THE EXTENT OF DEATH CLUSTERING IN RURAL KENYA: EVIDENCE FROM 1999 KENYA POPULATION AND HOUSING CENSUS

BY BERNARD ONYANGO

Q50/7569/2000

SEPTEMBER 2004

DECLARATION

This is my original work and has not been presented before in any other university or institution of higher learning for the award of a degree.

Signature .... Date. 21/01/2005 ....

ONYANGO BERNARD
(Candidate)

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

Signature.............................. Date. 27/01/2005 ....
DR. ANNE A. KHASAKHALA

Signature.. Date. 3/[illegible]/05 ....

PROF. ZIBEON MUGANZI

Population Studies and Research Institute
University of Nairobi
P.O BOX 30197
Nairobi.

DEDICATION

I dedicate this project to my parents Grace and George, my brother Hezron Okoth and to all my brothers and sisters who gave me the support, love and environment that led to this achievement. And to my lovely daughter Stacy, may God bless them all.

ACKNOWLEDGEMENT

My sincere gratitude goes to my sponsors, the United Nations Population Fund (UNFPA) for enabling me to undertake this degree program on full scholarship. Without their support and funding, I would not have had the opportunity to pursue the postgraduate training course.

I am greatly indebted to my supervisors Dr. Anne A. Khasakhala and Prof. Zibeon Muganzi, both of whom gave me guidance, critical insights and input into my work. Without their support and thoughts, my project would be alarmingly inadequate and wanting. I also wish to acknowledge further, the able guidance that I received from my other lecturer and instructor, Dr. Alfred Otieno Agwanda and others who constantly and positively faulted my work, and ensured that the final outcome would be without any major flaws.

There are many people without whose efforts this project could not have become a reality. Space may not allow to name them all, but am nevertheless really grateful for the support they rendered. However, a few of them require special mention; my mum Grace Anyango Orimbo and my brother Hezron Okoth who had to endure several inadequacies in order to see me through with my work. Bob, Victor, Mammy, Raph, Queen, Akinyi, Adhis, and the entire George family, may God bless you guys!

I would like to most sincerely acknowledge those special sacrifices made by true friends of progress; Ruphine Opondo for selfless support, Isaiah Nyandegah for the "technical break through" with my census data set and the entire PSRI team for the never ending encouragement. May God bless you all.

TABLE OF CONTENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ACRONYMS

STD DEV---STANDARD DEVIATION

CO-EFF OF VAR--------------------------CO-EFFICIENT OF VARIATION

ABSTRACT

This study set out to explore the extent of concentration of infant and child deaths in rural Kenya, as well as to investigate the factors that influence such clustering of deaths. It also hoped to come up with findings and recommendations that would guide future programme planning and to influence policy on issues regarding child survival programmes.

As a point of departure, the study was guided by two main research questions; is there evidence of death clustering in rural parts of Kenya? What are the factors that influence the concentration of such infant and child deaths?

To be able to adequately address the above issues, I adopted a modified version of Mahadevan (1986) model of studying child survival. The adoption of this model and not the others popularly used in mortality studies e.g Mosley and Chen (1984), was premised upon two arguments. One is because the Mahadevan model unlike the Mosley and Chen one, has concepts and terminologies that are specifically related to mortality. This is important as it avoids the confusion that arises when using the term "intermediate" and "proximate" determinants, which are more related to fertility. Instead, Mahadevan has developed the terms "Life Affecting variables" and "imminent variables" to specifically refer to mortality determinants. Secondly, the Mahadevan model is flexible and enjoys a number of advantages that made it even more appropriate for this study. It incorporates both micro and macro variables whose influence on the health and consequent death of the child is diverse.

ABSTRACT

This study set out to explore the extent of concentration of infant and child deaths in rural Kenya, as well as to investigate the factors that influence such clustering of deaths. It also hoped to come up with findings and recommendations that would guide future programme planning and to influence policy on issues regarding child survival programmes.

As a point of departure, the study was guided by two main research questions; is there evidence of death clustering in rural parts of Kenya? What are the factors that influence the concentration of such infant and child deaths?

To be able to adequately address the above issues, I adopted a modified version of Mahadevan (1986) model of studying child survival. The adoption of this model and not the others popularly used in mortality studies e.g Mosley and Chen (1984), was premised upon two arguments. One is because the Mahadevan model unlike the Mosley and Chen one, has concepts and terminologies that are specifically related to mortality. This is important as it avoids the confusion that arises when using the term "intermediate" and "proximate" determinants, which are more related to fertility. Instead, Mahadevan has developed the terms "Life Affecting variables" and "imminent variables" to specifically refer to mortality determinants. Secondly, the Mahadevan model is flexible and enjoys a number of advantages that made it even more appropriate for this study. It incorporates both micro and macro variables whose influence on the health and consequent death of the child is diverse.

Again the model clearly recognizes the fact that several LAV's (Life Affecting Variables) either in similar or dissimilar manner influence mortality in any society. It is this element of dissimilarity that made the model more appropriate for this study.

Following the Mahadevan model (modified), two main conceptual hypotheses were operationalized. These were that; environmental factors were likely to act via imminent variables to influence the risk of childhood deaths; and two, that child survival in Kenya is likely to be influenced by socio-cultural and socio-economic factors.

During analysis to establish whether death clustering actually exists in rural Kenya, the study compared two maternal demographic characteristics i.e parity and age, as well as other characteristics i.e educational level attained and region of residence, with a theoretical statistical distribution i.e binomial. The purpose was mainly to assess the extent of differences in the variability among women and how these differences contributes to the observed child deaths after allowing for chance factors (Zaba and David, 1996).

Besides confirming the study hypotheses and answering the study objectives fully, the results also confirmed earlier findings of studies of a similar nature by other scholars (Khasakhala A. 1998; UNICEF 1998; Katende, J. 1983).

A number of studies have shown that deaths, particularly infant and child deaths have a tendency to cluster or concentrate among certain women who share particular characteristics. These characteristics are but conditions which may range from socio-economic, socio-cultural, and environmental to demographic factors which determine the direction of magnitude such clustering may take (Das Gunpta, 1990; Khasakhala 1993; McMurray 1997).

This study has demonstrated that there is overwhelming evidence of death clustering among women in rural Kenya. This phenomenon is more pronounced among mothers of higher parity, and older ages (i.e 30 years and above).

Secondly, the results have further indicated an over dispersion of the distribution of deaths between women in parity groups. The analyses have further shown that there is a true increase in risk concentration (and risk variability) among women at the highest parities within each age group – a real indication of death clustering.

CHAPTER ONE

1.0 INTRODUCTION

This study intended to examine the extent of death clustering in the rural parts of Kenya. The data source used mainly came from the 1999 Kenya population census. Rural Kenya here refers to 15 selected districts of Bungoma, Kakamega, Kericho, Kilifi, Kisii, Machakos, Meru, Murang'a, Nakuru, Nandi, Nyeri, Siaya, South Nyanza, Taita-Taveta, and Uasin Gishu.

Whether gauged from a psychological, social, economic or demographic perspective, the death of an infant or small child represents one of the most costly of human experiences. Demographically speaking, every human birth is a unique and vital event that cumulatively impacts upon the fertility levels of a nation. Consequently the cost of the death of a child or infant is generally enormous considering the nutritional, health and medical resources spent on the newborn who does not live past early childhood. From a societal point of view, this represents largely wasted resources.

In Kenya, national estimates may present a low figure for infant mortality levels, a matter that disguises the fact that there are major mortality differentials within the country by socio-economic status, and geography.

There are major differences in infant and child mortality between mothers who have more and less education, who live in different parts of Kenya or who live in rural compared with urban areas.

The impact of early mortality on the overall level of deaths is considerable with all that it implies for social and economic development.

The contribution of infant and child mortality is also very substantial due to the large numbers of children born annually as a result of high but declining total fertility rate estimated at 7.1 and 5.8 for the rural Kenyan population in 1989 and 1993 respectively (NCPD, 1989; NCPD 1994).

1.1 THE PROBLEM

Death clustering basically refers to concentration of infant and child deaths among certain mothers. It is a consequence of siblings sharing many of the same mortality risks.

Infant and child deaths have been taken up as strong indicators of the degree of poverty and deprivation in a population (Hill, 1989). Several factors have been posited to be closely related with infant and child mortality. The International Conference on Population and Development (ICPD, Cairo, 1994) Programme of Action noted that, "Poverty, malnutrition, decline in breast feeding, inadequacy or lack of sanitation and health facilities are the important factors associated with infant and child mortality" and need to be addressed with great concern (UN Programme of Action, Section 8.12).

