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"IMPACT OF INFANT AND CHILD MORTALITY ON FERTILITY IN KENYA" ^

BY

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DECLARATION

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

Signature^ V ^_____Date^ _

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This project has been submitted for examination with our approval as university supervisors.

Dr. M. KIMA.M

Signature. f t j f e_____D a t e Z \ d h * 2 -

Dr. A.T.A OTIENO

DEDICATION

This work is dedicated to my parents, Late ***Joseph Ngure*** and late ***Felister Njeri*** "You were heroes in parenthood". To my brothers ***Joel, Stephen*** and ***Henry.*** To my sisters ***Nancy, Rebecca, Mary*** and ***Ladia*** for being there for me and to my fiancee ***Keziah***, for being a true friend.

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ABSTRACT

The present unprecedented growth of population around the world has made it imperative to understand the causes and look for cure of this growth. Fertility and mortality are the two important factors that contribute to this growth. An important demographic question that has been widely investigated recently is the degree to which changes in infant and child mortality can be expected to induce changes in fertility rates in developing countries. This study tries to answer this question by investigation the impact of infant and child mortality on fertility in Kenya.

This study utilizes 1998 Kenya Demographic Health Survey (1998 KDHS) data Conducted between February 1998 and August 1998. A study sample of women aged 35 years and above excluding those who have never been married and those who had never given birth was taken from this data. Ordinary Least Squares (OLS) and Two Stage Least Squares (2SLS) statistical methods were used to estimate direct effects of infant/child death(s) on fertility and replacement rate respectively.

The motivariate analysis results showed that, there exist direct effects of infant/child death(s) on fertility. Women who experienced infant/child death(s) had a higher number of children ever born. The result also showed that the replacement rate for the period of 1993 to 1998 was 0.27. This was lower compared to that of the period 1989 to 1993 which was 0.3 using Two Stage Least Squares method.

In the differentials, replacement rate was positively related with education and Infant/Child death(s) among women with no education was not significant in explaining fertility. When the analysis was carried out by type of place of residence, replacement rate was higher in rural areas than in urban areas. Infant/child death(s) was found to be insignificant in explaining fertility in urban areas. There was no significant difference in replacement when the analysis was carried out between low and high mortality regions.

For policy concerns, the study recommends programmes aimed at reducing infant and mortality should be integrated into programmes geared towards fertility reduction. This can be done by also promoting programmes that promote child nutrition and child care. Other programmes promoting girl child education (especially higher education), contraceptive use and age at first marriage should be implemented and strengthen those that are already existing. For further research, the study recommends further research on effects of School dropout on fertility and further investigations on Minimum Distance Estimation Model on Kenyan data.

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LIST OF ABREVIATIONS

2SLS	**-**	**Two-Stage Least Square**
CEB	-	Children Ever Born
CMR	-	Child Mortality Rate
DHS	-	Demographic and Health Survey
GOK	-	Government of Kenya
IMR	-	Infant Mortality Rate
KCPS	-	Kenya Contraceptives Prevalence Survey
KDHS	-	Kenya Demographic and Health Survey
KFS	-	Kenya Fertility Survey
MDE	-	Minimum Distance Estimation Model
NCPD	-	National council for Population and Development
NDS	-	National Demographic Survey
OLS	-	Ordinary Least Square
WFS	-	World Fertility Survey

Chapter 1

Introduction, Problem statement and Research objectives

1.1 General introduction

The present unprecedented growth of population around the world has made it imperative to understand the causes and look for cure of this growth. Fertility and mortality are the two important factors that contribute to this growth. This study looks at the impact of infant and child mortality on fertility.

Fertility and mortality relates in many ways. The theory of demographic transition states that a slow decrease in fertility will follow in a gradual manner the decline in mortality through such development as economic, industrial and urban growth. Some studies have shown that decrease in infant mortality rate is associated with decrease in fertility (Shultz, 1970). However its agued that, the future decline in fertility in developing countries need not follow the slow historic decline in mortality in the view of the many technological innovation control of human fertility. In this context, the study of impact of infant and child mortality on fertility is of great interest.

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It is hypothesized that, couples who experience infant /child losses are less likely to use contraceptives, tend to have shorter birth intervals and hence more children, (Otieno 2000). Thus the effect of infant and child mortality on fertility can be categorized into behavioural and physiological effects. Behavioural effects are channelled through: -

(a) "Hoarding effects", where couples may have more children than the desired number in anticipation that some may die.

(b) "Replacement effect", where a couple responds to actual death of a child by giving birth to an additional one.

The physiological effects on the other hand, are attributed to the curtailment of breastfeeding when a nursling dies. This hastens the return of ovulation and thus shortening the interval to the next birth if contraception is not used (01senl983).

This study focuses mainly on behavioural effects of infants and child mortality and measures their impact on fertility. Studying this relationship will increase our understanding on the role of infant and child mortality as a determinant of variation in fertility. On the other hand, programmes for reducing infant and child mortality with the reduction of fertility as one of the ultimate outcome, would be based on a better understanding of this relationship (Kimani 1992).

Estimate of this relationship can be useful in analysing the demographic effects of different health polices (Wallace 1984) and also permits the formulation of policy guidelines and identification of promising areas for future research.

1.2 Statement of the Problem

The study of infant and child mortality has been attracting worldwide attention mainly because of the considerable depletion of each human generation, during the relatively short period of the first few months of gestation and the first few years of life respectively. The scope of these studies has been confined largely to the quantitative aspects of infant and child mortality and the factors associated with their high levels in the last two decades.

Many scholars, particularly in connection with the fertility decline during the demographic transition, have postulated a relationship between infant and child mortality (Rutstein 1974). Many scholars have recognized that the relationship between infant and child mortality and fertility is not clear as general mortality. Empirical research findings suggest that, fertility responses to reductions in infant and child mortality vary widely in timing and strengths. This lack of consistency, in empirical results calls for further research on the linkages of infant and child mortality with fertility.

In Kenya little has been done on this relation. Analysis by Brass pointed that there is lack of clear relationship between infant/child mortality decline and fertility decline in all districts (Brass 1993, Brass and Jolly 1993). This somehow contradicted finding in an earlier study by Kelly and Nobbe that, changes in infant and child mortality as a result of expansion of the immunization programme, was among the factors occurring in the mid-1980s that were suggested as more likely to have caused the dramatic fertility decline. In his study, Kimani found that, there exist behavioural effects of infant and child mortality on fertility (Kimani 1992).

An important demographic question that has been widely investigated recently is the degree to which changes in infant and child mortality rates can be expected to induce changes in fertility rates in developing countries. A recent study in Kenya by Otieno (Otieno 2000), using 1993 KDHS data and applying Olsen technique, found that 10 percent decline in infant mortality rate would induce a 0.17 decline in total fertility rate for the period 1983 to 1993. He also found replacement rate to lie between 0.30 and 0.75, which implied that elasticity ranged from 0.025 to 0.062. The questions that arise now

are, what is the replacement rate for the period 1993 to 1998? Is there a change in the replacement rate between both periods? Also can a further decline (increase) in infant and child mortality induce a further decline (increase) in total fertility? Its thus important to know the rate at which child death (prevention of child death) produce more (fewer) births when measure taken to influence development of our country have effect upon mortality. This help in achieving our population policy whose main objective is to accelerate decline in the level of fertility through expansion of the coverage of child survival programmes (GOK, NCDP, 1997-2001).

This study therefore, sets out to investigate the impact of infant and child mortality on fertility using Ordinary Least Squares (OLS) and Two Stage Least Squares (2SLS) regressions. Kenya Demographic and Health Survey (1998 KDHS) data was used to investigate if there is consistency with the results that were found by Otieno (1999, 2000) and also find out the change of replacement rate if any. The choice of 2SLS regression models is the fact that, 2SLS estimate replacement rate without any bias and needs no correction, (Olsen 1980, Otieno 2000). Unlike Olsen technique, Minimum Distance Estimation (MDE) model and other model which stop short of consistently working out reduced form consequences of the initial specification and hence providing a framework for unbiased estimate of replacement rate and also tend to overstate the extent of replacement rate which is expected. Moreover Olsen's statistical correction of the estimated value of replacement rate provides unbiased estimates only when replacement probability is zero, (Wallace 1984).

This study is also aimed to add more information and expand knowledge of family level relations between infant and child mortality with fertility in Kenya. This study tries to answer the question; How much fertility change is induced by infant and child mortality in the period 1993 to 1998? Correct answer to this question is needed not only for its theoretical importance in the conceptualization of demographic transition, but also for very practical reasons.

1.3 Objectives of the Study

The objective of this study is to investigate the impact of infant and child mortality on fertility

1.4 Research Justification

The Kenyan population growth rate has been and still is above the world growth rate. This has been attributed to high fertility rate. Many factors have been associated with the high fertility rate and programmes set up having an objective to lower it. But infant and child mortality has not been exhausting studied to establish how much it can contribute to the lowering of fertility rate.

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No doubt that, there is growing awareness among policy-makers that birth control programmes are not enough in reducing fertility in Kenya. Its increasing apparently that in most developing countries, optimisation of fertility at the individual level through provision of perfect birth control services would still leave substantial excess fertility at societal level. Thus the study on impact of infant and child mortality on fertility would therefore, help the policy makers in understanding how vital is the infant and child mortality in policies geared to influence fertility decline whose easy alternatives are

lacking. Infant and child mortality has remained to be the only policy variable that can be manipulated by the government to lower fertility.

This study will also enlighten couples in the reproductive age the effect of their replacement and hoarding behaviour on total fertility. This will increase the acceptance of health and family planning services. "Evidence accumulates that the reduction of infant mortality may be necessary prerequisite to the acceptance of family planning" (cf Preston 1975). Couples will not wish to prevent pregnancies until they have some assurance they the child they already have will survive.

At practical level, the study will help the programmers and donors of population programmes to refocus on child survival programmes and use the findings to develop strategies for integrating infant and child mortality programmes in programmes aimed at fertility reduction. It will also help them to realise that, the optimal allocation of funds between alternative health and family planning programmes requires empirical information about the effect of infant and child mortality on fertility.

This study will add more information and expand knowledge of family level relations between infant and child mortality with fertility in Kenya: Due to the model used that will give unbiased estimate of replacement rate, the results of this study will provide a robustness check for the other parameter estimates by other models. Lastly the study will give statistics that will be helpful in future projection of fertility in Kenya.

1.5 Scope and limitation of the study

This study seeks to examine the impact of infant and child mortality on fertility in Kenya. The study focuses on all regions in Kenya except the drier North- Eastern Province and two Districts in Rift valley and other two Districts in Eastern Provinces. Nomadic populations who constitute only 4 percent of the total Kenyan population normally inhabit these regions. These regions were not covered by KDHS1998.

Since the survey was cross-sectional, the impact is examined at appoint in time hence, the analysis cannot give an indication of possible changes in time. As indicated by the topic, the study will only examine the impact of infant and child mortality on fertility, but does not examine the impact of socio-economic, socio-cultural and Demographic factors on fertility, but these factors will be used as control factors. The study will only examine impact on one-way i.e. from infant and child mortality to fertility but not the vice versa. There was also lack of pertinent data for the correct evaluation of the paths of influence and data necessary to evaluate the indirect personal experiences and perception about mortality and societal experiences such as norms and beliefs. The study was limited to women who were ever married excluding childless women. These women were considered to be ideal sample for the analysis of lifetime fertility.Due to the lack of time, replacement rate was based only on one model that is, Two Stage Least Squares. Otherwise other models such as Olsen technique and Minimum Distance Estimation model could have been used to get variations in estimates from various models.

Chapter 2

Literature and Analytical Framework

2.1 Introduction

In this chapter, the literature on impact of infant and child mortality on fertility is reviewed. This helped to draw the basis of the study from existing studies. The main issues arising from this literature review were conceptualised.

2.2 Literature review

This section examines the studies done in two categories, those done in the rest of the world and those done in Kenya.

