420575.99	3.02
75	[illegible]	0	40716.99	40716.99	187696.19	187696.19	4.61

DIX 4

Estimation of Infant and child mortality and life tables working status of mothers

Non working

ge group	FPOP	CEB	CD	Age group Index(i)	Average Parity P(i)	Proportion Dead D(i)	Multiplier K(i)	Age of children (x)	q(x)
5-19	1368	207	20	1	1513	0966	1.088	1	.1051
-24	852	1078	77	2	1 2653	0714	1 2622	2	0901
5-29	453	1494	105	3	3 2980	0703	9956	3	0700
0-34	399	1952	204	4	4.8922	1045	1.0239	5	1070
5-39	292	1859	222	5	6.3664	1194	1.083	10	1293
0-44	236	1671	186	6	7 0805	1113	1.083	15	0092
5-49	183	1467	172	7	8.0164	1172	1.0415	20	1221

= 1196 /P3 = 3837

A Non working

e group	qx	nPx	lx	ndx	Lx	Tx	ex
	06498456	93501544	100000	6498.456	95451.08	5883773.71	58.8377319
	038117113	961882886	93501 544	3564.009	364383.352	5788322 63	61.9061719
	017181669	98281833	89937 535	1545 277	445824.482	5423939.28	60.307849
	010246904	989753095	88392 258	905.747	439696.922	4978114 80	56.318448
	013529365	986470634	87486.511	1183.637	434473 462	4538417 88	51.875630
	018425829	981574171	86302.874	1590.202	427538.865	4103944 41	47 552810
	019983598	980016401	84712.672	1692.864	419331 2	3676405 55	43.398530
	021967865	978032134	83019.808	1823 768	410539 62	3257074 35	39.232496
	024978508	975021491	81196 04	2028.156	400909 81	2846534 73	35.057556
	030494133	969505866	79167 884	2414 156	389804 03	2445624 92	30.891629
	036867733	963132266	76753.728	2829.736	376694 30	20558220.8	26.784638
	.050781794	949218205	73923 992	3753.993	360234.977	1679126 59	22.71423
	067218441	932781558	70169 999	4716.718	339058 2	1318891.61	18.79566
	100051256	899948743	66453.281	6548 683	310894 697	979833.417	14 96996
	151910450	848089549	58904 598	8948 224	272152 43	668938.719	11.35631
	231709951	768290048	49956374	11575 389	220843 397	396786 289	7 9426559
		0	38380 985	38380 985	175942 892	175942 892	4 584116

B. working

Age group	FPOP	CEB	CD	Age group index(i)	Average Parity P(i)	Proportion Dead D(i)	Multiplier K(i)	Age of children (x)	q(x)
15-19	417	157	24	1	0.3765	0.1529	0.7810	1	1194
20-24	752	1115	112	2	1.4827	0.1004	0.9315	2	0935
25-29	746	2280	225	3	3.0563	0.0987	0.9490	3	0937
30-34	711	315	328	4	4.4388	0.1039	1.0073	5	1047
35-39	451	2654	295	5	5.8847	0.1112	1.0801	10	1201
40-44	417	2382	392	6	6.9113	0.1360	1.0665	15	1450
45-49	257	1920	314	-	7.4708	0.1635	1.0414	20	1703

P1/P2 = .2539 P2/P3 = .3837

B. working

Age group	qx	nPx	lx	ndx	Lx	Tx	ex
0	07071933	92928067	100000	7071.933	95049.647	5747198.02	57.4719802
1	043096473	956903526	92928.067	4004.372	360899.114	5652148.38	60.8228338
5	019298676	980701323	88923.195	1716.1	440325.725	5291249.26	59.5035892
10	011360532	988639467	87207.095	990.719	433558.677	4850923.54	55.6253312
15	014684774	985315226	86216.376	1266.068	427916.71	4417364.86	51.2357985
20	019837208	980162791	84950.308	1685.177	420538.598	3989448.16	46.9621388
25	02155589	97844441	83265.131	1794.829	411838.582	3568909.56	42.8619942
30	023724043	976275956	81470.302	1932.805	402519.497	3157070.98	38.7511878
35	026974007	973025993	79537.497	2145.445	392323.873	2754551.47	34.6321117
40	032709366	967290633	77392.052	2531.445	380631.648	2362227.61	30.5228783
45	039288086	960711913	74860607	2941.13	366950.21	1981595.95	26.4704676
50	053483801	946516198	71919.477	3846.527	349981.068	1614645.75	22.4507437
55	070614489	92932551	68072.95	4811.021	328337.198	1264664.68	18.5780796
60	104467269	89553273	63261.929	6608.801	299787.643	936327.484	14.8008051
65	157656272	842343727	56653.128	8931.721	260936.337	636539.841	11.2357404
70	239226413	760735868	47721.407	11418.021	210061.982	375603.504	7.87075502
		0	36303.386	36303.386	165541.521	165541.521	4.55994714

APPENDIX 5. Under five mortality (q5) for both sexes in Kenya, by socio-economic variables

Figure 5.