Although a few countries in the developing regions, Kenya being one of them, have recorded tremendous declines in overall infant and child mortality levels, there are still wide regional variations in the risk of child survival within these countries. For example in Kenya certain regions and sub groups of the population are still subject to higher risks of infant and child mortality (Khasakhala A; 1998)

The problem of child survival risks has considerable implications for reproductive health and child survival programmes .For instance, in many developing countries, health services are made available largely in response to demand. Therefore, if deaths were heavily concentrated in certain regions of the country, this would suggest that substantial improvements in child and infant mortality could be achieved by adopting more cost effective techniques focusing on the areas with high risks of child deaths (Gupta, 1997)

Studies done in Kenya show that the present socio-economic structures are deeply entrenched in historical former colonial authorities that maintained separate and distinct development policies between various regions of the country. This imbalance has persisted in the post independence era to the extent that structural evolution rather than revolution has exacerbated uneven distribution of services and facilities, particularly in rural areas (Anker and Knowles, 1978; Mott, 1980; Henin and Mott, 1979;Ominde, 1978;UNICEF, 1981). The vital services include health, piped water, roads, etc most of which were, and still are concentrated only in certain areas of the country i.e. urban areas. Efforts to correct this imbalance have been slow and expensive especially with the rapidly increasing population of which 50% is below 15 years of age.

1.2 The Research Question

The study intended to answer the following two main research questions;

- Is there evidence of death clustering in rural parts of Kenya?
- What are the factors that influence the concentration of such infant and child deaths?

1.3 OBJECTIVES

The study intended to address the problem of the extent of death –clustering in rural Kenya. Specifically, the study aimed;

1.To asses the extent of concentration of infant and child deaths in rural Kenya.

2.To investigate the factors that affect infant and child survival in Kenya.

3.To examine the implications of child survival for effective planning and policy interventions.

1.4 SCOPE AND LIMITATION

The type of data used, first and foremost, limits this study. The study has used the 1999 Kenya Population Census data. This data set had many corrupted hence unclean data. Entire sections of socio-cultural and what I would consider as sanitation/environmental variables could not be clearly interpreted. Consequently, the study focused only on a few socio-economic and maternal factors that were captured clearly by the 1999 census questionnaire.

1.2 The Research Question

The study intended to answer the following two main research questions;

- Is there evidence of death clustering in rural parts of Kenya?
- What are the factors that influence the concentration of such infant and child deaths?

1.3 OBJECTIVES

The study intended to address the problem of the extent of death –clustering in rural Kenya. Specifically, the study aimed;

1.To asses the extent of concentration of infant and child deaths in rural Kenya.

2.To investigate the factors that affect infant and child survival in Kenya.

3.To examine the implications of child survival for effective planning and policy interventions.

1.4 SCOPE AND LIMITATION

The type of data used, first and foremost, limits this study. The study has used the 1999 Kenya Population Census data. This data set had many corrupted hence unclean data. Entire sections of socio-cultural and what I would consider as sanitation/environmental variables could not be clearly interpreted. Consequently, the study focused only on a few socio-economic and maternal factors that were captured clearly by the 1999 census questionnaire.

Secondly, this study assumes that a mother's age and parity explains most of the variability (in childhood deaths) between women. Consequently, it appears to imply that there is no clustering of deaths which is independent of parity. The rationale behind this assumption is that the differences and trends in "death concentration" in real populations are due only to the fact that as fertility and mortality decline, there are fewer deaths to spread among women. Implicitly, high death risks are likely to be concentrated in an increasingly smaller group of high parity women.

Thirdly, the study only focused on fifteen (15) rural districts and not the entire 41-plus districts found in the country. This was so in order to facilitate an easier analysis and also for some other methodological considerations.

1.5 JUSTIFICATION

A study of infant and child mortality is highly justified partly because any changes in fertility are always often related to changes in mortality. The strong association between child mortality and fertility is well documented in literature where it is hypothesized that couples who experience child losses are less likely to use contraception, tend to have shorter birth intervals and hence more children. However, this association is neither a proof of causation nor does it say any thing about causal direction (Rosero-Bixby, 1997). In her study, Akwara P.A. (1994) recommends in her concluding statements that there's need for more research on the prevailing patterns of morbidity and mortality in Kenya with special attention to cultural and ethnic variations (c.f Pop. And Dev. in Kenya;

2000). In light of Kenya's recent fertility decline, an understanding of trends and extent of mortality especially childhood mortality is therefore crucial.

Secondly, a study of infant and child mortality in Kenya is necessary as it is not only a central theme in population studies but is also crucial for the design of policies that attempt to influence population change. More pointedly, Kenya's population policy thrust has been greatly influenced by the need to slow the population growth rate. According to the1997-2001 National Development Plan (GoK, 1997), the main objective is to accelerate decline in the level of fertility through expansion of the coverage of child-survival programmes. Implications of this policy perspective therefore inter alia, raise certain important issues for theory, policy and further research

2.1 LITERATURE REVIEW

Enough evidence abound from various literature pointing to the fact that risks of dying are never equally spread in populations. Differentials in bio-demographic characteristics such as mother's age, the spacing of her births, her parity, the sex of the child and differentials in socio-economic characteristics such as education show that both biological and social factors affect the distribution of risk among children and their families. Mosley and Chen (1984), while trying to specify with an analytical framework the mechanisms by which social and bio-medical factors influence the risk of dying in childhood, recognized that the wider social milieu and household resources can influence child survival only by operating through a set of factors that are behavioral and have a direct biological link to illness and death (i.e. the proximate determinants). Perhaps as a result of the wealth of data and this influential model, which was first conceptualized at the aggregate level of a population but lends itself more easily to individual analysis, the search for causal processes and pathways has been dominated by increasingly sophisticated analysis of data for individual births. With these data, the probability that a child will die can be related to characteristics of the mother and behaviour in the intervals surrounding its birth.

E. Gardiner and J. Yerushalmy (1939), while writing on "Familial susceptibility to still births and neo-natal deaths", in the American journal of Hygiene, 30(1939), notes that mothers prone to child deaths share certain (constitutional) factors such as poor housing conditions and over crowding. The same observation has been made by A. G. Hill and A Aguirre on "Childhood Mortality estimates using the Preceding Birth Technique: some applications and extensions" in Population Studies, 44 (1990). They noted that deaths in childhood are often clustered, with a small proportion of families contributing a large proportion of the total. Hence, in their conclusion they contend that the distribution of risk in populations may differ not only in levels, but also in its dispersion or shape.

Meegama (1990) in his study, "Socio-economic determinants of infant and child mortality in Sri Lanka: an analysis of post war experience" has shown that 33 percent of reported child deaths in the Sri Lankan Fertility Survey occurred to the 1.5 percent of mothers with multiple child deaths. He thus concluded that it would seem that child mortality rates are high because of the conditions in a small number of households, i.e. those in which a mother had lost two or more children.

Das Gupta et al (1989) has reported that 12 percent of women who experienced multiple child deaths accounted for 62 percent of all child deaths in her sample. She had conducted a study, along with other scholars on "Death Clustering other: A quantitative exploration of the distribution of child deaths among mothers."

Ronsmans, C. (1993) in his unpublished thesis entitled "The Clustering of child deaths in rural Senegalese families", arrived at similar observations like in the earlier studies. Both Ronsmans and Das Gupta observed that women who had experienced multiple child deaths were often less resourceful and organized in caring for currently living children and running the household. This therefore suggests what Das Gupta calls a "death clustering variable", whether or not a child had siblings who had died, a proxy measure of parental competence.

However, neither study allowed for the fact that parity affects the probability of being a "multiple death" mother. High parity women will always be over represented among women with multiple child deaths. We know this intuitively because the probability of observing a death increases with the number at risk. A woman with only one birth cannot have experienced more than one child death. It hence follows that women with more births would be more likely, on the basis of increased exposure alone, to contribute more deaths than women with fewer births. Any discussion on "clustering" of deaths among women must clearly allow for the systematic parity effects of increased number of children exposed to risk. Data from the 1979 census of Kenya calculated by B Zaba and P

David (1996) show that there is a very strong correlation between parity and the proportion of children who have died, even when mother's age or marriage duration are allowed for. This means that parity itself, or factors strongly associated with parity, account for a large part of the observed interwoman variance in risk. (See table below).