2.2.1 Studies in the rest of the world

A number of studies have been done on this subject in both macro and micro levels in various regions using different methodologies whose results have not been always consistent. This may be due to the fact that fertility and mortality are influenced by socio cultural factors that are different from one society to another society. Some of their findings are as follows: -

Olsen 1980, noted that child mortality is common in less developed countries. He also noted that parents' desires are formulated in terms of live off springs. If couples try to attain some number of surviving children then we expect the death of a child to lead its parents to try to offset this disturbance to their plans. Thus those couples suffering one more child death will tend to have one more birth. He also noted that, parents in a higher

child mortality environment will require more births to achieve the same number of survivors. This may lead to earlier marriage in order to allow the couple more time to achieve its desired fertility, (Olsen 1980; Schultz 1980). Olsen observed that high rates of child mortality might result in deaths when the couple is older and less able to adjust fertility subsequent to death. In response couples may produce additional children for hoarding purposes.

Olsen (1983), hypothesized that some cultural practices in certain behaviours in response to a common level of mortality such as, taboos against intercourse during religious festivals to enable the society to attain a given level of fertility which generates a reasonable stable population (c.f. Otieno 1999)

Ritcher and Adlakha 1989, using the WFS data for Columbia found that replacement effects existed and was similar across all the groups i.e. the effects did not vary by levels of education and by type of residence. Mensch (1985), using the same data found the existence of replacement effects but only after the fifth birth interval. He also found that previous child loss was found to affect woman's decision to use birth control during fifth and sixth birth intervals. The probabilities of using contraceptives were 1.2 and 1.4 times greater respectively among women who have experienced child death compared to those whose children had survived.

Rutherford, Shyam and Bhakha, using 1976 Nepal Fertility Survey (NFS) found that, in Nepal both preceding birth interval and following birth interval have substantial effects on infant mortality before the introduction of breastfeeding of the effect of following

birth interval whereas a short following birth interval tends to be associated with early weaning of the index child. This reduces the waiting period for conception to occur.

Nane and Suewen (1985), in their study of relative income, race and fertility utilizing census of 1970 for California and Hawaii found that birth and care of children imply a long term financial commitment by the parents. Despite the greater ability of rich couples to support numerous children the actual income of husbands has failed to show a positive association with wives' cumulative fertility. However fertility has been higher among white women married to men with high incomes compared to other white men of similar age, education, occupation and region. This suggested that income when judged as more favourable than that received by others with similar work credentials/environments could lead to higher cumulative fertility.

Huffman (1985), argues that breastfeeding behaviour is a more important factor in prolonging amenorrhoea among lactating women than in the mother's nutritional status. Using data for a longitudinal study in 1975 in Bangladesh a sample of non-pregnant women who had at least one birth were used. This has also been evidenced in other studies by; Palloni 1996, UN 1987 and Rutstein 1975.

Rutstein (1974), in his study in Taiwan postulated that child mortality and fear of child mortality lead to increased fertility and population growth. In that case a decline in child mortality and fear of child mortality would lead to a decline in fertility. Thus the death of a child induces a desire to replace the lost child that results in an increased probability of having an additional birth. In his finding, Rutstein states that experience of child mortality generally increases the likelihood of having another birth when a boy has died

and increases it to a lesser extent when a girl has died. With regards to contraception he noted that the main effect of child mortality on the use of contraception is a delay in the initial use of contraception for couples who have experience of child mortality. This suggests that in Taiwan, contraception is used mostly for limiting and not for spacing.

Chowdhury (1975), using data from rctrospectivc prcgnancy histories of 2910 currently married women (Pakistan National Impact Survey 1968-69) and from longitudinal vital registration data (1966-1970) of 5236 women residing in rural area of Bangladesh found that median birth intervals in Pakistan varied from 35.3 to 41.2 months increasing with parity within each party group no consistent difference was observed between women with and without previous child loss. In Bangladesh median birth interval for all women with a surviving infant was 37.2 months. This was shortened to 24.1 months by an infant death. When intervals with infant deaths were excluded little or no behavioural influence was detected among women at the same parity but with varying levels of previous child loss. This shows that infant and child mortality affected fertility in these regions.

Heer and Hsing-Ying (1975), in their study on urban Morocco found that women who lost one child from their first three live births had 0.60 more subsequent children than women who post none of their first three live births. They also found that there is inverse relation between the number of times a woman is married and subsequent fertility and that total number of births are positively associated with the number of sons surviving.

Rutsein and Vilma (1975), in their study of the effects of infant and child mortality on fertility in Latin America found that child mortality had little the effect on actual fertility behaviour except for a shortening of closed birth intervals with an infant death due to a

biological effects is attributed to the low level of use of fertility control in areas studies portion of the low level of contraceptive use was attributable to infant and child mortality.

In his justification of the choice of woman's education as an exogenous variable, in his study, Wallace (1984) gives the reason that previous research in both developed and less developed countries supports a strong relationship between woman's education and both fertility and mortality rates. Increase in a woman's education level would lower the price of quality relative to quantity of children and improve her contraceptives efficiency thus decreasing her fertility. Similarly, mortality rates would be expected to be lower for more educated at maintaining child health in the home both through financial access to and knowledge of good sanitation, nutrition and health fertility.

N. Iskandar and Jones (1975), in their study on Indonesia found that higher proportion of women wanted more children among those who have experienced one or more child death than among those who have not. This tendency to compensate for the relatively high infant and childhood mortality levels is one factor keeping fertility high.

In his study in Trinidad and Tobago Ebanks, found that larger percentages of those women whose child died progress to the next higher parity than those whose child survive. This was well witnessed from 3rd parity. He also noted that in Jamaica women who experienced an infant or child loss at any parity eventually have more live births than those whose child survived. In Guyana he observed that, in general, women who have experienced infant and child loss are less likely to be using a contraceptive than those whose children are all alive.

Pebley , Delgado and Brieman(1979) examined if fertility desires are shaped by familiar and personal experience with child mortality (death of siblings and ones own children). They also set out to find if fertility desires are based on perceptions of mortality conditions. They used data from rural Guatemala. The study assumed that fertility decisions are made sequentially and it may vary at different parities. Child loss was analyzed together with the Socio-economic central variables such as education, residence and housing quality index and by using logit method. The results were that women who desired additional children are likely to be younger and more educated than those who don't. This was observed within each parity group. They to also were found to have more experience with child deaths, both their own and siblings. The logit coefficient analyzed suggested that, education appears to increase the probability of wanting additional children with child mortality. Own child death and siblings death was found to be strongly and positively related to the desire for additional children at parity three and above. The conclusion was that child mortality experience affecting a woman's fertility decision are both of her own and her mothers children and these are manifested at different life stages as is represented by parity levels.

Manadevan K. (1981) in a study done in south central India found that, the number of infants and child deaths showed that definite direct relationship with fertility existed in all the three cultural groups, Muslims, Harijans and Casto Hindus. This trend was found to persist without change even where age of the mother was controlled in all the three groups and also separately in the categories of infant and children. This finding confirmed that higher incidence of infants and child mortality increases fertility and thereby mortality influences fertility as a major pronatalist force.

2.2.2 Kenyan Studies

Few studies have been done in Kenya, most of which have consistent results as those described above.

According to Musalia (1991), using 1989 KDHS data found that, when other factors that affect fertility are controlled by use of multiple classification analysis, at each given parity, women who suffered child losses went on to have a higher number of births in order to replace the dead ones. He gives an example from this analysis, that women with two child losses had a higher mean number of children ever born than those with one or no child loss.

In his study Ongor (1989) using 1977/78 KFS data studied some factors that influenced fertility attitude and outcome. His specific objective was to look into the effect of personal infant or child loss on fertility attitude and outcome. Using cross tabulation and stepwise regression technique, he found that direct infant and child loss experiences had some influence on the mean children ever born. He also found that duration of marriage gave an increasing CEB at specific loss levels. Women of longer duration of marriage were found to have higher CEB and living children. It was still found that effects of infant/child loss further increase the CEB by duration of marriage. Duration of marriage also showed a positive relationship although insignificant for women in the age group 25-34years implying that these women are not very enthusiastic about having additional children.

It was also found that additional children wanted were higher irrespective of current age for women who have a lower number of living children. It was also demonstrated that living chijiren are important determinant of additional children wanted. The regression model used confirmed the hypothesis that a positive relationship exists between CEB and direct infeit/child loss. It was evident that women of higher child loss levels tend to have a high taal fertility rate. This shows that replacement and insurance strategies are embeddec in family decision-making and maybe an important factor explaining the variations in total fertility rates.

Kimani (1992) observed that, there is existence of behavioural effects of replacement and insurance. According to his findings, shorter birth intervals are associated with infant/chi-i deaths in that birth intervals were shorter in case of child deaths compared to when there were no such deaths. He also found that, behavioural effect of insurance arising frcm the mortality experiences at personal level was found to be higher than that due to mortality at the community. This analysis also showed that breastfeeding explained i larger proportion of the variations in the birth intervals than coital frequency and coniraceptive use put together. This suggests that in Kenya replacement of infants/chidren who have died is partly realized through curtailment of breastfeeding of later-bom children.

Otieno (2000), using Olsen technique found replacement rate to lie between 0.30 and 0.75, which implied that, elasticity, may range from 0.025 to 0.062. He also found that a 10 percent decline in infant mortality rate would induce a 0.17 decline in total fertility rate for tie period 1983-1993. In his analysis of birth intervals, Otieno noted that effects of infant death are more pronounced in the tempo (speed of child bearing) and proportion

of intervals being close within 18 months. When the index child or previous child dies there is a higher propensity to move to the next births compared to when both children survive.

2.3 Summary of Literature review

The studies reviewed reveal various mechanisms/paths through which infant and child mortality affect fertility. These mechanisms are discussed below:

2.3.1The Mechanisms

The impact of infant and child mortality on fertility has been thoroughly demonstrated by many researchers especially through examination of data from censuses the world fertility surveys (WFS) and Demographic and Health Surveys (DHS)

Infant and child mortality has been postulated to affect fertility through household responses both to an experienced infant and/ or child death termed as replacement effects as well as to anticipated infant and/or child death termed as hoarding effects.

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Olsen (1980) argues that the notion of rationality among couples leads to the conclusion that, the numbers of children born by women reflect a decision that has been made regarding the desired number of births. This desired number of births are formulated in terms of preferred number of surviving children, thus if couples try to attain some number of surviving children, then we expect the death of an infant/child to lead to its parent to try to offset this disturbance rested on their will and ability (the replacement hypotheses). On the other hand the anticipation that, that death may occur due to the

underlying mortality rate may also enter into determination of the desired number ot surviving children.

The other mechanism that exists is the biological or the physiological effect, where the death of an infant shortens the birth interval in population where breast-feeding extends to a few months its ovulatory-suppressant effect results in longer average intervals to the next birth. Following the death of breastfeeding infant, breastfeeding is discontinued shortening the period before the next conception if contraception is not practiced affecting the total number of births. Where contraception is practiced the shortening of lactation period should only produce a variation in the timing of births (Olsen 1980,UN1987, Menschl985, Rutstein 1975).

Its also hypothesized that cultural practices in certain societies particularly where children are valued by parents for old age protection and support, physical security etc. proscribe certain behaviours in response to societal level of mortality to enable them attain a given level population stability. Norms on specific aspects of fertility behaviours such as those on age at first marriage, sexual relation within marriage and use of fertility control methods are regulated at societal level (Olsen 1983, UN 1987, Wallace 1984). This indicates that couples correlates of demand for surviving children includes socio-economic and socio-cultural factors. Its observed that when partial effects of parental education, wages and family planning programmes are held constant, infant and child mortality would still be related to fertility and that such partial association may reflect the role of unobserved variables.That affect infant and child mortality or the reverse effect of fertility on infant and child mortality (Shultz 1997 cf. Otieno 2000).

2.4 Analytical Frame Work

The effects of the infant child mortality on fertility via replacements have been estimated from linear regressions of the single equations modes using household survey data (Olsen 1980). However, such single equation results in biased estimates of the replacements rate since child deaths are endogens and correlated with included exogenous variables.