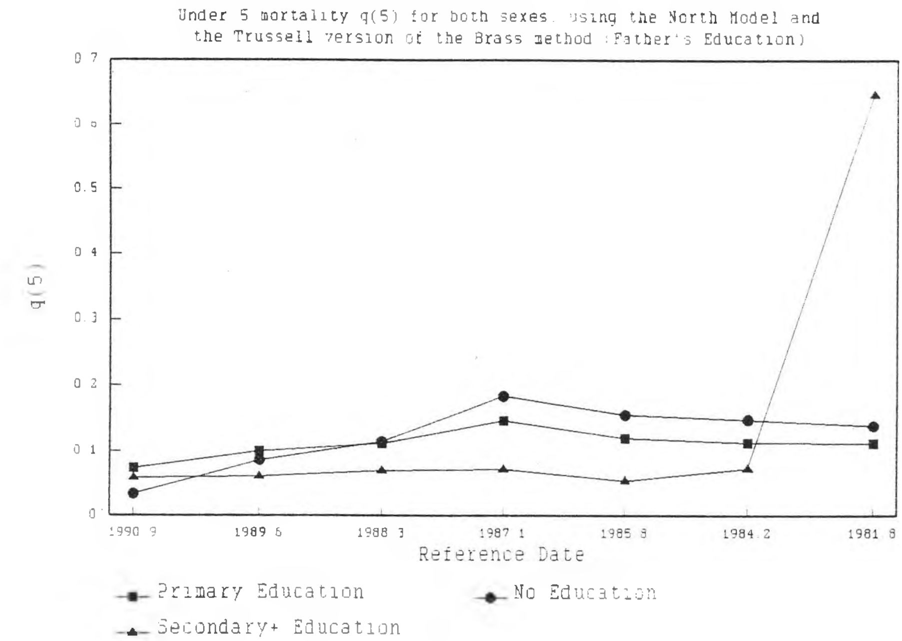

Fig 8. Under five mortality (q5), for both sexes in Kenya, by working status of mothers'

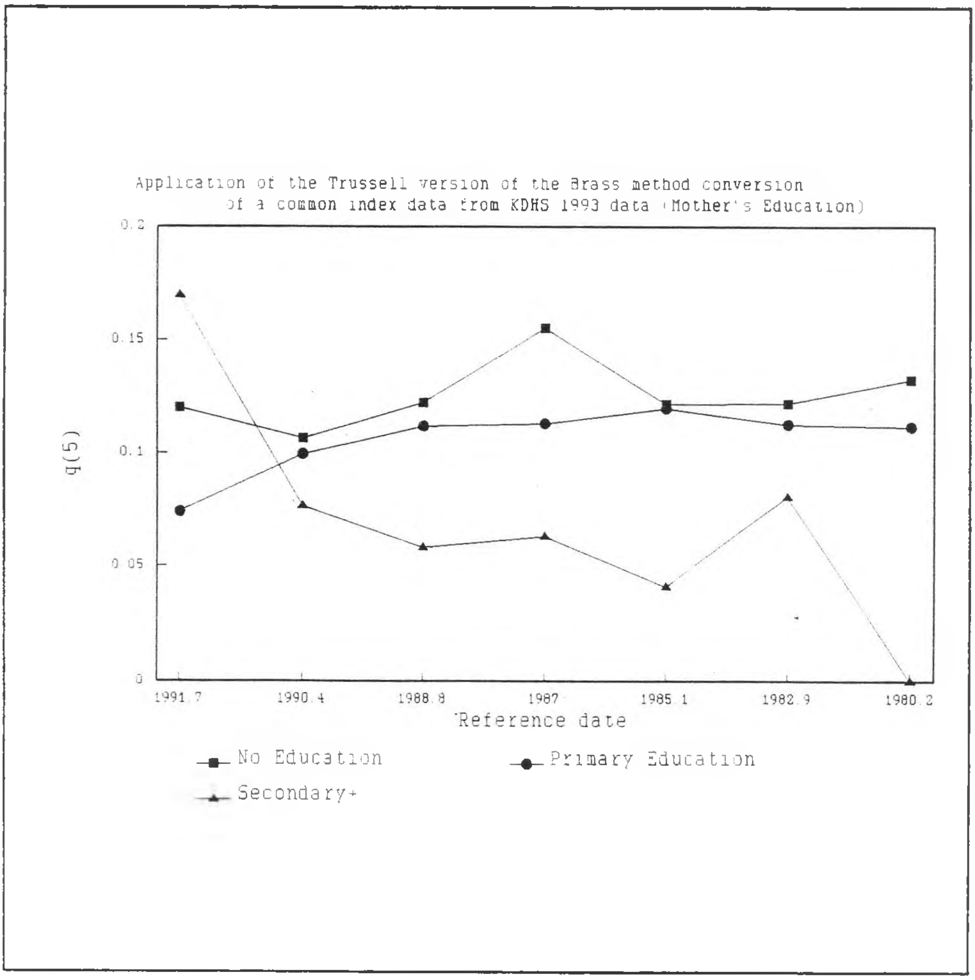

Fig. 7 Under five mortality (q5), for both sexes in Kenya, by working status of mothers