Table A: Proportions of children who have died by parity and mother's age group, Kenya, 1979 (Values shown for groups with 100+ mothers)

Parity	15-19	20-24	25-29	30-34	35-39	40-44	45-49	All Ages
1	0.067	0.062	0.086	0.131	0.136	0.161	0.151	0.076
2	0.116	0.083	0.078	0.114	0.138	0.171	0.178	0.097
3	0.174	0.116	0.092	0.112	0.136	0.160	0.195	0.117
4		0.142	0.113	0.109	0.147	0.176	0.212	0.132
5		0.175	0.135	0.117	0.134	0.183	0.195	0.141
6		0.196	0.159	0.138	0.142	0.177	0.210	0.159
7			0.192	0.156	0.152	0.183	0.224	0.175
8		0.245	0.204	0.178	0.167	0.195	0.228	0.190
9				0.218	0.192	0.210	0.250	0.216
10				0.242	0.205	0.228	0.252	0.227
11				0.280	0.235	0.240	0.280	0.256
12				0.282	0.261	0.257	0.289	0.273
13					0.270	0.280	0.301	0.290
14				0.310	0.298	0.295	0.298	0.297
All parities	0.111	0.124	0.141	0.167	0.183	0.217	0.252	0.180
N	55,069	41,790	32,637	24,965	19,631	16,727	13,475	124,322

Source: Calculated from five percent sample, 1979 census of Kenya.

Similar relationships between age, parity and mortality risk have been documented for a wide range of populations by Fernandez-Castilla in a 1985 PhD thesis.

R. H. Gray (1981) contends in the study "Birth intervals, post-partum sexual abstinence and child health", that the association between parity and risk of child death can arise in two ways: women who experience child deaths may go on to bear more children than those whose children survive, through either voluntary or physiological replacement mechanisms; risk of dying may be higher among the children of high parity women, possibly because of increased transmission of infection, maternal depletion or sibling competition. K. Merchant and R. Martorell (1989) hold the same view.

To date, no one has definitively attributed causality to these latter mechanisms, but the strength, consistency, and pervasiveness of the association between short birth interval and risk of child death clearly indicate that reproductive patterns in families are an important source of heterogeneity.

Potter et al (1987) argues that other conventional measures of concentration, such as the concentration ratio, the index of dissimilarity and the proportion of mothers who account for half the observed events in a population from concentration curves are all affected by the increased exposure to risk of multiple child deaths of women with more than one child.

Parity and age convey a good deal about whatever factors contribute to regularly increasing risk patterns in families. This is true, despite the other known differentials in mortality that have been observed in Kenya such as urban-rural, regional and ethnic differentials (Blacker J et al, 1987).

At very high parities, studies have shown that women who have experienced larger numbers of child deaths must contribute a very considerable excess since the risks continue to rise steeply despite a larger than expected number of mothers who have not experienced any child deaths.

Available evidence has established that there are a number of factors that are very strongly associated with risk of infant and child mortality. The importance of water supply and sanitation as determinants of risk has been underscored by several studies in developing countries. Merrick (1985) studied the effect of piped water on the risk of early childhood mortality in urban Brazil and concluded that the differential by income class declined significantly with increased access to piped water. In most under developed settings, children share environmental household hazards including limited and contaminated water supplies, inadequate human waste disposal facilities and unhygienic home conditions (K'Oyugi, 1997; In Population and Development in Kenya, Oucho J.O. et al (ed) 2002).

If a dwelling place has no proper sanitation facilities, the quality of life necessarily declines (Ocholla-Ayayo, S.A. Odhiambo and J.A.M. Otieno; 2000). Amos Rapport

(1969) discussed types of housing, building materials, construction techniques and interior furnishing of rooms. According to Vestbro (1975), none of these aspects of habitat can be assumed to be complete without consideration of their significance to social life and by extension, their effect on quality of life. There is also consistent evidence that risk of childhood mortality is higher in small, poorly built apartments/houses.

Hull (1981) found that a large sibling group is associated with higher mortality risk. In the area of diseases, community studies of measles from the developing countries suggest that mortality is higher in rural areas where the age at infection is higher than in urban areas. Studies in Burma (Chin and Theung, 1985), Guinea-Bissau (Aaby et. al., 1984), India (Brinder, 1983; John et.al, 1980) and Nigeria (Wilson, 1981; Hondins and Sutonis, 1979; Rea, 1968) in which rural and urban measles mortality within the same country were analysed, established that rural outbreaks have always had high age-specific case-fatality ratios.

Cotch David and Bauni (1989, using data from the 1986 Liberia Demographic and Health Survey sought environmental risk factors of childhood mortality including characteristics of the mother's household among 5,604 children born in the preceding 5,604 children born in the preceding 5 years. In bivariate analysis, water supply from a river or stream and lack of access to toilets indicated fairly higher risk of child mortality. The importance of these factors were confined in multivariate logistic regression results in which the effects of type of sanitation facility and of water source remained significant.

In Brazil, Victoria et.al. (1986) found sewage disposal to be highly significant in predicting nutritional status of a child, though family income and parent's education were the most important predictors, while the effects of access to piped water or treated water were much less important.

Similarly, environmental conditions have also been found to influence the extent of infant and childhood deaths. Thus, some researchers have found that infectious diseases often mediate the effect of family dwelling on the risk of infant and child mortality. For instance, Feachem (1981) found that infectious diseases associated with water supply and lavatory facilities, such as diarrhoeal diseases would be a major benefit of programmes aimed at improving dwelling units and facilities therein.

Esney and Habicht (1988) in their study found that literate Malaysian mothers can protect their infants in environments lacking toilets and made better use of boiled water for their infants. In fact, parental education has consistently been shown to have independent effects on child survival. Yet, as cultural capital, education can work through its ability to determine the level of household assets, physical living conditions and better use of health services (Cleland and Van Ginen, 1979).

Within Africa, Katende (1983) in her study of the effect of housing conditions on mortality risk in Bushenyi district, Uganda, found that the poorer the housing conditions, the higher was the level of risk in mortality among children. Thus, children born in temporary houses had higher risk rate than those born in semi-permanent and permanent houses. As expected by her study, households living in temporary dwellings were mainly the uneducated. Good toilet facilities were also found to be scarce in such temporary dwellings. Meanwhile, Teckce and Shorter (1984) as well as Puffer and Serano (1973) also found that type of materials used for constructing dwellings were among the important determinants of child survival.

In Kenya, Khata (1983), in a study of factors influencing risk of child mortality, found that such factors included maternal education, household income, quality of drinking water, ownership of cattle, ownership of cash crops, methods of sewage disposal, ownership of a radio in the household, visits by government health workers, subsistence farming and lack of formal schooling. In particular, availability of sewage disposal facilities had significant effects on child survival in the coastal region and middle dry zones.

Ominde et.al. 1993) found that diarrhoea and vomiting from malaria attacks were the commonest childhood diseases of/in tropical developing countries. A report by UNICEF (1992) found that about one in five child deaths in Kenya results from diarrhoea. Household monitoring surveys conducted in 1991 in selected districts show annual attack rates ranging from two episodes per child in Baringo (Rift Valley Province) and Embu (Eastern Province) to thirteen episodes per child in Mombasa (Coast Province). Most cases of diarrhoea occur in Western, Nairobi and Nyanza provinces. In Nairobi, diarrhoea is most common in the large and densely population low-income areas with poor sanitation

According to census reports for 1948-1988 censuses, and KDHS reports for 1989 and 1993, improvements in infant and child mortality rates were attributed to provision and availability of health services, parental education, malaria control, improved nutrition and the general socio-economic development existent in the country then. However, these reports show that significant differences exist in regional mortality rates as well as concentration of risk due to such factors as ecological conditions, cultural beliefs and practices, access to medical and health services among others.

Traditional beliefs about cases of diseases persist to a greater or lesser degree in different ethnic cultures in Kenya. Most of these beliefs make the control of preventable diseases of children difficult and should not be ignored if the incidence of these diseases is to be reduced and the chances of child survival enhanced. (Akwara P.A. cf. Population and Development in Kenya; 2000). Among the Luo of Nyanza Province, the occurrence of diseases such as measles, marasmas and kwashiorkor was traditionally attributed to a breach of society's code of behaviour or taboo commonly known as 'chira' (GoK/UNICEF, 1992; Ocholla-Ayayo, 1991).