Attempts have been made to avoid the resulting biases of the child replacement rate. However, all these models stop short of consistently working out in the reduced form consequences of the initial specification and hence providing a framework for unbiased estimates of replacement probabilities. Therefore even though the second round of models represent an improvement in the analysis of survey data vis-a-vis replacement probabilities, they stop short of consistent framework, which frilly accounts for endogeneity of mortality, fertility and replacement. Olsen (1980) corrected replacement rate when mortality rate is not constant across the women is given by :

$$r = r_0 Ls + 1/ [P+O-P)\ n /Var(n) + (Var(Pi)(l+n"^2-n) /Var (n))/P$$

In an attempt to recognize the endogeneity of child deaths and replacement births, Wallace developed Minimum Distance Estimation Model (MDE), which gives a consistent framework that frilly accounts for endogeinity of mortality, fertility and replacement. MDE is based on the same assumption about reproductive behaviour as used in Mouskopt's (1983) Non-linear Maximum Likelihood Estimation Model (MLE).

It assumes that:

i) Distributions for child births, child deaths and replacement are discrete and are not independent of one another and unlike Mouskopt's MLE, no assumption is required about the explicit form of distribution of children if no deaths.

ii) It's never possible to distinguish between initial and replacement births by direct observation of a woman's birth/infant and child deaths history.

iii) There is no information on the timing of births and deaths or there is doubt that such data is accurate.

iv) All children born are exposed to the same mortality risk irrespective of the birth order.

v) All children who have died are potentially replaced

The key element of this framework is the number of children that would be born if the woman had experienced no child death denoted by Y*. Y* includes both desired number of surviving children and those born for hoarding purposes due to child mortality. The other key element is children ever born to the woman (Y). Is assumed Y* < Y. Equality holds when a woman experiences no infant/child death. Thus expected replacement per woman r is expressed as

$$r = \frac{n\ P\ X}{i - pn}$$

Where:

n is the probability of replacing a lost child

A. is the mean of children born if no death

P is the probability of a child death

Its shown that replacement level is a function of these three parameters n, A, and P, plus 5^2 which is the variance of children born if no death. On the other hand population means; E(Y) and E(d), variances; Var(Y) and Var(d) and co variances of children born and children dead across women can be expressed as non-linear functions of the four basic parameters n, A, P and 8^2.

This study assumes that the true relationship connecting fertility and mortality is given by:

$$Yi = Y + r (dj - dj + s$$

Where Yj is children ever born, dj is the number of infant/child deaths and s is a random error .Y and d are the means of Y, and dj respectively. Cross sectional data was used so the i indexes couples. The regression coefficient r indicates the rate of replacement, that is, the average number of additional births, which occur in response to an additional incident of child mortality.

Since there are other factors that affect fertility besides infant/child mortality, its rare to get unbiased results of the relationship above. In this case factors like education, age, age

at first marriage, region of residence, type of place of residence and partners' education were controlled for, to give amore realistic relationship. Thus the relationship will be:

$$Yj = f(di, educ, peduc, reg, res, age, afin)$$

Where Yj is the children ever born

di is child death

educ is women education attainment

peduc is partners' education

reg is region of residence

res is the type of place of residence

age is the age of the mother

afin is age at first marriage

2.5 Study hypotheses

The hypothesis tested by this study is that, there exist direct replacement of infant/child dead among Kenyan women and this replacement is positively related to education.

2.6 Variables and their measurement

This study used the following variables in the analysis:

Dependent variable

Children Ever Born

This will be the dependent variable and it will be the number of children that has ever been born to a woman. It will be in scale ie. 1, 2, 3, 4…

Independent variable

Infants and/or children dead

This will be the number of infants and/or children that have died per woman. It will be measured in scale i.e. 0, 1, 2, 3…

Control variables

Education attainment

This will be taken to mean the level of schooling respondent had reached. It will be classified into no education, Primary incomplete, primary complete, secondary incomplete and secondary complete plus.

Partner's education

This will be taken to mean the level of schooling respondent's husband had reached. It will be classified into no education. Primary incomplete, primary complete, secondary incomplete and secondary complete.

Region of Residence

This will mean the Kenyan region where the respondent stays. This variable is classified in 2 regions. Region 1 comprising Nairobi, Central and Eastern provinces and Region 2 comprising Western, Nyanza, coast and Rift valley provinces.

Place of residence.

This is the type of area respondent were staying at time of interview either Rural or Urban.

Age cohorts

This is taken to mean the number of completed years.

Age will be categorised into 35-39,40-44 and 45+

Age at first marriage

This will mean the number of completed years. The respondent had when first married it will be categorized at < 16 yrs, 17-20 yrs, 21+ years.

Chapter 3

Source of Data and Methods of Analysis

3.1 Sources of data

The source of data used in this study is the Kenya demographic Health survey of 1998 (KDHS 1998), which was conducted from 16th February 1998 to 29thJuly 1998.

The Survey was a national survey carried out by the National Council for population and Development (NCPD) in collaboration with central Bureau of Statistics (CBS) Macro Intentional Inc (USA) provided technical and financial assistance through it contract with US agency for international Development (USAJD) while Department of international development (DFID/UK) provided financial assistance.

The ultimate aim of the survey was to assess the overall demographic situation in Kenya and assist in the evaluation of the population and reproductive health programmes in Kenya among others. Specifically to provide data on family planning and fertility behaviour of the Kenya population and to measure changes in fertility and contraceptive prevalence. Also to study the factors which affect these changes such as marriage pattern, desire for children availability of breast feeding habits and important social and economic factors among others. Also to produce reliable nation estimates as well as urban and rural estimate of fertility and childhood mortality rates, and population indicator of contraceptive prevalence

3.1.2 Sample Design

The KDH Surveys are national in scope with exclusion of all three Districts in North Eastern Province and four other Northern districts tow from Eastern and Rift Valley Province each. The excluded areas account for less than 4 percent of Kenya's population. The KDHS utilised two-stage, stratified sampling approach. First step involved selecting sample points "clusters" while the second stage involve selecting house holds within sample point from a list compiled during a special KDHS household listing exercise. Sample points were selected from national master sampling frame (NASSEP-3) maintained by central Bureau of Statistics. From this 536 sample points were drawn: 444 rural and 92 urban for the 1998 KDHS.

3.1.3 Quality of data

Selected district were over sampled in the 1998 KDHS, in order to produce reliable estimators fro certain variable at the district level. However, this over sampling did not affect the representative ness of the survey. Fifteen districts were targeted, in addition t

Nairobi and Mombasa were also targeted. Due to this over sampling the 1998 KDHS was not self-weighted. Three types of questionnaires were used in 1998 KDHS, the household questionnaire, the women's questionnaire and the men's questionnaire. This study utilizes data from women's questionnaire administered to women of 15-49 years since it included detailed productive history, which are excluded in men's questionnaire.

In **1998** KDHS out of 9465 eligible households, **8380** households were interviewed giving response rate of 97 percent. **8233** eligible women (age 15-49) were identified and **7881** were successfully interviewed fielding a response rate 96percent.

A complete birth history covering all births whether still alive or not was obtained. The survival status was ascertained and the age at death if the infant/child has died. This information was given in the order of birth. The data of number of children infant dead, and Children Ever Born was obtained from this information. Data was collected from mothers regarding breast-feeding duration of their children less than three years of age at the tine of survey. Also family planning information was collected giving data on contraceptive use. Background and Demographic characteristics expected to affect women reproductive performance were also obtained for each respondent.

3.2. Methodology

This section discusses the mathematical models that were used to analyse the data, and the method of analysis.

3.2.1 Statistical methods

3.2.1(a) Chi- Square Test

Chi-square is a measure of the discrepancy existing between observed and expected frequencies according to the rules of probability. It's given by :

$$\chi^2 = \sum_{j=1}^{k} \frac{(o_j - e_j)^2}{e_j}$$

Where Oj are observed frequencies

ej are expected or theoretical probability

If =0. observed and theoretical frequencies agree exactly, The larger the values of x", the greater is the discrepancy between observed and expected frequencies number of degree of freedom v is given by v =k-l (Blalock 1960).

Chi-square was used to measure discrepancy in the distribution of observed frequencies and expected frequency in cross tabulation tables thus testing the significance of the association between independent and dependent variables. The hypothesis tested is:

Ho: There is no significant association between the dependent and independent variable

H,: There is no significant association between the depedent and independent end of variation

The null hypothesis is rejected when computed yj is greater than critical value i.e tabulated x^2-

3.2.1(b) Least Square Models

The confusion of general binomial association of more deaths with more births with a behavioural tendency of couples to have more children in order to replace children who may have died has a wide recognition. The methodological response to this dilemma has been to use a variety of statistical specifications using mortality rates, interval analysis, and parity progression ratios as well as simulation experiment (Olsen 1980). Two regression models were used in this study namely Ordinary Least Square (OLS) and Two Stage Least Square (2SLS).

3.2.1(c) **Ordinary Least Squares (OLS)**

OLS model is often used in studies that try to solve an estimation problem. It involves the problem of forecasting or predicting the value of a process variable from known related variables. The variable of interest being Y that is related to a number of predators/independent variables X|, X2. . . . . X&.

The principle of least square method is; "Choose as the best fitting line that minimizes the sum of squares of the deviations of the observed values of Y from those predicted". Mathematically, we wish to minimize the sum of squared errors given by: -

$$S\ S\ E\ =\ E(y_i-y_i)^2$$

Since the predicted value of y, (i.e. y,) corresponding to X - Xj is p + (3]Xj, this quantity is substituted for yj and obtain

$$SSE = E[\ yi\ -\ (P\ +piXj)]^{l2}$$

Thus the values of Po and pi that minimizes SSE are given by

Po = y - P i X and $\beta_1 = \frac{Sxy}{Sxx}$

Where Sxy is covanance of x and y

Sxx is variance of **x**

This results to a Least Square Prediction equation or regression line

$$Y = (3o + P,Xj$$

A general probabilistic model for y is related to x by the equation

$$\mathbf{Y = Po + P,Xj + e}$$

Where Y is for observation of dependent variable,

po is the value of y when x =0

PiXj is the regression coefficient which indicates the amount of change in Y associates with a unit change in x.

Xj is the value of the independent variable (Predator).

£ is the error term.

The above model involves only one independent variable and can thus be used only at bivariate level, i.e bivariate regression. In most cases most, several independent (or Predator) variables are used to explain the variation in Y . In this case, the General model is given by

Y, =pi + P2xe+Pix«3 +...+ PkX,k+ e

$$Y_t = \beta_1 + \sum_{K=1}^{k} \beta_k x_{tk} + \varepsilon_t \qquad (2)$$

t=1,2,...T

Where Y, is the dependent/endogenous variable for observation t

Y* is the ith observation on the kth independent/exogenous variable

Pi is a constant or intercept.

Pic the coefficient for the kth variable

£(is the stochastic element or random error for observation t.

Equation 2 gives the Ordinary Least Square regression model at multivariate level.

Its worth noting that, this model estimate direct effects of each explanatory variable on the dependent variable when values of the other explanatory variables held constant. The coefficients in the population model (eqn 2) represents the change in Y expected from unit change in a particular X, the values for other variables being held constant.

These direct effects describes the mean behaviours for all members of the population regardless of the characteristics of that member (Hanushek, 1977).

Assumptions of OLS

The assumptions that result in a valid regression analysis are: -

1. Xj is measured without error thus no Xj is correlated with error term
2. g is a random variable such that for a given values of X

   E(s) = 0 and $8^2_e = S^2$ and all pairs 8| £j are independent in a probabilistic sense.
3. 8 Possesses a normal probability distribution.

Though OLS is faced with a lot of biases its advantage in this approach is that it involves the direct estimate of the relation under study namely the effect of infant/child mortality on fertility

3.2.1(d) Two Stage Least Square (2SLS)

Two stage least square population model is the same as that of OLS (eqn. 2), except that, contrary to the assumption that, no X, is correlated to error term at least one of the Yk (independent variables) is corrected with error term That is,

$$E(IX^{*}s.) \neq 0$$

This would result in a biased and inconsistent OLS estimate. However if for such trouble-some variable X_k, an alternative variable exist (Instrument of X_k) that is uncorrected with St but still correlated with Y_k .its possible to get consistent estimates of the parameters in the population model. Any other exogenous variable that is uncorrelated with 8_t serves as its own instrument. These instruments are used along with Y to estimate pi, Pi... Pl- Its important to point that the higher the correlation between the exogenous variable and it's variable, the lower the variance of the estimated coefficients. This is the reason why other X_k'S are used as their own instruments if uncorrelated with s. Under this regression model, each included endogenous variables is regressed against the complete set of exogenous variables, and the predicted values of Y from these equations are subsequently used to estimate the structural equation, hence the name two stage least squares.