A study on Population Health, Nutrition and Family Planning in Kisumu (Ominde et al. 1983) found that children's illnesses and death were believed to be caused by violation of forbidden acts, relationships and sexual affairs. Also, violation of food taboos by the mother when pregnant or breast-feeding is believed to cause child illness, or even death by rural as well as urban poor. The culture of a society defines the cultural food system, i.e the cultural items which interrelated to produce the feeding habits of a given people. Consequently, these feeding habits translate into culturally defined child-feeding patterns and practices, which eventually affect the health and survival chances of infants and children. (Jensen and Juma; 1989).

A study of malnutrition and infant mortality among the Samia of Western Kenya (Olenja, 1988) focussed on cultural explanations of malnutrition in children. It found that malnutrition is greatly influenced by cultural beliefs; hence traditional perceptions of malnutrition do not directly take into account its bio-medical causes. For example, marasmas is perceived as an element of social misbehaviour and is entrenched in the notion of 'ekhira' – a mystical affliction often related to transgression of cultural norms. Akwara P.A. (1994) recommends in her study that educational opportunities for girls and women generally should be expanded. She argues that education of mothers should focus on child-rearing practices. Her findings reveal that socio-economic factors continue to have a strong bearing on the health status of children in Kenya. In her conclusion, she recommends the need for more research on the prevailing patterns of risk concentration morbidity and mortality in Kenya with a special attention to cultural and ethnic variations (cf. Population and Development in Kenya, 2000). According to UNICEF state of the The World's Children 19988 report, unequal educational opportunities for girls, women and mothers have helped increase the incidence of malnutrition and risk of childhood mortality in most developing nations. A lack of access by mothers to good education and correct information leads to improper health-seeking behaviour.

According to the 1993 United Nations Economic Commission for Africa publication, maternal education is the single most important determinant of major components of demographic processes including mortality. Education in less developed countries is highly associated with wealth, hygiene, better methods of child care, lower level of fertility and better chances of child survival (Hess P; 1988).

2.2 THEORETICAL STATEMENT

In the preceding section i.e. literature review, it has been shown through the evidence of various studies that infant and child mortality is a function of several factors. Consequently, these factors constitute the premise of my theoretical and operational models in this study. Thus, the theoretical statement is; "Infant and child survival in rural Kenya is likely to be influenced by socio-economic and imminent or health factors which operate either directly or indirectly, independently or jointly".

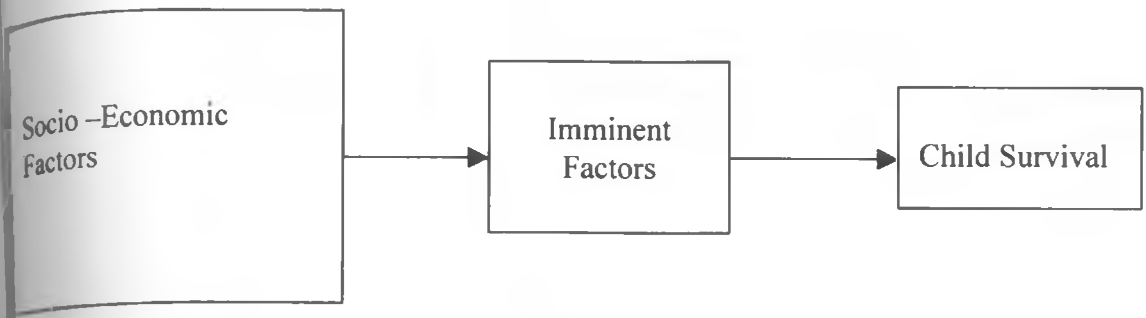
2.3 THEORETICAL FRAMEWORK

Any attempt to investigate and explain how various variables impact on infant and child mortality requires the specification of a framework that will incorporate all the relevant factors that directly or indirectly affect child health and mortality. A framework identifies causal linkages between different factors that affect child health and child survival. Besides, a framework assists in the understanding of factors that may cause a change in the extent or level of mortality in a given society. Several frameworks have been developed to link various factors to child health and mortality (Mosley and Chen, 1984; Shultz, 1984; Mahadevan, 1986; Venkatcharya, 1985; Norren and Vianen, 1986; Cornia and Steward, 1987; Berman et. al., 1994; Millard, 1994). Of all these frameworks, the most comprehensive and systematic framework is that developed by Mosley and Chen (1984). This framework has remained the most popular and widely adopted model in studies of child survival. However, my study adopted the model developed by Mahadevan (1986) to study child survival. The reasons for this trend are two-fold. One is because Mahadevan model has concepts and terminologies that are specifically related to mortality. This is important as it avoids the confusion that arises when using the term intermediate and proximate determinants, which are more related to fertility. Instead, Mahadevan has developed the terms "Life Affecting Variables" and "Imminent Variables" to specifically refer to mortality determinants. Life Affecting Variables (LAVs) are first broadly classified under the heading of situations and sequential events from the stage of polity-cum-policy through several other factors, institutions and stages of development of life. These are further sub divided/classified into one or more sub-sections of LAVs depending on the requirements of clarity, communication and empirical feasibility. Imminent variables in this model are those that are thought to be more significant or have greater and immediate influence on mortality. Thus, Imminent variables are the equivalent of Proximate determinants applied in fertility studies. Just as Proximate determinants have a direct and immediate influence on fertility, Imminent variables also have a direct and immediate effect on mortality.

The Mahadevan model is flexible and has a number of advantages that make it appropriate for my kind of study. It incorporates both micro and macro variables whose influence on the health and consequent death of the child is diverse. Again, it clearly recognizes the fact that several LAVs either in similar or in a dissimilar manner influence mortality in any society. It is this element of dissimilarity that makes the model more appropriate for my study. For instance, the effect of education or any socio-cultural factor like breast-feeding in one society or region may not necessarily be similar in another society even if it is the same level of education or length of breast feeding. Nonetheless, the model has one main shortcoming; that of incorporating far too many determinants of mortality which may make it hard to isolate the key mortality determinants.

However, the author of the model recommends that a group of relevant and related variables can be considered from the list of variables mentioned in the model – and their influence on mortality can be examined. Therefore, the model is quite flexible and allows each researcher to identify those variables that are relevant to his/her study as dictated by the kind of society and environment he/she is studying. (For a detailed study of the model, refer to Mahadevan et. al., (1986.)

Fig 1.0 CONCEPTUAL MODEL FOR STUDYING INFANT AND CHILD SURVIVAL.



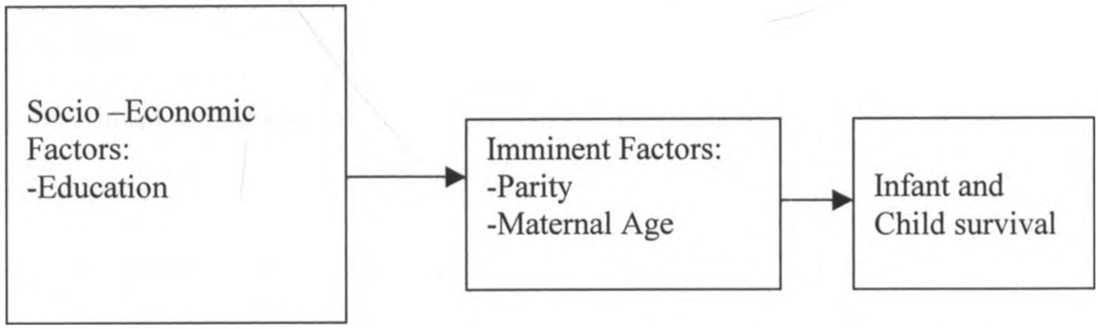
Source: Modified Mahadevan et. al. (1986) Model

- **Unit of Analysis in this study is the woman of child bearing years 15-49**

2.4 CONCEPTUAL HYPOTHESIS

Child survival in rural Kenya is likely to be strongly influenced by socio-economic factors.

Fig. 1.1 OPERATIONAL MODEL FOR STUDYING INFANT AND CHILD SURVIVAL



2.5 OPERATIONAL HYPOTHESES

This study is founded on the following operational hypotheses;

1. Regional place of residence (i.e. whether one is in Central, Nyanza, Western, Rift Valley, Coast, Eastern, or North Eastern Province) is likely to influence a mother's risk of childhood deaths in rural Kenya.

3. Maternal level of education is likely to act through parity and age of mother to influence the survival chances of an infant or child.

DEFINITION OF KEY CONCEPTS

INDEPENDENT VARIABLES

a). Socio-economic variables

-Education

b). Imminent variables;

-Family size

-Age of mother

DEPENDENT VARIABLE

-Infant and child survival

- The unit of analysis for this study, however, is not the child but the woman aged 15-49 years

FURTHER DEFINITION OF CONCEPTS

A) Socio-Economic Factors;

Refers to the educational attainment of the mother i.e. whether she has completed primary education (Primary Complete), or has not completed primary education (Primary incomplete), or has gone to secondary and above (Secondary plus), or has not gone to school at all (None).

Region is defined in this study as an administrative province comprising several districts. The districts are the 15 rural districts defined earlier. In this study, Regional place of residence has been included in the operational hypothesis in spite of it not being featured directly in the conceptual framework. During analysis, this variable has been treated as a common variable that is 'communally shared' and not individual based, and since the unit of analysis for this study is the woman, not communities or groups or regions, I reasoned that women in this study inhabit different environments or regions, hence an analysis of regional distribution of risk in childhood deaths would be interpreted as a derivative of constitutional factors inherent within various regions or provinces.

B) Imminent Factors

Refers to all those factors that mediate between the explanatory variables and the dependent variable. Imminent factors may also directly affect the survival chances of the infant or child. They include age of mother, family size or parity etc.

C) Dependent Variable

This is the variable that is being explained by the other entire explanatory and imminent variables. It is the infant or child survival i.e. whether infant/child is alive or dead. As explained earlier, the unit of analysis for this study is the woman, and not the child. The study set out to examine the distribution of the risk of childhood deaths among women aged 15 to 49 years as captured by the 1999 Population and Housing Census.

CHAPTER THREE

3.0 DATA SOURCE AND METHODOLOGY

3.1 Data source

The data for this study is drawn from the 1999 Kenya Population and housing census. The 1999 census is the sixth census to be carried out since 1948 and the fourth since independence. This census was carried out between the nights of 24th/25th and 31st August 1999. The specific objectives were:

- Composition and spatial distribution of the population.
- Levels of education attained by the population.
- Levels of fertility, mortality and migration rates.
- Rate and pattern of urbanization.
- Size and utilization of the labour force.
- Housing conditions and availability of social amenities.

The government of Kenya, through the office of the president, Ministry of Planning and National Development and the Central Bureau of Statistics (CBS) – carried out the 1999 population census with financial technical and material support from UNFPA, UNDP, CIDA, ODA, UNDTCD, UNECA and the Government of Netherlands.

3.2 THE QUALITY OF MORTALITY DATA

From previous trends, census data has indicated that mortality has been on the decline since 1962. While a similar trend is apparent from the data of various surveys, the levels of mortality are often different between those derived from surveys such as the KDHS.

Mortality levels from surveys have always been found to be lower than those from censuses. However, the KDHS 1993 states "Child survival in Kenya has not improved during the recent decade. In fact most of the rates show either no change or a small increase during the most recent period." If this assumption is true, then this U-turn is quite disturbing with serious implications on health policies and programmes.

3.3 QUALITY OF THE DATA

Within columns P40 and P45 of the 1999 census questionnaire, all women aged 12 years and over were required to provide information on the number of children who were born alive and were living in the household of enumeration, those living elsewhere and those who had died. The sum of the entries in the six columns yielded the number of children ever born (CEB) while the sum of the last two columns gave the number of children dead (CD). These two data sets were then used in the estimation of child mortality.

It should be noted that in spite of the concerted efforts to generate complete and accurate data on mortality, problems of under–reporting of infant deaths, age misreporting and wrong dating of deaths still persist. Analysis of the information on CEB indicated that there was still a considerable rate of non-response, which amounted to about 20.0%. These cases were from all the provinces with North Eastern having the lowest (about 14%) and Western the highest (around 23%).

Further breakdown revealed that two age groups i.e. 12-14 and 15-19 were the major culprits for this omission as they accounted for over half of the non-stated cases in all the provinces. While information on CEB incorporated aspects of CD, there were some cases where females aged 12 and over stated their parity yet for some reason failed to give information on CD.

CHAPTER FOUR

EXTENT OF DEATH-CLUSTERING IN RURAL PARTS OF KENYA

4.0 INTRODUCTION

In the present chapter, I examine the extent of infant and child deaths among women in the rural parts of Kenya. The research question I intend to address is whether there is evidence, significant enough, to suggest the presence of the risk of death concentration among certain mothers in rural Kenya.

4.1 Methodology

A number of methodologies have been developed for assessing the extent of death clustering among women or families. One of these methods involve counting the number of women who have experienced more than one child loss (Das Gupta, 1990; Curtis et al., 1993; Guo, 1993; Curtis and Steele, 1993) while the other method entails the examination of whether the number of women with different numbers of child deaths exceeds that which would be expected if the risk were constant for all women and their children (Ronsmans, 1995; Zaba and David, 1996). The latter involves taking maternal demographic characteristics, preferably parity or age group and comparing these with a theoretical statistical distribution, viz; binomial, Poisson or negative binomial distribution depending upon the realization of the event. The comparison between the application of these theoretical distributions allow the assessment of the extent of differences in the variability among women and how these contributes to the observed child deaths after allowing for chance factors (Zaba and David, 1996). If the risk is assumed to vary with parity, then women of higher parity may experience higher child loss, and if within each parity group there are no differences in the risk of dying for births of different orders and between children of different mothers, then the distribution of numbers of deceased children will follow some theoretical statistical distribution. I discuss a few of the commonly used distributions namely binomial, Poisson and negative binomial distributions respectively.

The binomial distribution estimates the distribution of failures to be expected in a given number of trials with a constant probability of failure. In the case of mortality, it estimates the expected distribution of deaths in a group of live born children who are subject to a given mortality risk. In a large sample, this distribution should approximate the observed distribution of deaths. The assumption inherent in the use of the binomial model is that fertility decisions are made, by and large, without a clear notion of their outcome generally referred to as the " hoarding approach" (Wolpin, 1997).

The Poisson model is basically a generalized model of the binomial model and as such the assumptions embodied in the binomial model are almost similar to those in the Poisson model. The negative binomial model on the other hand, assumes that childbearing may be targeted toward a certain number of surviving children i.e. the replacement approach. This implies that parents try to replace children who have died until the desired number is attained and then cease childbearing. The use of negative binomial in such cases assists in generating a random distribution of deaths because it estimates the number of trials needed to obtain a particular number of successes with a given probability of failure. Thus, the model tests the difference between the distribution of deaths that would prevail under conditions of pure targeting (Das Gupta, 1997). This model is therefore best suited for situations where women may have completed childbearing. However, we must recognize the fact that these three models may still actually be variants of the same family of distributions.

The probability of observing *r* deaths out of *n* births under the binomial distribution is given by:

$$P\ (x=r)=n!\ /[r(n-r)!]q^{r}\ (1-q)^{(n-r)}\ , \qquad (1)$$

Where q is the probability of dying of an individual child. The expected number of deaths out of n births is nq, which is estimated from the proportion of dead children among women of parity n. The variance of this distribution will be nq (1-q).

If a random variable, Y=0, 1, 2, ….., n denotes the number of occurrences of an event of interest in a given time interval, and y (t, t + dt) denotes the number of events actually observed in the short time interval (t, t + dt), then the number of events in an interval of given length is Poisson distributed with the probability density function:

$$Pr\ [Y=y]=f\ (y;\mu)=exp(-\mu)[\ \mu y/y]\ y=0,\ 1,\ 2,\ \ldots,\ \mu>0 \qquad (2)$$

The negative binomial distribution may be described as the probability distribution of the random variable Y defined as the number of failures encountered before the M^{th} success. Its probability density is given by:

$$Pr\ [Y=y]=f(y;M,P)=[(M+y-1)!/y!\ (M-1)!](P/Q)^{y}\ (1+P/Q)^{M}$$

$$Y=0,\ 1,\ 2$$

With parameters M and P,

where P=(1-p)/p, and Q=P+1

In the following page, results of the expected deaths from binomial models are shown for women of different parities. By looking at women in these parity groups, observed distributions of child deaths are compared with those expected on the basis of the binomial distributions, allowing risk to vary with parity. The comparison, of course, then allows us to assess how much differences in the variability in risk between women contribute to the observed child deaths, after allowing for chance factors.