3.2.2 Method of analysis

In the preliminary analysis the frequencies of the variables considered were carried out and percentages determined. Results were tabulated according to variable categories. Cross tabulation were carried out for the number of children ever born by each independent variable. This was to determine the distribution of CEB by each independent variable. Chi square test was performed for each distribution. This was to measure the significance of the association between the two variables and as a guide in variable recording. Bivariate analysis was also carried out to by regressing CEB on each independent variable. OLS regression was used and the test level of significance was carried out for each variable. Bivariate analysis was carried to find out the effect of each independent variable in absence of other covariates.

At multivariate level, OLS regression and 2SLS regression were carried out for the whole population and for type of place of residence, region of residence and for women education attainment. This was to give national results and differential results. OLS regression was to give direct effects of infant/child death on fertility. 2SLS regression was used to give unbiased estimate of replacement rate.

In OLS regression CEB (Y) were regressed on infant and child death(s) and on the other hand, in 2 SLS regression the observed infant/child mortality rate d/yj was used as an instrument of number of infant/child death(s) (dj). The primary virtue of di/yi is that, di/yi makes an excellent instrument variable since it is highly correlated with di and it's at the same time uncorrected with error term (s).

The use of d/y, was to offer a solution to the Ordinary Least Square bias (Olsen 1980. Wallace 1984). Unlike the results of OLS, which needed correction in order to give consistent estimate of replacement rates, 2SLS provides unbiased estimates, and no correction is needed.

The replacement rates from 2SLS regression of sub- samples were taken as the replacement rate of the respective sub samples. Vital statistics for some variables considered to be of great help were computed and tabulated for comparison and reference. These variables are CEB, infant/child death and total number of living children.

Chapter 4

Background Characteristics of the Study Population

4.1 Introduction

This chapter looks at the characteristics of the study population according to the study variables. It is divided into two parts. In the first part, the frequency distributions of women are computed and presented according to various background characteristics. In the second part the result of cross tabulation between children ever born and selected independent variables are presented to show the relationship between the dependent variable and each of the independent variables.

The variables considered includes children ever bom (CEB) as dependent variable, current age of the woman, age at first marriage, educational attainment of the woman, partner's education, region of residence, type of residence and number of infant/child death.

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This study utilizes data from 2063 women aged 35 years and above. The reason of using the data is that, the study investigates lifetime fertility thus women aged 35 years and above have completed their child bearing or are about to. Childless women and women who have never been married were excluded from the analysis to eliminate biases which may lead to under estimation of replacement level.

Frequencies, descriptive and cross tabulation of the number of living children was computed and are presented below.

Table 4.1: Distribution of the study population by background characteristics

	Count	Percentage	
Number Children ever born			
1-4	549	26.6	
5-7	822	39.8	
8-10	586	28.4	
11 and above	106	5.1	
Total	**2063**	100	
Mean			**6.34**
Variance			**6.79**
Number of children dead			
0	1212	58.7	
1-2	660	32.0	
3 and above	191	9.3	
Total	**2063**	**100**	
Mean			**0.78**
Variance			**1.55**
Age Cohort (Years)			
35-39	942	45.7	
40-44	617	29.9	
45+	504	24.4	
Total	**2063**	**100**	
Types of residence			
Urban	278	13.5	
Rural	1785	86.5	
Total	**2063**	**100**	
Age of first marriage			
< 16 years	755	36.6	
17-20 years	822	39.8	
20+	486	23.6	
Total	**2063**	**100**	
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Region of residence			
Region 1	615	29.8	
Region2	1448	70.2	
Total	**2063**	**100**	
Education attainment			
None	637	30.9	
Primary incomplete	587	28.5	
Primary Complete	448	21.7	
Secondary incomplete	158	7.7	
Secondary complete Plus	233	11.3	
Total	**2063**	**100**	
Partner's education attainment			
None	354	17.4	
Primary incomplete	440	21.6	
Primary complete	569	27.9	
Secondary incomplete	168	8.2	
Secondary complete plus	484	23.7	
Don't know	24	1.2	
Total	**2038**	**100**	

Source of data KDHS 1998

From the population 45.7 percent women were aged between 35 years and 39 years, 29 percent aged between 40 years and 44 years and 24.4 percent were aged 45 years and above. The analysis shows that 29.8 percent of the women considered were living in Nairobi, Central and Eastern Provinces while 70.2 percent lived in Western, coast and Rift Valley Provinces. Those who were living in urban areas contributed to 13.5 percent while 86.5 percent were from rural areas.

When the population was categorized by the age at fist marriage, the result showed that 36.6 percent were married at the age of 16 years or below. 39 percent were married at an age between 17 and 20 years while the rest 23.6 percent were married at the age of 21 years and above.

As per education attainment 30.9 percent of the women had no education and those with only primary incomplete education contributed to more than half of all the women considered i.e. 30.9 percent and 28.5 percent respectively. 21.7 percent had completed primary education. 7.7 percent had incomplete secondary education and the rest 11.3 percent had completed secondary education and higher.

When respondent's partner's education is analyzed the results show that 17.4 percent had no education, 21.6 percent had incomplete primary education, 27.9 percent had complete primary education while only 8.2 percent had incomplete secondary education and only 32.7 percent had complete secondary education and higher education

4.2 Results of cross tabulation

At this stage the association between each of the independent variables and children ever born (Dependent variable), is investigated. Each independent variable is cross tabulated with number of children ever born and the percentage distribution observed tabulated. The Chi- square is used to show the degree of association and its significance. The table below summarizes the results.

Table 4.2: Percentage distribution ofCEB by background Characteristics of the women

Independent variable	Children ever born			
	1-4	**5-7**	**8-10**	**11+**
Age cohort (years)				
35-39	33.8	44.6	19.5	2.1
40-44	23.3	37.4	33.7	5.5
45+	17.3	33.9	38.5	10.3
£ value = 141.174				
Degree of freedom (df) =6				
Significance = 0.000				
Age of first marriage (years)				
< 16	18.4	35.0	37.0	9.7
17-20	22.7	44.8	28.6	3.9
21 +	45.9	39.1	14.8	0.2
£ value =207.795				
df = 6				
Significance = 0.000				
Types of residence				
Urban	58.6	28.8	10.8	1.8
Rural	21.6	41.6	31.1	5.7
£ value = 175.742				
df = 3				
Significance = 0.000				
Region of residence				
Region 1	38.9	39.3	20.2	1.6
Region 2	21.4	40.1	31.9	6.6
£ value = 91.456				

df = 3				
Significance = 0.000				
Educational attainment				
None	20.6	35.6	37.2	6.6
Primary in complete	19.1	40.7	32.9	7.3
Primary complete	28.1	44.2	23.7	4.0
Secondary incomplete	27.8	50.0	20.9	1.3
Secondary complete plus	58.4	33.9	7.3	0.4
£ value = 209.869				
df = 12				
Sig = 0.000				
Partners education				
None	22.0	39.0	33.3	5.6
Primary in complete	18.6	36.8	35.7	8.9
Primary complete	20.9	42.4	31.6	5.1
Secondary incomplete	32.1	42.9	22.0	3.0
Secondary complete plus	40.2	40.4	17.2	2.3
£ = 117.789				
df =15				
Sig = 0.000				
Children Dead				
0	38.0	42.9	18.2	0.9
1-2	13.3	40.2	40.2	6.4
3+	0.5	19.4	52.4	27.7
£ =523.078				
Df = 6				
Sig= 0.000				

Source of data: KDHS 1998

The results indicated that, for women aged 35 years to 39 years, the highest percentage 44.6 percent had 5 to 7 children ever born compared to 33.8 percent who had 1 to 4 children ever born, 19.5 percent having 8 to 10 children ever born and a mere 2.1 percent had 11 CEB and above. Similarly those who had 5 to 7 CEB among women aged 40 to 44 years had the highest percentage, while 33.7 percent had 8 to 10 children ever born, 23.3 percent had 1 to 4 CEB and 5.5 percent had 11 CEB and above. Among women aged 45 years and above, those with 8 to 10 CEB had the highest percentage of 38.5 percent followed by those with 5 to 7 CEB with 33.9 percent while those with 1 to 4 CEB and those withl 1 and above CEB had 17.3 percent and 10.3 percent respectively. This results show that women aged 35-39 years had the highest percentage among women with 1 to 4 CEB and 5 to 7 CEB while those aged 45 years and above had highest percentage among women who has 8 to 10 CEB and those with 11 CEB and above. Thus the result affirms the theory that the number of CEB increases as age increases.

The distribution of CEB by the age at first marriage indicates that among those women who were married at the age below 17 years, 37 percent had 8 to 10 CEB contributing to the highest percentage but slightly followed by those with 5 to 7 CEB as they contributed 35 percent while the rest with 1 to 4 CEB and 11 and above CEB were 18.4 percent and 9.7 percent respectively. Those with 5 to 7 CEB among the women married at the age of 17 to 20 years had the highest percentage of 44.8 percent while those with 11 and above CEB were 3.9 Percent. Among those married at the age of 21 years and above, 45.9 percent had 1 to 4 CEB and 39.1 percent had 5 to 7 CEB compared to only 0.2 percent with 11 and above CEB. This result indicates that, the higher the age at first marriage the fewer the CEB and Vice Versa.

Among those who live in urban areas 58.6 percent had 1 to 4 CEB compared to only 21.6 percent of those who live in rural areas. On the other hand 31.1 percent of those who live in rural areas had 8 to 10 CEB compared to 10.8 percent of those living in urban areas, while women living in rural areas with 5 to 7 CEB had a high percentage of 41.6 compared to 28.8 percent of those living in urban with the same number of CEB. This shows that women living in rural areas tend to have more CEB than women living in urban areas.

Among the women living in Nairobi, Central and Eastern Provinces, 39.3 percent and 38.9 percent had 5 to 7 CEB and 1 to 4 CEB respectively while the rest 20.2 percent and 1.6 percent had 8 to 10 percent CEB and 11 CEB and above respectively. Most of those living in western, Coast, Nyanza and Rift valley provinces had 5 to 7 CEB and 8 to 10 CEB i.e. 40.1 percent and 31.9 percent. Only 21.4 percent had 1 to 4 CEB. This indicates that women in Nairobi, Central and Eastern Provinces tend to have fewer CEB that the rest.

The distribution of CEB by women education attainment shows that those without any education had the highest percentage of 37.2 percent had 8 to 10 CEB slightly above those with 5 to 7 CEB who were 35.6 percent and highest percentage in all groups. Those with 11 and above CEB are 6.6 percent. Among those with incomplete primary education 40.7 percent had 5 to 7 CEB and 32.9 percent had 8 to 10 CEB only, 19.1 percent had 1 to 4 CEB and lowest in all groups with 1 to 4 CEB. On the other hand, 7.3 percent had 11 and above CEB, which turns to be the highest percentage of all education categories with 11 and above CEB.

Women with incomplete secondary education had the highest percentage in those with 5 to 7 CEB of 50.0 percent which is about double of those with 1 to 4 CEB of 27.8 percent only 1.3 percent had 11 and above CEB. Most of those with complete primary education. 44.2 percent had 5 to 7 CEB while 28.1 percent and 23.7 percent had 1 to 4 CEB and 8 to 10 CEB respectively compared to 7.3 percent and a mere 0.4 percent with 8 to 10 CEB and 11 CEB and above respectively. These results show that the higher the education, the fewer the number of CEB and vice versa. This shows a negative association between education attained and CEB.

The distribution of CEB by partner's education attained is similar to that of by respondent's education. Most of them 39 percent had 5 to 7 CEB and 33.3 percent had 8 to 10 CEB. On the other hand those with incomplete primary education had highest percentage of those with 11 and above CEB among all the education categories, i.e. 8.9 percent, while most of them have 5 to 7 and 8 to 10 CEB with 36.8 percent and 35.7 percent respectively. 42.4 percent of those with complete primary education had 5 to 7 CEB while 31.6 percent hand 8 to 10 CEB. The rest 26 percent had 1 to 4 CEB and 11 CEB and above, 40.2 percent and 40.4 percent of those with complete secondary education and above had 1 to 4 CEB and 5 to 7 CEB respectively while the rest 19.5 percent had 8 and above CEB. This results show there is a negative association between partner's education and CEB

The results indicate that, among women who experienced no death, 42.9 percent had 5 to 7 CEB while 38 percent had 1 to 4 CEB and only 19.2 percent had 8 and above CEB. Less than 1 percent had 11 and above CEB. Among those who experienced 1 to 2 child

deaths) 40.2 percent had 5 to 7 CEB and the same percent had 8 to 10 CEB. The distribution changes as the women experience more than two child deaths as only 0.5 percent had 1 to 4 CEB compared to 52.4 percent and 27.7 percent who had 8 to 10 CEB and 11 CEB and above. This shows that there is a positive relationship between number of children dead and CEB.

Chapter 5

Estimation of replacement rates

5.1 Introduction

In this chapter the direct effects of independent variables on CEB are examined and replacement rate estimated. Ordinary Least Square (OLS) regression and Two-Stage Least Square (2SLS) regression were used. OLS was used to compute direct effects of the independent variables on the dependent variable while 2SLS was used to estimate the replacement rate. OLS and 2SLS are discussed in details in chapter three.

At bivariate level, direct effects of each independent variable was estimated in absence of the other variables. At multivariate level, the regressions were carried out in two folds. First all variables were used and study population model fitted and secondly regressions were carried out by region of residence, women education attainment and type of place residence. The results were presented in the same categories.

5.2 Bivariate analysis

The relationship between independent variable was examined by carrying out regression on CEB with each independent variable at a time. Dummy variables were created to help in examining the effect of each category of independent variable and its significance in explaining the relationship between the variable and CEB. The table below outlines the results obtained.

Table 5.1: Result of Bivariate regression

Variable	P	S.E (P)	Significance
Age cohort (years)			
(45+)			
35-39	-1.575***	0.139	0.000
40-44	-0.546***	0.151	0.000
Age at first marriage (years)			
(17-20)			
< 16	0.712***	0.125	0.000
21 +	-1.371***	0.142	0.000
Region of residence			
(Region 2)			
Region 1	-1.144***	0.123	0.000
Place of residence			
(Rural)			
Urban	-2.053***	0.162	0.000

Education attainment			
(None)			
Primary Incomplete	-0.043	0.142	0.760
Primary Complete	-0.823***	0.153	**0.000**
Secondary Incomplete	-1.048***	0.221	**0.000**
Secondary complete plus	-2.487***	0.190	**0.000**
Partner's education			
(None)			
Primary Incomplete	0.797***	**0.111**	**0.000**
Primary Complete	0.308***	0.103	0.003
Secondary Incomplete	-0.242	0.152	0.112
Secondary complete plus	-0.894***	0.108	**0.000**
Children dead	1.030***	0.040	**0.000**

Source of data: KDHS 1998

*** Significant at 0.01 significant level
** Significant at 0.05 significant level
* Significant at 0.1 significant level

Notes

Reference categories are in parenthesis
Region 1 comprises of Nairobi, Central and Eastern Province while Region 2 comprises of Western, Nyanza, Coast and Rift Valley Provinces.

The result of bivariance analysis shows that women of age 35 to 39 years have 1.575 less CEB than women with 45 years and above. It also shows that women of 40 to 44 years have 0.44 less CEB than those with 45 years and above. Thus the age of the mother was significantly related to CEB.

On the other hand, age at first marriage of the women significantly related to CEB. Those who were married at the age of 16 years and below tend to have approximately 0.7 CEB more than those married at age of 17 to 20 years. Women married at age of 21 and above tend to have approximately 1.37 CEB less than those married at the age of 17 to 20 years.

Women living in Nairobi, Central and Eastern Provinces had 1.144 CEB less than women living in Western, Nyaza, Coast and Rift Valley Provinces. The relation was significant at 0.05 level of significance. Type of place of residence was significantly related to CEB. Women living in urban areas were found to have approximately 2 CEB less than those living in rural areas.

The results by women's education showed that as education level rises women tend to have more CEB than women with no education. For example, the results show that women with completed secondary education and above have approximately 2.5 CEB less than women with no education. Those with incomplete secondary education have approximately 1 CEB less than those with no education whereas women with complete primary education had 0.823 CEB less than women with no education. Women with incomplete primary education had 0.043 CEB less than those with no education which was found to be insignificant; otherwise the whole variable was significant at 0.05 level of significance.

Women with partners of incomplete primary education tend to have approximately 0.8 CEB more than those with partners of no education while those with complete primary education had 0.3 CEB more than those with no education. Women with partners of incomplete secondary education and complete secondary education and higher had fewer

CEB i.e. 0.24 and 0.89 CEB less than those with no education. The result also shows that women who have experienced a child death had 1 CEB extra to offset the child loss.

5.2 **Multivariate analysis**

Having examined the relationship between CEB with each independent variable by fitting a model of each variable and having found that all variables were significant at bivariate level, the next step was to fit the final model including all the variable.

Ordinary least square (OLS) and Two stage least square (2SLS) were used to fit the model. In 2SLS model proportion of children dead was used as an instrument of the number of infants/ children dead. This is to eliminate/reduce errors that can be as a result of interrelationship between child mortality and Fertility (Wallace 1984). The table below shows the result of2SLS and OLS regressions.

Table 5.2: The result of 2SLS and OLS regressions on children ever born for women aged 35-49 years. *N=2063*

	2SLS			OLS		
Variable	**Coefi (/?)**	**SE** *(p)*	**|T-ratio|**	**Coef** *(p)*	**SE(/?)**	**|T-ratio|**
Mean CEB = 6.34 (0.057)						
Constant	7.2871***	0.1550	47.013	6.631***	0.145	45.652
Age cohort (Years)						
(45+)						
35-39	-1.2263***	0.1254	9.780	-0.977***	0.120	8.156
40-44	-0.4403***	0.1319	3.338	-0.315**	0.127	2.493
Age at first marriage						
(17-20)						
<16 years	0.3666***	0.1154	3.176	0.183	0.110	1.659
21 + years	-0.9578***	0.1288	-7.436	-0.868***	0.124	7.021
Education attainment						
(None)						
Primary incomplete	0.2147	0.1259	1.705	0.237	0.121	1.959
Primary complete	0.0193	0.1433	0.135	0.128	0.138	0.931
Secondary incomplete	0.0090	0.2092	0.043	0.187	0.201	0.934
Secondary complete plus	-0.6431***	0.2266	3.113	-0.526**	0.198	2.653
Partner's education						
(None)						
Primary incomplete	0.2607**	0.1012	2.576	0.201	0.097	2.071
Primary complete	0.0305	0.0911	0.355	0.060	0.087	0.685
Secondary incomplete	-0.2226	0.1313	1.695	-0.233	0.126	1.851
Secondary complete plus	-0.1243	0.1078	1.153	0.086	0.104	0.826
Place of residence						
(Rural)						
Urban	-1 419***	0.2066	3.113	-1.279***	0.143	8.973
Region of residence						
(Region 2)						
Region 1	-0.6334***	0.1106	5.727	-0.420***	0.106	3.977
Child death	0.2687***	0.4950	5.428	0.793***	0.04	19.898
Adjusted R^2	**0.26**			**0.36**		
Degree of freedom	**15**			**15**		

Source of data: KDHS 1998

*** Significant at 0.01 significant level
•• Significant at 0.05 significant level
* Significant at 0.1 significant level

Notes:
- reference categories are given in parenthesis
- Region 1 comprises of Nairobi, Central and Eastern Provinces while Region 2 Comprises of Western, Nyaza, Coast and Rift valley Provinces.

The results of multivariate analysis show that, women of age 35 to 39 years had 1.23 CEB less compared to those of age 45 and above while those women aged 40 to 44 years who had 0.44 CEB less compared to those of age 45 years and above. Age turned out to be significant in explaining CEB per woman.

On the other hand, age of first marriage also turned out to be significant in influencing the number of births. Those women married at the age below 17 years had 0.37 CEB more compared to those married at the age between 17 to 20 years while women married at the age of 21 years and above had 0.96 CEB less than those married at the age of 17 to 20 years.

According to the results, only complete secondary and higher emerged significant in influencing the number of CEB; where those with this level of education had 0.64 CEB less than those with no education. Those with incomplete primary education had 0.21 CEB more compared to those with no education while the rest showed negligible increase of CEB.

Only women with partners with incomplete primary education and incomplete secondary education turned out important in explaining the risk of child birth. They had 0.26 CEB

more and 0.22 CEB less than those whose partner's education respectively. Those with partners of complete secondary education and higher had 0.12 CEB less than those with partners without education while those with complete primary education had only 0.03 CEB more than those with partners of no education.

Place of residence and region of residence were also significant, with women living in urban areas and Nairobi, Central and Eastern Provinces having 1.42 CEB and 0.633 CEB less than those living in rural and Western, Nyanza, Coast and Rift Valley Provinces respectively. Child death also turned out to be significant with those who had experienced child death having approximately 0.27 CEB more.

From the results of OLS regression the estimates of replacement probability obtained is 0.79 (without correction). Using an instrumental variable (Two-Stage Least Square regression), it resulted in a replacement rate of 0.27. Since the results of 2SLS need no correction we conclude that replacement rate for the period 1993 to 1998 is 0.27. This result is in the neighbourhood of the results found by Otieno (2000), where he found the replacement rate for the period 1989 to 1993 to be 0.30 using 2SLS model. This shows that there was a reduction in replacement rate in the period 1993 to 1998 of 0.03.

5.3 Replacement rates differentials

In the previous section, we examined replacement level of the whole study population. In this section the sub-group variations in replacement level are examined. Replacement level has been estimated by:

a) Women's education attainment, categorized into: no education. Primary incomplete, Primary complete, Secondary incomplete, Secondary Complete and above.
b) Region of residence which is categorized into high mortality regions comprising of Western, Nyanza, Coast and the Rift Valley provinces and low mortality regions comprising of Nairobi, Central and Eastern provinces.
c) Type of place residence categorized either Rural or Urban.

Table 5.3.1(a): Results of OLS regression on CEB of women aged 35 years and above bv education attainment

Variable	Education Attainment				
	None N=637	Prima rv incomplete N=587	Primary complete N=448	Secondary incomplete N-158	Secondary complete^
Constant	6.248***(24.787)	6.859***(27.642)	7.205* * *(27.228)	5.929-** (6.988)	5.986***(15.9!
Age cohort (years)					
(45+)					
35-39	-.718*** (3.103)	1.001* **(4.436)	-1.269*** (4.976)	-1.397* **(-3.285)	..792**(2.591)
40-44	0.080 (.349)	.306(1.272)	-.862***(3.037)	-.752 (-1.614)	• 1.123 (.367)
Age at first marriage (years)					
(17-20)					
<16	.125 (.598)	273 (1.376)	.142 (.594)	.476(1.162)	.073 (.176)
21+	-.897/***(-3.187)	-1.039*** (-3.885)	-.946***(3.950)	-.*122** (2.194)	-.399(1.905)
Partners education					
(None)					
Primary incomplete	.287 (1.403)	.356* (2.156)	-.002 (.001)	1.488 (1.370)	.152 (.363)
Primary complete	.524*** (2.570)	-0.074 (.466)	-.06 (.379)	.879(1.103)	-.166 (.585)
Secondary incomplete	.001 (0.002)	-.253 (1.029)	.095 (.451)	.703 (.899)	.276 (.824)
Secondary complete Plus	-.775 (1.879)	-.140 (.654)	.008 (.048)	1.342 (1.820)	-.405(1.929)
Type of residence					
(Rural)					
Urban	-1.650***(4.877)	.1.019* (3.023)	-.990* **(3.565)	−1. 605*** (3. 826)	-1.118*** (-5
Region of residence					
(Region 2)	.403 (1.611)	-.462** (2.241)	0.809*** (3.974)	-.490*** (1.613)	-.771* **(3.1
Region 1	.744*** (11.044)	.799***(11.436)	.876*** (8.541)	1.056* **(4.882)	,867***(6.7"
Child death	.264	.332	.304	.312	.377
Adjusted R~	11	11	11	11	11
df					

Source of data: KDHS 1998

*** Significant at 0.01 significant level
** Significant at 0.05 significant level
* Significant at 0.1 significant level