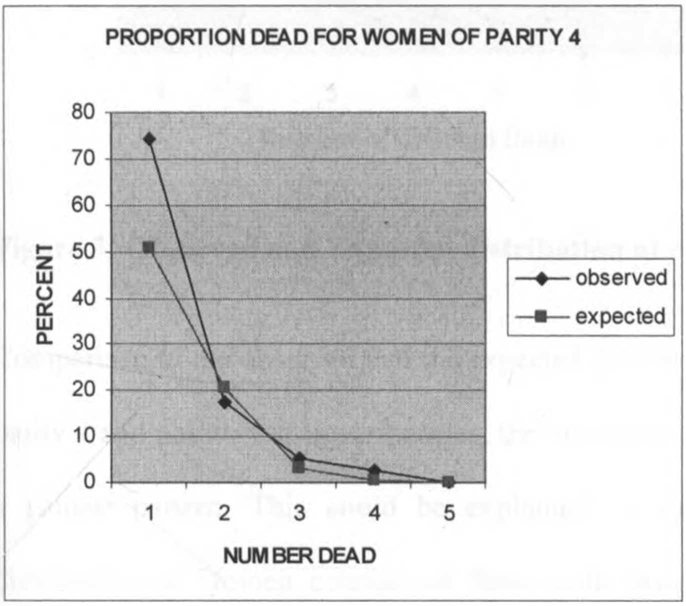


Figure 2; Observed and Expected distribution of child deaths for women of parity 4

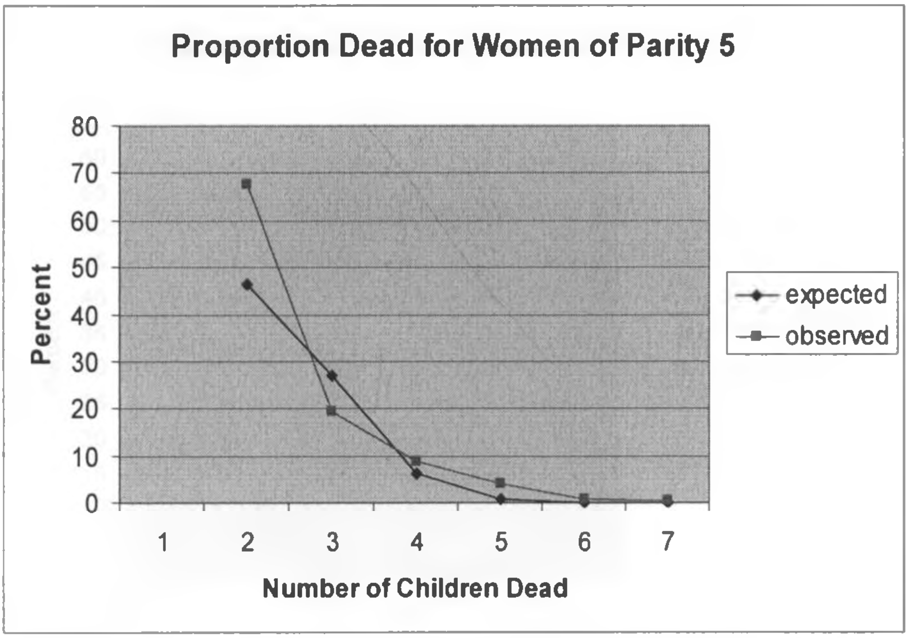


Figure 3; Observed and Expected distribution of child deaths for women of parity 5

Comparison of the observed and the expected distributions in figures 2 to 5 reveals that at parity 4 and possibly at lower parities, the observed and the expected distributions follow a similar pattern. This could be explained by the fact that, at lower parities, the distribution of women consists of those with fewer births and hence, may not have experienced as many deaths as women of higher parities. More so, the unmeasured and/ or unobserved factors may not be so pronounced at lower parities. Thus following Ronsmans (1995) and Zaba and David (1996), the observed pattern for higher parities does not follow that of the theoretical distributions. The wider dispersion for higher parities could be explained by the fact that, as parity increases, women become increasingly more polarized in the apparent risks of their children's experience.

Zaba and David (1996) observed that these differences persisted in spite of making allowances for parity-specific risk.

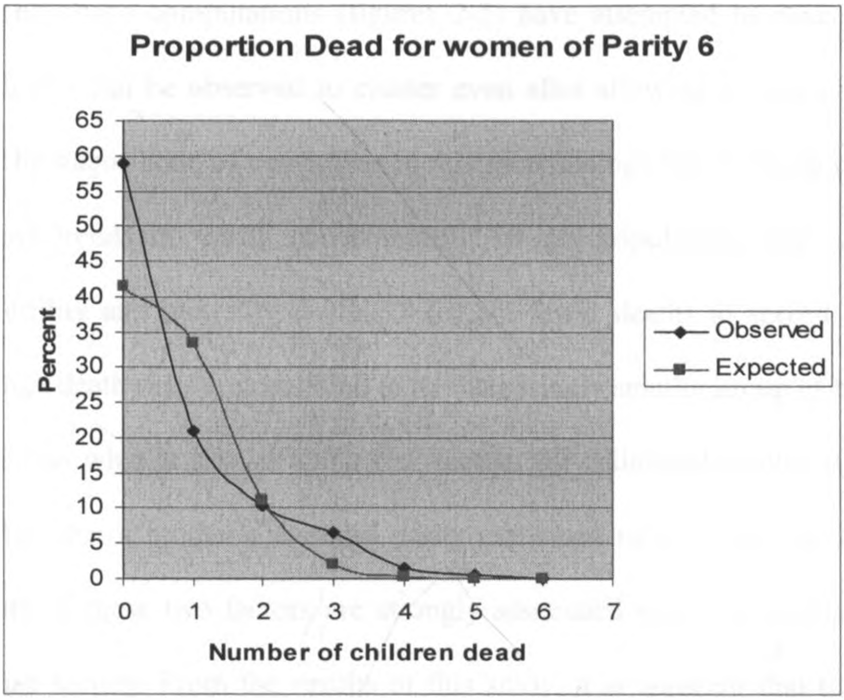


Figure 4; Observed and Expected distribution of child deaths for women of parity 6

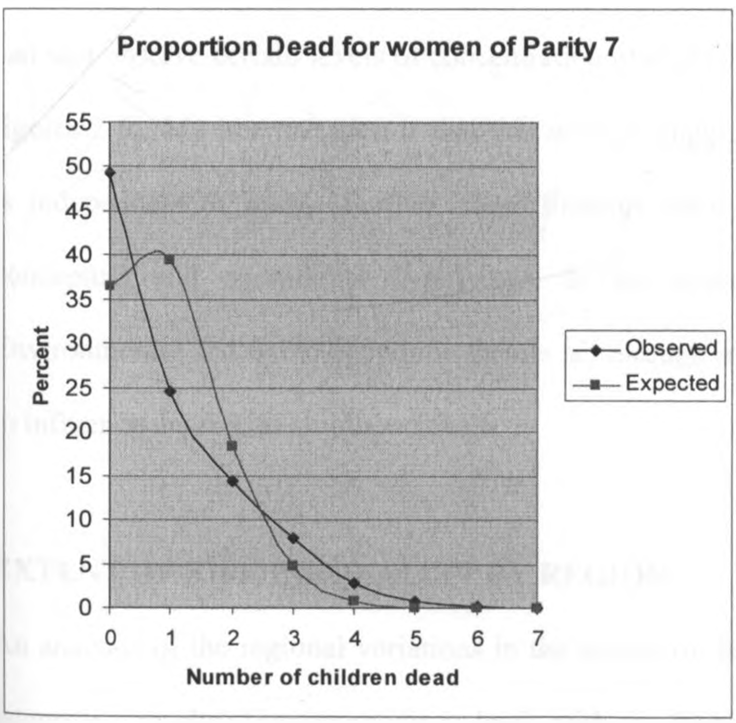


Figure 5; Observed and Expected distribution of child deaths for women of parity 7

The above computations (figures 2-5) have attempted to measure the extent to which deaths can be observed to cluster even after allowing for parity-associated risk factors. The major bone of contention in this methodology has been the question; are differences and trends in "death concentration" in real populations due only to the fact that, as fertility and mortality decline there are fewer deaths to spread among women? Or are high death risks concentrated in an increasingly smaller group of high-parity women?

Given what is known about risk factors for childhood deaths, it would be surprising to find that a mother's age and parity explained most of the variability between women, unless these two factors are strongly associated with a constellation of other important risk factors. From the results of this study, it is apparent that the greater the variability among women of a given parity, the smaller role is parity itself likely to play in explaining the excess observed risk. Clearly, once the risk with parity is allowed for, we can still observe certain levels of concentration of child deaths among some women. (See figures 2-5). My interpretation is that this strongly suggests a clustering of deaths, which is independent of parity. Further, these findings point clearly in the direction of my conceptual and operational hypotheses. In the hypotheses, I had postulated that Environmental and Socio-economic factors act through imminent variables such as parity to influence the risk of childhood death.