Notes:

S r i s i s of Western. Nyanza, Coas, and Rift valley Provmces.
Absolute T- ratios are in parentheses

r

Table 5.3.1(b): Results of 2SLS regression on CEB of women aged 35 yean and above by education attainment

Variable	Education attainment				
	None N=637	Primary incomplete N=587	Primary complete N=448	Secondary incomplete N-158	Secondary complete N'
Constant	7.099***(23.329)	7.448***(28.5.2)	T607***(27.618)	6.09* •* (6.995)	6. 100***(16. t^b)
Age cohort (years) (45+)					
35-39	-.1.088*** (4.333)	-1.292*** (5.525)	1.364*** (5.227)	-1.460** (3.347)	-.839* *(2.7:
40-44	•.033 (.134)	-.455 (1.836)	,925***(3.188)	-.837(1.749)	-.150 (444)
Age at first marriage (years) (17-20)					
^ 16	366 (1.618)	0.399(1.448)	267(1.087)	.804** (1.870)	125 (.299)
21-f-	-.991***(3271)	1.144***(4.150)	1.011***(4.126)	-.784* (2.320)	.413(1.963
Partners education (None)					
Primary incomplete	.416(1.884)	.381* (2.243)	0.079 (.387)	1.199(1.396)	.113 (.270)
Primary complete	.481 (2.192)	-.103 (.633)	-.091 (.558)	1.068 (1.305)	-.138(417)
Secondary incomplete	-2212* (.426)	-.195 (.771)	-.104 (.481)	873 (1.087)	.281 (.836)
Secondary complete plus	-.621 (-1.398)	-.197 (-.893)	-.067 (-.375)	1.449(1.917)	-399(1.893
Type of residence (Rural)					
Urban	-2.223*** (5.534)	-1.160*** (3.394)	-.964*** (3.394)	-1.746***(4.043)	.1.161***1
Region of residence (Region 2)					
Region 1	0.013 (.048)	-.657** (3.085)	-1.000*** (4.773)	-1.576(1.843)	-,8ii***(:
Child death	0.073 (.800)	.386*** (4.731)	0.419*** (3.488)	.471*(1.694)	.695*** (5
Adjusted R^2	0.13	0.23	0.22	.23	.34
df		11	11	11	II

Source of data: KDHS 1998

*** Significant at 0.01 significant level
** Significant at 0.05 significant level
* Significant at 0.1 significant level

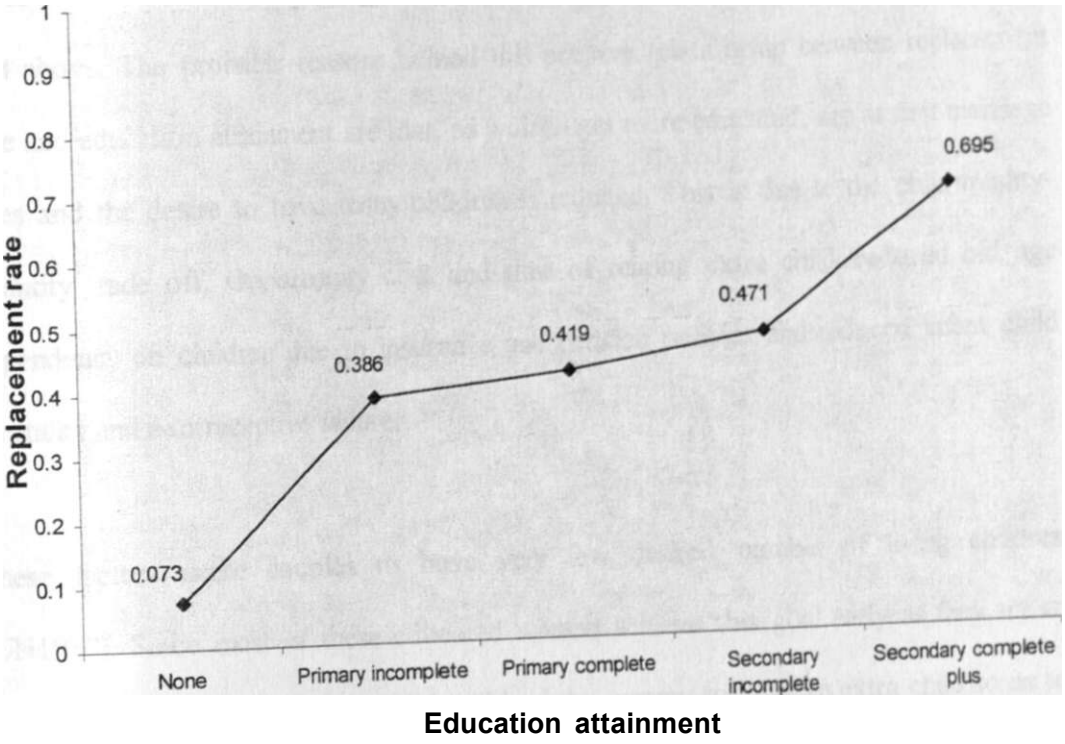
Notes:

Reference categories are g.ven m ^en,l*sis provmces while Region 2

S ^ s T ^ ^ Co^ and R * valley Proves.

Absolute T- ratios are in parentheses

Chart 1: Replacement rate by education attainment



The results in the table above shows that direct effects of infant/child deaths increase from 0.74 For women with no education to 1.056 for those with secondary incomplete and then decrease to 0.867 for those with complete secondary education plus. On the other hand, replacement rate increases as education increases ranging from 0.073 for those women with no education to 0.695 for women with complete secondary education and above. The probable reasons behind this positive relationship between replacement rate and education attainment are that, as women get more educated, age at first marriage rises and the desire to have many children is reduced. This is due to the child quality-quantity trade off. Opportunity cost and time of rearing extra child, reduced old age dependency on children due to insurance and pension policies and reduced infant child mortality and contraceptive failure.

These factors make couples to have very few desired number of living children (UNI987). Since most of these educated women achieve this goal early as they try to catch up, the death of that one child will lead the woman to have an extra child so as to keep her family size stable and hence high replacement rate. It is also worth pointing that these factors may work to reduce replacement rate depending on method of contraception where if a woman had tubal ligation she cannot be able to replace the lost child (Knodel 1968).

Women with no education tend to marry early resulting to high number of children ever born. Also high number of children ever bom is as a result of effects of cultural practices such as beliefs and norms and as a result of low prevalence in contraceptive failure and high mortality rate. This results to high number of unwanted children thus, when one

infant/child dies they have low desire of replacing the lost infant/child. Also high infant and child mortality rate experienced by these women will make them to have more children for hoarding purposes and as a result direct replacement of a child death is reduced. The replacement rate in higher education level turned out to be significant at 0.01 level of significance except for those with incompletely secondary education that was significant at O.lOlevel of significance. Replacement level for women with no education turned out to be insignificant. This shows that women with no education highly practice replacement by hoarding rendering direct replacement negligible. The reverse applies to women with high education.

Table 5.3.1(c) Estimated and Observed moments by Education attainment

variable	**None** **N =637**	**Primary incomplete** **N =587**	**Primary complete** **N =448**	**Secondary incomplete** **N =158**	**Secondary complete** **N = 233**
Parameter estimates					
r	0.073	0.386	0.419	0.417	0.695
P	0.153	0.118	0.079	0.056	0.043
n	0.744	0.799	0.876	1.056	0.867
Observed moments				t	
X	5.80	5.92	5.50	5.48	4.13
S^2	5.951	5.064	4.707	3.474	2.711
Y	6.89	6.85	6.07	5.84	4.40
d	1.09	0.93	0.55	0.36	0.27
Var(y)	7.293	6.823	50834	4.223	3.457
Var(d)	2.046	1.812	0.959	0.461	0.612
Cov(yd)	1.694	1.786	1.043	0.605	0.679

Source of data: KDHS 1998

Where:

P is the proportion of infant/child dead

X is the mean number of living children

S^2 is the variance of number of living children

Y is the mean of CEB

d is the mean of infant/children dead

Var(y) is the variance of CEB

Var(d) is the variance of infant/children dead

Cov(yd) is the covariance of CEB and infant/child dead

n is the direct effects of infant/child death

r is the replacement rate

Observed moments are shown to vary with education. Mean of children ever born decreases as the level of education decreases it ranges from 6.89 for those with no education to 4.4 for those with complete secondary education and higher. Similar trend is observed on the mean of number of living children. Mean number of child deaths also decrease as education level rises ranging from 1.09 to 0.27 for those with no education and those with complete secondary education and higher. Other moments vary in the same way.

These moments indicate that, more educated women have a reduced desire to have more children than less educated women. This could be due to quality versus quantity trade off, opportunity cost of rearing extra child and less dependency on children at older ages (Palloni 1999 Wallace 1984). These results agree with results of other studies on effects of education of fertility.

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The parameter estimates vary with mother's level of education but in the expected direction. The probability of child death decreases with increase of level of education as the mean of children born if no death. The same applies to the mean of children over born. The replacement probability increases with increase in education attainment. Meaning there is a high chance of higher educated a woman replacing a lost child a woman of a lower education.

Table5.3.2(d): Results of OLS and 2SLS regression on CEB of women aged 35 years and by region of residence

	Region 1 N =615		Region 2 N=1448	
	OLS	2SLS	OLS	2SLS
Constant	6.866*** (27.655)	7.278*** (27.582)	6.471*** (37.553)	7.140*** (38.694
Age cohort (years) (45+)				
35-39	-1.177***(-5.877)	-1.363*** (6.613)	-.848*** (5.753)	-1.120*** (7.223)
40-44	-228 (-1.085)	-.346(1.596)	-.309(1.982)	-.437 (2.674)
Age at first marriage (years) (17-20)				
<; 16	.307(1.507)	.431* (2.06)	.122 (.922)	.311** (2.245)
21+	-6.86*** (3.856)	-.772*** (4.229)	-.945*** (5.731)	-1.048*** (6.071;
Partner's Education (None)				
Primary complete	.203(1.258)	.229(1.388)	.203 (1.694)	.274** (2.181)
Primary complete	.093 (+584)	-.083(.586)	.152(1.370)	-.164 (.897)
Second incomplete	-.106 (. 584)	-.161 (.866)	-.305 (1.805)	-.265 (1.501)
Secondary complete (plus)	-.169(1.074)	-.172(1.067)	-.079 (.584)	-.136 0.966
Education attainment (none)				
Primary incomplete	-.507* (2.152)	-.533* (2.205)	.379** (2.661)	.357* (2.397)
Primary incomplete	-808*** (3.331)	-.916*** (3.682)	.404** (2.377)	.296(1.664)
Secondary incomplete	-567(1.717)	-.653 (1.931)	.377(1.485)	.150 (.601)
Secondary complete plus	-1.536*** (4.726)	-1.660*** (4.982)	-.200 (.791)	-.330 (1.245)
Type of residence (Rural)				
Urban	-.785*** (3.472)	-.823*** (3.55)	-1.484*** (8.203)	-1.662*** (8.766
Child death	.814*** (7.794)	.246*(1.988)	0.797*** (18.101)	.284*** (5.158)
Adjusted	.354	.302	.334	.211
df	14	14	14	14

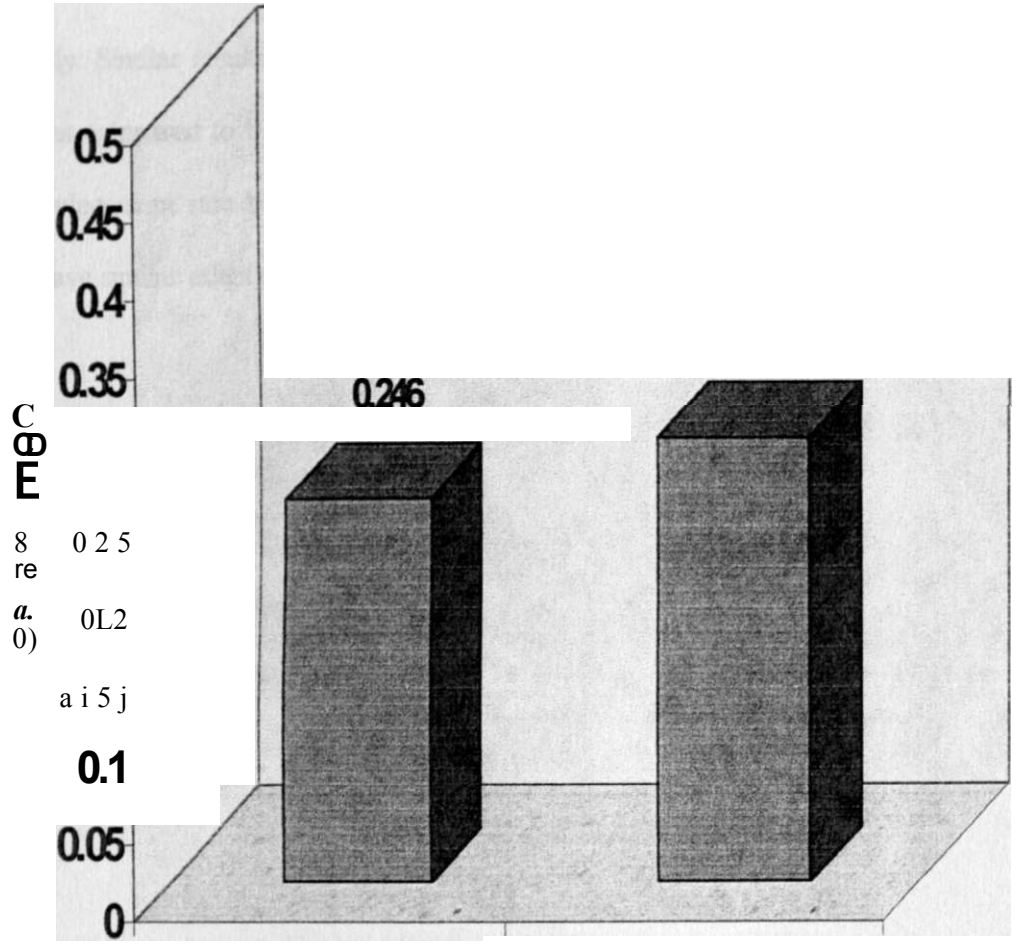
Source of data: KDHS 1998

*** Significant at 0.01 significant level
** Significant at 0.05 significant level
* Significant at 0.1 significant level

Notes:
Reference categories are given in parenthesis
- Region 1 comprises of Nairobi, Central and Eastern Provinces while Region 2 Comprises of, Western, Nyanza, Coast and Rift valley Provinces.

Absolute T- ratios are in parentheses

Chart 2: Replacement rate by regions



The result of the regression above shows when the study sample is divided into low and high mortality regions, direct effects of child/infant death on CEB are almost the same. That is 0.814 and 0.797 extra CEB for a death of an infant/child in low and high mortality rates respectively. Similar results are shown in replacement level where it is 0.25 in low mortality regions compared to 0.28 in high mortality regions. This shows that there is no difference in replacement rate between the two regions. This indicates that, factors that affect fertility have similar effects in both regions.

Table 5.3.3: Results of OLS and 2SLS regression on CEB of women aged 35 years and by type of place of residence

variable	Urban N = 278		Rural N=1785	
	OLS	2SLS	OLS	2SLS
Constant	4.274***(10.307)	4.828***(10.758)	6.785***(43.940)	7.427***(45.241)
Age cohort (years) (45+)				
35-39	-.487(1.585)	-.757** (2.298)	-1.065***(8.196)	-1.315*** (9.688)
40-49	-.515(1.404)	-.792 *(2.021)	-.301*(2.232)	-.420 ***(2.988)
Age at first marriage (17-20)				
< 16	.501(1.594)	.823 **(2.437)	.114 (.968)	.282** (2.29)
21 +	-.730**(2.349)	-.774** (2.345)	-.885*** (6.558)	-.983 ***(7.010)
Education attained (None)				
Primary incomplete	.843 *(1.999)	.852(1.901)	.187(1.478)	.162(1.232)
Primary complete	.777(1.887)	.946 *(2.157)	.046 (.314)	.081 (.600)
Secondary incomplete	.553(.971)	.502 (.828)	.173 (.802)	0.001 (.000)
Secondary complete	.047 (.015)	-.039 (.082)	-.580** (2.517)	-.693 (2.891)
Partners education (None)				
Primary incomplete	.502(1.497)	.444(1.245)	.175(1.719)	.239 **(2.251)
Primary complete	-.121 (.453)	.013 (.047)	,077(..824)	.044 (.653)
Secondary incomplete	-.136 (.404)	-.138(.385)	-.265(1.933)	-.254(1.783)
Secondary complete plus	-.027(.109)	-.137 (.528)	-.098 (.856)	-.133(1.114)
Region of residence (Region 2)				
Region 1	-.168 (.603)	-.342(1.150)	-.497*** (4.323)	-.717*** (5.965)
Child death	1.037***(6.673)	.130 (.602)	.771*** (18.620)	.276*** (5.467)
Adjusted R	.275	.159	.317	.210
df	14	14	14	14

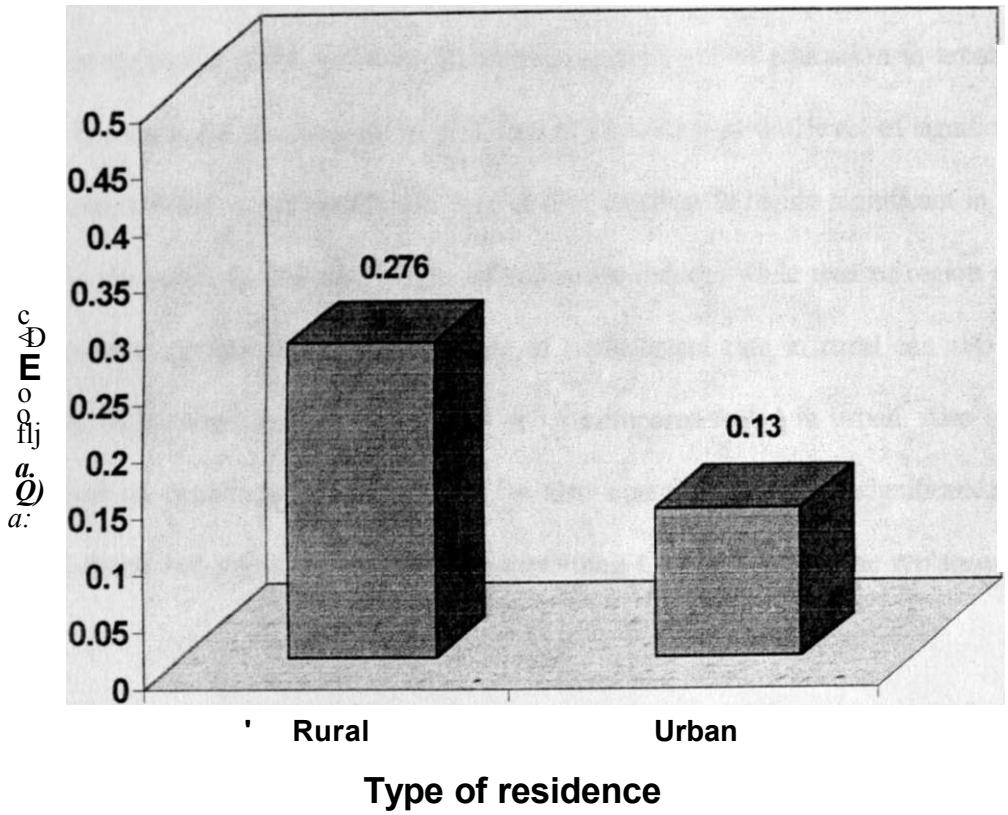
Source of data: KDHS 1998

*** Significant at 0.01 significant level
** Significant at 0.05 significant level
* Significant at 0.1 significant level

Notes:

- reference categories are given in parenthesis
- Region 1 comprises of Nairobi. Central and Eastern Provinces while Region 2 Comprises of Western, Nyaza, Coast and Rift valley Provinces.
- Absolute T-ratios are in parentheses

Chart 3: Replacement rate by type of residence



The result shows that women living in urban who experience a death of an infant/child has approximately one additional CEB compared to 0.8 additional CEB for rural women. Though the case, the rate of replacement of a lost child in urban area is lower than that of the rural that is, 0.13 and 0.28 respectively. This shows that, when the sample population is divided into rural and urban, effects of some factors that affect replacement of a lost infant/child are reduced over by other factors whose effects become more significant in this sub-grouping. An example is women education level. In rural none of its level is significant in explaining CEB and only primary complete level of education in urban is significant. On the other hand region of residence is significant at 0.01 level of significant in rural, while in urban is not significant. Age at first marriage is highly significant in the rural than in the urban In this case effects of education reduces while that of region and age at first marriage increased. The high rate of replacement rate in rural can also be explained by high mean of children dead that is 0.8 compared to 0.4 in urban. Also high rate of access to contraceptives in urban areas also contribute to the insignificance of infant child death and region of residence in explaining CEB and hence the replacement rate.

Table 5.3.4: Estimated parameters and Observed moments by Region of residence and type of residence

Variable	Region of residence		Type of residence	
	Region 1 N=615	**Region 2 N =1448**	**Rural N =1785**	**Urban N =278**
Estimated parameters				
r	0.246	0.284	0.276	0.130
P	0.059	0.128	113	0.077
7l	0.814	0.797	0.849	1.156
Observed moments				
X	5.15	5.73	5.61	3.9
8^2	4.531	5.317	5.573	5.007
Y	5.53	6.68	6.43	4.28
l	.38	0.95	0.82	0.38
d	5.393	6.996	7.29	6.195
Var(y)	0.585	1.861	1.631	0.662
Var(d)	0.723	1.770	1.676	0.925
Cov(yd)				
1				

Source of data: KDHS 1998

Where:

P is the proportion of infant/child dead

A. is the mean number of living children

8^2 is the variance of number of living children

Y is the mean of CEB

d is the mean of infant/children dead

Var(y) is the variance of CEB

Var(d) is the variance of infant/children dead

Cov(yd) is the covariance of CEB and infant/child dead

n is the direct effects of infant/child deaths

r is the replacement rate

The above table shows that, Region 1 had smaller mean of children ever born than region 2 in 5.53 and 6.68 respectively. Region 1 also had smaller mean of number of living children compared to region 2that is 5.15 in region 1 compared to 5.73 in region 2. The mean umber of children deaths was smaller 0.38 in region 1 compared to mean of children dead 0.95 in region 2. These moments show that, region two has a high fertility than region two. This can be due to the fact of trying to counter balance the high mortality in the region.

The observed moments in the table above shows that urban areas had smaller mean of children ever born than rural areas. That is, 4.56 in urban compared to 6.61 in rural similar trend is observed in the mean of number of living children that is urban and in rural. Mean number of children deaths in rural are higher than that of urban (0.82 and 0.40 respectively). Showing that infant child mortality rate in rural is higher than that in urban. This partly explain why fertility is higher in rural than in urban. Other moments follow the same trend.

Chapter 6

Summary, Conclusion and Recommendations

6.1 Introduction

This chapter summarizes the whole research, outline major findings and make conclusions vested of the findings. Recommendations for policy and future research are also given at the end of the chapter.

6.2 Summary

This study set out to analyze child mortality and lifetime fertility of women aged 35 years and above. The whole study was carried out with an objective of investigating the impact of infant and child mortality on fertility in Kenya for the period 1993 to 1998.

The source of data for this study is Kenya Demographic Health Survey (KDHS) conducted between February 1998 to August 1998. The data was collected among women aged 15-49. The survey targeted 8233 women for interviews and 96 percent were successful which was the total sample of 7881 women out of this sample. A study sample for this study was taken. This sample comprised ever-married women who were aged 35-49 years at the time of survey and who had at least one birth. Inclusion of never married women and those who were childless would have increased errors in the estimations. The sample totalled to 2063 women.

Ordinary Least Square (OLS) Regression and Two-Stage Least Square (2SLS) were used to determine direct effects of infant and child death and replacement rate among women who experience infant/child death respectively.