EXTENT OF RISK INEQUALITY BY REGION

An analysis of the regional variations in the spread of the risk distributions reveals very interesting results. Nyanza province leads with the highest amount of risk in childhood mortality (see figures below). Observed variance for Nyanza is the highest at 1.21 compared to Central Province with the least amount of risk concentration (see table B). Central has an observed variance of 0.24 hence by merely looking at variance statistic as an indicator of risk concentration, Table B gives a clear picture on the various levels of risk concentration along regional lines.

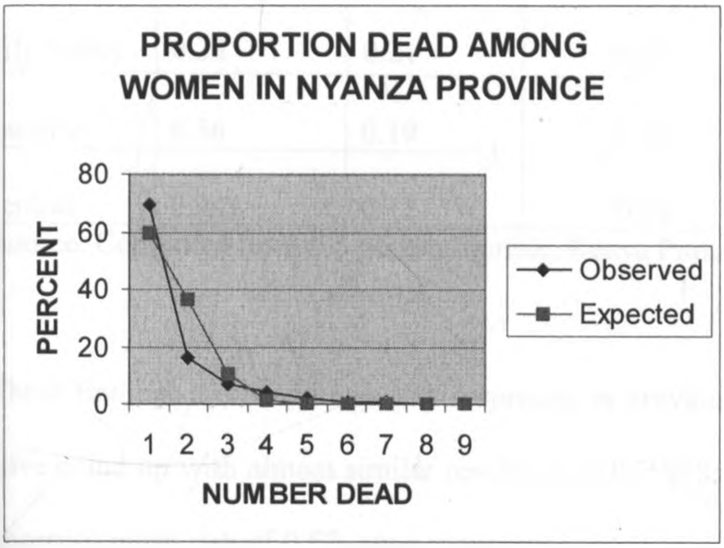


Figure 6: **Observed and Expected distribution of child deaths among women in Nyanza**

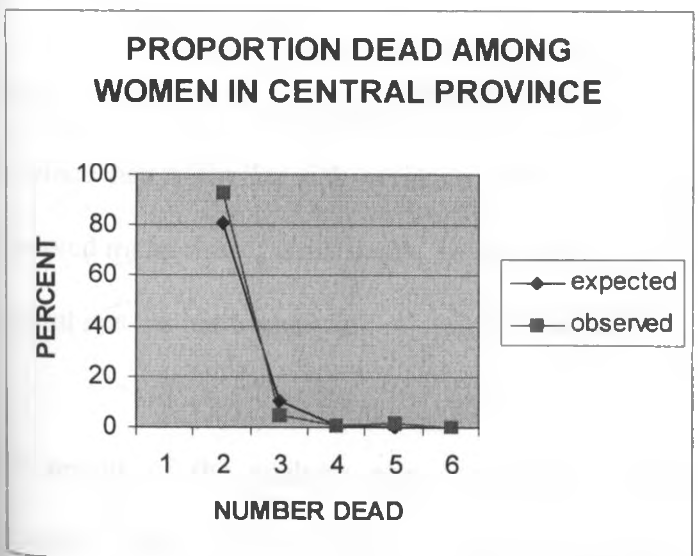


Figure 7: **Observed and Expected distribution of child deaths among women in Central**

mortality (see figures below). Observed variance for Nyanza is the highest at 1.21 compared to Central Province with the least amount of risk concentration (see table B). Central has an observed variance of 0.24 hence by merely looking at variance statistic as an indicator of risk concentration, Table B gives a clear picture on the various levels of risk concentration along regional lines.

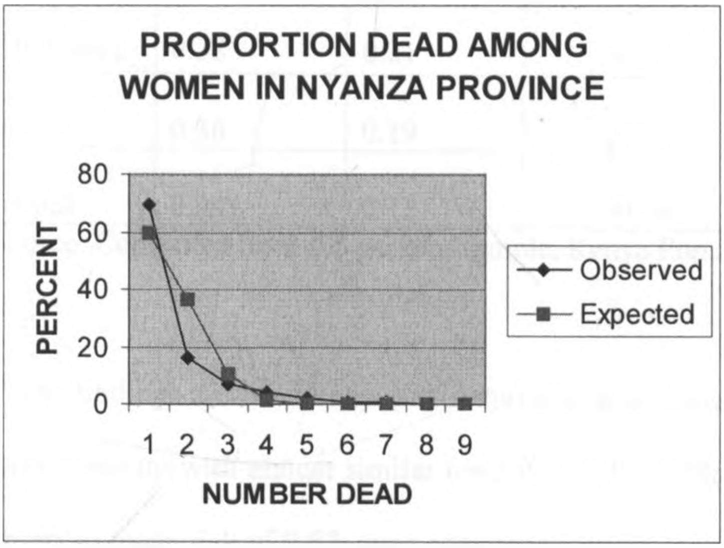


Figure 6: **Observed and Expected distribution of child deaths among women in Nyanza**

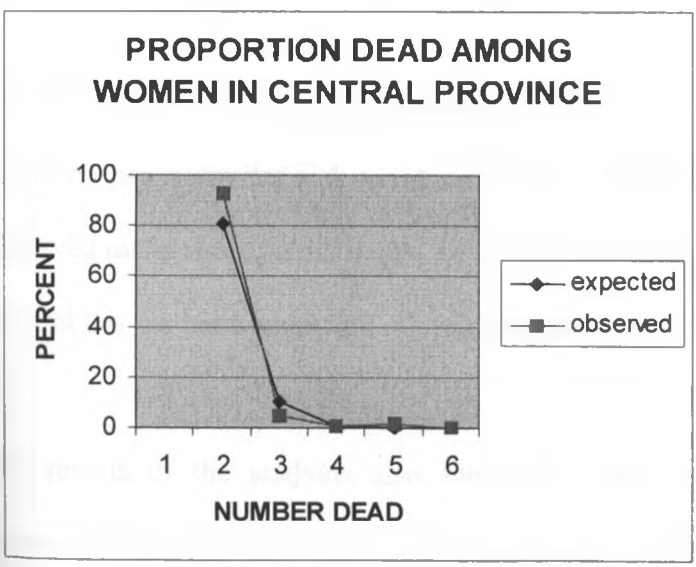


Figure 7: **Observed and Expected distribution of child deaths among women in Central**

Table B: Observed variances in the number of deaths for different regions, Kenya 1999 census

REGION	VARIANCE	MEAN (X)	STD DEV(Y)	CO-EFF OF VAR (Y/X)
Nyanza	1.21	0.57	1.10	1.93
Western	0.71	0.40	0.84	2.10
Coast	0.71	0.37	0.84	2.27
Rift Valley	0.38	0.21	0.62	2.95
Eastern	0.36	0.19	0.60	3.16
Central	0.24	0.12	0.49	4.08

Source: Computed from 0.5 percent sample, Kenya Population Census data, 1999

These findings are not in any way surprising as previous studies on childhood mortality have come up with almost similar results (KDHS 1998; 1993). Nyanza province has an observed mean risk of 0.57, once again coming out as the highest mean risk in the region studied.

Closely following Nyanza is Western province with a risk variance of 0.71. Western Province has a similar risk variance with Coast province although they differ in their observed mean risk of child death, i.e. 0.4 and 0.37 for Western and Coast respectively. Central has the least mean risk of child deaths, at 0.12.

The results of the analysis also show Rift valley and Eastern provinces having an observed variance of 0.38 and 0.36 respectively. They have a mean risk of death 0.21 for Rift valley and 0.19 for Eastern.

At this point, therefore, we can pose the question: what do these distributions of mean risk of childhood deaths tell about these regions? Is there evidence of death clustering? The answer is of course an overwhelming yes. The results indicate that there is substantial evidence of risk of concentration of child deaths among some regions in the study sample. Nyanza province with an observed risk variance of 1.21 stands out as the region with the biggest concentration of childhood deaths. Nyanza also has a co-efficient of variation of 1.93 and compares very poorly with Central, which has a co-efficient of variation of 4.08. It means that in this region, certain women experience higher than average risk in infant and child deaths. As a rule in the statistics of measures of variability or dispersion, if the dispersion is small e.g. a smaller variance' this would imply that many values (or deaths in this case) would cluster around the average value (and approximate to it), whereas if the dispersion is large (larger variance), then a considerable proportion i.e. over half the total, are markedly different from the average.