In cross tabulation the study revealed that factors such as age of the mother, age at first marriage of the mother, complete secondary education and above, place of residence region of the residence and child death were significant in influencing CEB hence lifetime fertility. The result showed that women of age 35 years to 39 years had approximately 1.2 CEB less than those with 45 years and above. Women who married at age above 21 years had fewer births same to women of secondary complete and above level of education. Those living in urban and Nairobi, Central and Eastern provinces had fewer CEB than their counterparts and those who experienced a child death had a higher number CEB.

These results are consistent to those found by Otieno using KDHS 1993 data. The reason of fewer CEB in the increase in women's education would lower the price of quality relative to quantity of children. Improve her contraceptive efficiency lowering fertility. They are also voted to be more efficient at maintaining child health, through financial access and knowledge of good sanitation, nutrition and health facilities lowering child mortality hence increasing desire for fewer births. High economic status, low mortality rate contributes more to desire for fewer births in urban and Nairobi. Central and Eastern provinces (Wallace 1984, Otieno 2000 Olsen 1980)

Same factors emerging to be significant when regression is carried out by region of residence but all the effects reduce a little except the effect of childbirth increase in Western Nvanza. Coast and Rift Valley. Education of the partner emerges to be insignificant in all areas. Age at first marriage of 21 years and above has more effect in

Western, Nyanza, Coast and Rift Valley than in Nairobi, Central and Eastern. Incomplete primary education in region 2 is significant while it is only secondary complete and above is significant in region 1.

Factors have similar effect in rural areas as in the whole Kenya while the effects are reduced in urban areas. Replacement rate prove to be insignificant in urban areas while it is significant in rural. The effect of age at first marriage of 21 years and above is higher at lower education levels than in higher levels. Women in urban had approximately more than 1 CEB less than those in rural areas in all education levels. Those in region 1 had fewer CEB than those in region 2 except for those with more education who had almost same effect. Effect of child death increased with increment of education level where women of higher education who had a child death had more CEB than those of lower education.

To estimate the replacement probabilities, Ordinarily least square regression and two stage least square regression were carried out for the whole sample and by division of the sample by women education region of residence and types of residence. While OLS resulted to high replacement probabilities, 2SLS resulted to lower Replacement rates. The reason for this difference is that OLS takes probability of a child death to be constant across all women, and since mostly this is not the case, there is need for correction of this probability. On the other hand, 2SLS uses the proportion of children death as a instrument of infant/child death(s), in this case taking probability of a child death to be random across all women. This proportion of children death is highly correlated with children dead at the same tine uncorrected with the error therein. This means that 2SLS

yields consistent estimators of replacement rate which needs no correction (Otieno 2000 Olsen 1980 Wallace 1984)

6.3 Conclusion

The study found that there is existence of direct replacement of infant/child dead among Kenyan women. This finding agrees with other studies carried out by Kimani 1992, and Otieno 1999, 2000. From the analysis of this study, replacement rate for period 1993 to 1998 is 0.27. This is lower than that of 1989 to 1993 (Otieno 2000). Replacement rate was found to increase with the increase in level of education. The study also found that there is no difference in replacement rates between low and high mortality regions. The replacement rate was high in rural areas than in urban. Infant/child death emerged insignificant in explaining CEB in urban areas.

6.4 Recommendations

6.4.1 Policy recommendations

Results of this study are of high policies supplication especially in policies geared to the reduction of fertility in Kenya. This study has revealed that there is need to put up policies and strength the already existing policies to accelerate fertility decline. These policies should integrate programmes that will reduce child mortality by increasing coverage in increase of access of nutrition, and child health care. Other programmes are those geared to increase, education opportunity for girls and especially higher education, contraceptive coverage, increase of age at marriage and programmes that will increase economic status of women.

6.4.2 Recommendations for further research

Further research on this area should be focused on the impact of school dropout on fertility as the effect of women who had incomplete primary and incomplete secondary education were emerging significance in explaining CEB. There is also need to investigate further the Olsen correction method and Wallace's minimum distance estimation model on Kenyan data.

References

Bongaarts, J. (1978)

A framework for analyzing the proximate determinants of fertility:
Population and development review. 4:105-132

Bongaarts J., et al (1984)

The Proximate Determinants Of Fertility, In Sub-Saharan Africa. *Population And Development Review 10(3) 511-537*

Chowdhury, et al: (1975)

The effects of mortality experience and subsequent fertility. An empirical analysis of Pakistan and Bangladesh data. Seminar on infant mortality in relation to level of fertility Bangkok, Thailand, CICRED 1975.

E Banks G.E. 1985;

Infant and child mortality and fertility, Trinidad and Tobago, Guyana and Jamaica

Hear D. Hsin-yingw 1975;

The separate effect of individual child loss perception, child survival and community mortality level upon fertility and family planning in rural Taiwan with comparison with data from urban Morocco. Seminar on infant mortality in relation to level of fertility Bangkok, Thailand, CICRED 1975.

HuffinanS. 1985

Response to determinants of natural fertility reconsidered.
Population studies 39 (1985) 163-168

Hunushek. E. A. (1977);

Statistical methods for social scientists

Iskandar N. Jones G. 1975

Effects of infant and child mortality on subsequent fertility in Indonesia. Seminar on infant mortality in relation to level of fertility Bangkok, Thailand, CICRED 1975.

Kimani M. (1992):

Effect of infant and child mortality and fertility in Kenya.

Unpublished PhD Thesis 1992, University of Nairobi.

MahaDevan K. (1981)

"Culture Nutrition and Infant and Child mortality. A case study in south central India" Manilla IUSSP

Mensch B.S. 1985

The effect of child mortality on contraceptive use and fertility in Colombia Costa Rica and Korea: *Population Studies 39:309-327*

Mosley W.H. and Chen LC (1984)

An analytical framework for the study of child survival in developing countries *Population and Development Review Supplement 10: 25-45*

Murray

Shum's Outline series: Theory and problems of Statistics. *First edition*

Musalia J. (1989);

Effects of infant and child mortality on fertility. Evidence from Kenya Demographic Health Survey 1989. *Unpublished M.A Thesis University of Nairobi.*

Nane J; Suewen L (1998)

Relative income, race, and fertility. Population studies vol. 39 (1)

National Council for Population and Development (NCPD):

Kenya demographic and health survey (KDHS) 1993.

National Council for Population and Development (NCPD):

Kenya demographic and health survey (KDHS) 1998.

Olsen R. 1980:

Estimating the effect of infant and child mortality on the number of births, *Demography Vo. 17 No. 4: 429-443*

Olsen R. Trussell J (1983);

Evaluation of the Olsen Technique for estimating the fertility response to child mortality. *Demography Vol. 20 No. 3: 391-405*

Ongor A. O. (1989);

Socio-economic and some demographic factors affecting fertility in Kenya: with special reference to infant and child mortality. *Unpublished* A*LA Thesis, University of Nairobi*

Otieno A.T.A (2000);

The fertility response on infant mortality in Kenya: Evidence from, 1993 KDHS. In oucho J. 0., Ocholla-Ayayo A. B. C., Ayiemba E. H. O., Owanda L. O. (Eds). *Population and development in Kenya, essays in honor of S.H Ominde 2000. Population Studies and Research Institute.*

(1999);

Timing and spacing of births in Kenya. *Unpublished PhD Thesis, International Institute for Population Sciences (Deemed University).*

Palloni A. Hantamala R.(1999);

The effects of infant mortality on fertility revised: New evidence from Latin America. *Demography Vol. 36 No. I: 41-58*

Peldey. R.A.H. Delgado and E. Brineman (1979)

Fertility desires and child mortality experience among Guatemalan women

Studies in family planning 10.4

Preston, S.H 1975;

Introduction, seminar on infant mortality in relation to level of fertility Bangkok, Thailand, CICRED 1975.

Richeter K., Adlaka A. (1989);

The effects of infant and child mortality on subsequent fertility.
Journal of Population and Social Studies 2(1): 43-64

Robert Retherford (1975);

The effect of child mortality on fertility and review of mechanisms seminar on infant mortality in relation to level of fertility Bangkok, Thailand, CICRED 1975.

Rutherford R.D et al (1989);

To what extent does breastfeeding explain birth interval effect on early childhood mortality. *Demography 26(3): 439-450*

and M.D. Braches (1986);

Child death and time to the next birth in Central Java. *Population Studies 38 (July): 241-253*

Rutstein S.O (1974);

The influence of child mortality on fertility in Taiwan: *Studies In Population Planning Vol. 5(6) .182-188*

Rutsein S, Medica V. (1975);

Effect of infant and child mortality on fertility in Latin America. Seminar on infant mortality in relation to level of fertility. Bangkok. Thailand. CICRED 1975.

Wallace T.D, Mauskopf J. (1984);

Fertility and replacement: Some alternative Stochastic models and results for Brazil. *Demography Vol. 21 No.4:519 - 536*

Williams A. D. (1977);

Measuring the impact of child mortality on fertility: A methodological note. *Demography Vol. 14 No. 4: 581-590*

Table 7.1: Total fertility rate differentials in various years

Source	Year	Total Fertility Rate
Census	1962	5.3
Census	1969	6.6
NDS	1977	8.0
KFS	1977/78	7.9
Census	1979	7.9
KCPS	1984	7.7
KDHS	1989	6.7
KDHS	1993	5.4
KDHS	1998	4.7

Chart4: Trend of total fertility rate in Kenya (1982-1998)

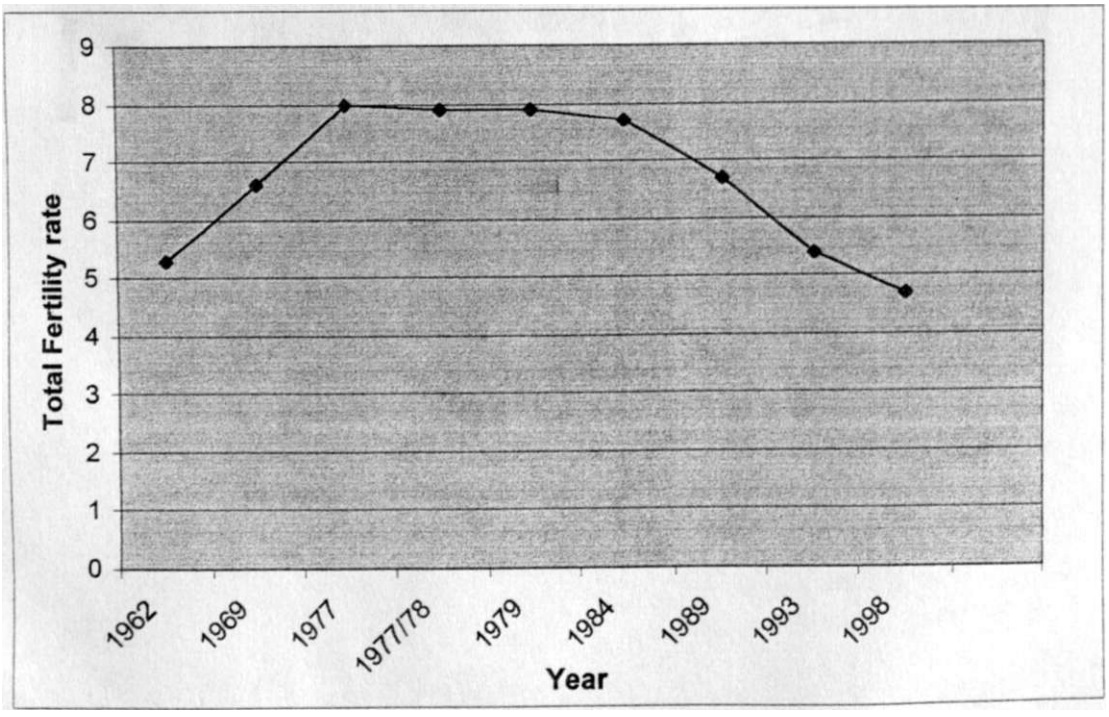


Table 7.2: Infant, Child and Under five mortality differentials in various years.

Period	IMR	CMR	Under five MR
1974-1978	64.1	44.2	105.5
1979-1983	57.6	37.8	93.1
1984-1989	59.6	31.5	89.2
1988-1993	61.7	36.7	96.1
1994-1998	73.7	40.8	111.5

Chart 5: Trends of Infant mortality, Child mortality and Under five mortality in Kenya (1974-1998)