According to these findings, Central Province is the only region in rural Kenya where clustering of childhood deaths among mothers would be described as normal or average. With a variance of 0.24, and a mean of 0.12, Central Province has co-efficient of variation of 4.08. This translates into a very low variability of deaths, hence a relatively negligible proportion of risk in childhood deaths. We can statistically argue that since the variance as a measure of dispersion is relatively close to the average (the normal), then there is comparatively very limited evidence of clustering of childhood deaths in this region.

Another notable observation from table B is the level of similarity in the observed variances and co-efficient of variation between Western and Coast regions. This could probably imply that women in both the regions experience more or less similar factors that influence risk of childhood deaths. As postulated in my conceptual and operational hypotheses, the two regions could highly likely be having very comparable socio economic levels and other background environmental factors that eventually influence the direction and extent of risk in childhood deaths.

4.3.1 EXTENT OF RISK INEQUALITY BY REGION WHEN PARITY IS FIXED

An analysis to determine the extent of risk but with parity fixed at four children for all women in the study was carried out. The findings, as shown below, are not in any significant way different from those done when parity is not fixed.

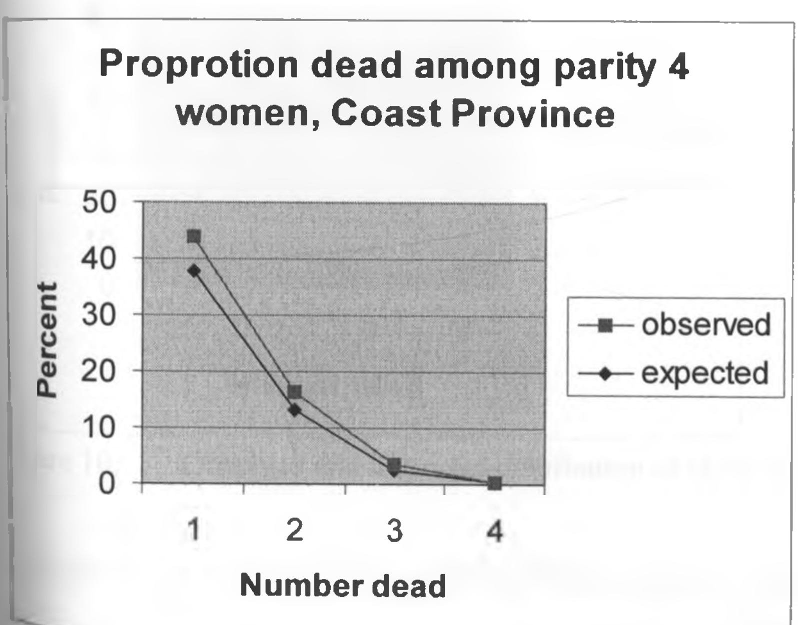


Figure 8: Observed and Expected distribution of child deaths for Coast Region

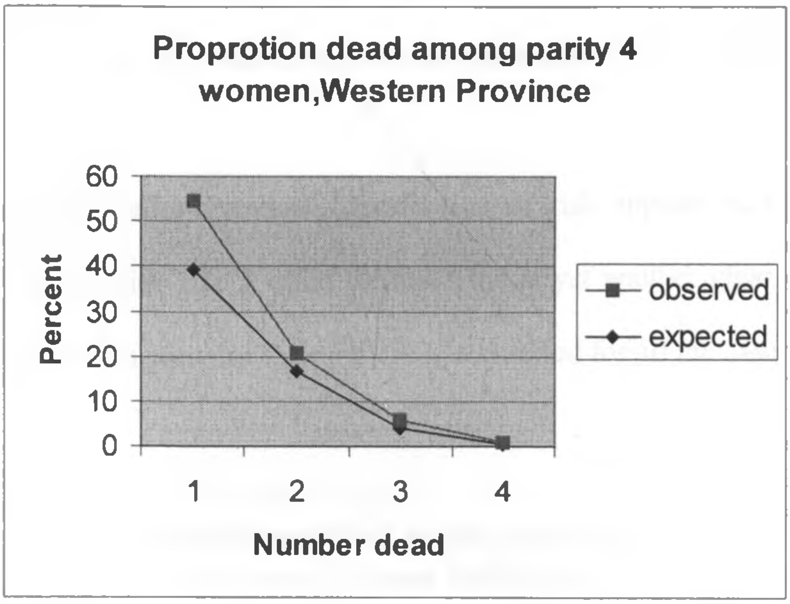


Figure 9: Observed and Expected distribution of child deaths for Western Region

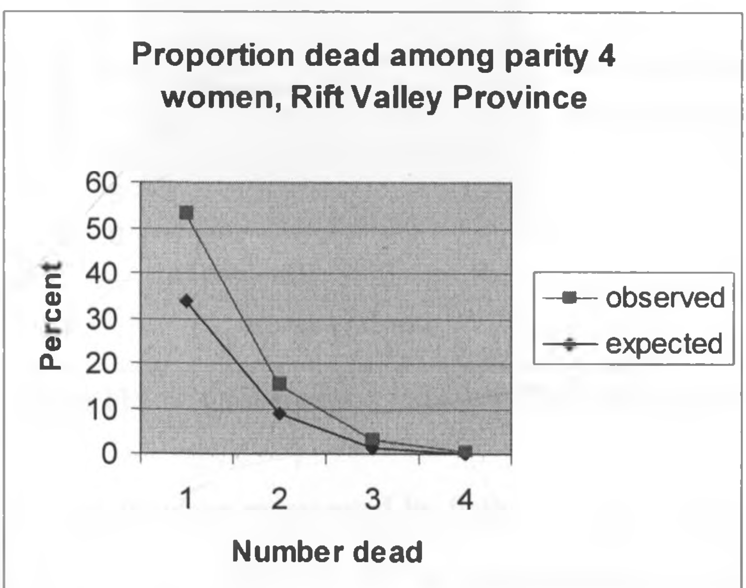


Figure 10: Observed and Expected distribution of child deaths for Rift Valley Region

In Figure 8, the trend is similar to that of Western region. The distribution of risk appears to be concentrated among women who had lost 1 to 3 children. Figure 9 for Western Province shares near-same trends with Coast region when parity is fixed. The distribution of deaths seems to be more concentrated among women who had lost between 1 and 2 children. In this region, there is thus clear evidence of death clustering.

In Rift Valley Province, distribution of risk appears to be more concentrated among women with 1 to 2 child deaths. This is yet another clear evidence of death clustering even when parity of the mothers is controlled for all the cases.

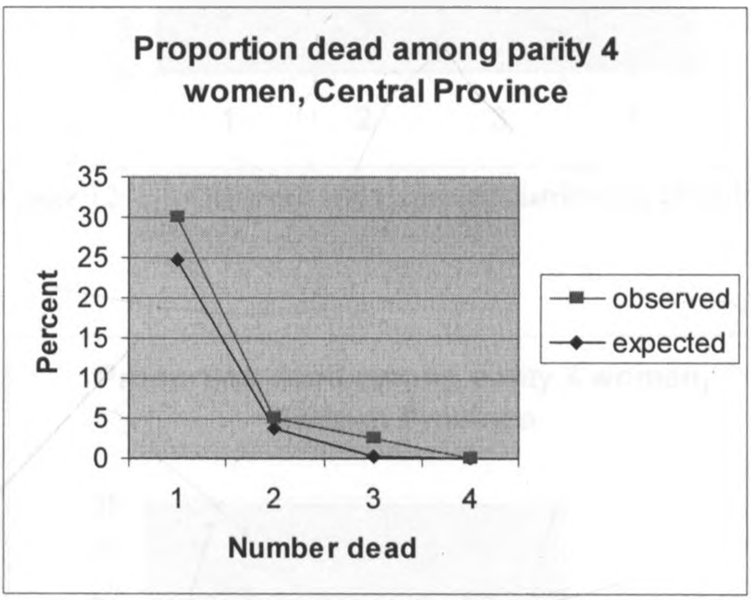


Figure 11: Observed and Expected distribution of child deaths for Central Region

Central Province represented by figure 11 above seems to display exceptionality in the extent of distribution of risk. As can be observed, this is the only region in the entire country whose proportion of risk distribution is relatively and significantly lower. It displays a different trend compared to other regions in the sense that in this region, the highest concentration of risk is observed at two points, 1 and 3 as shown above.

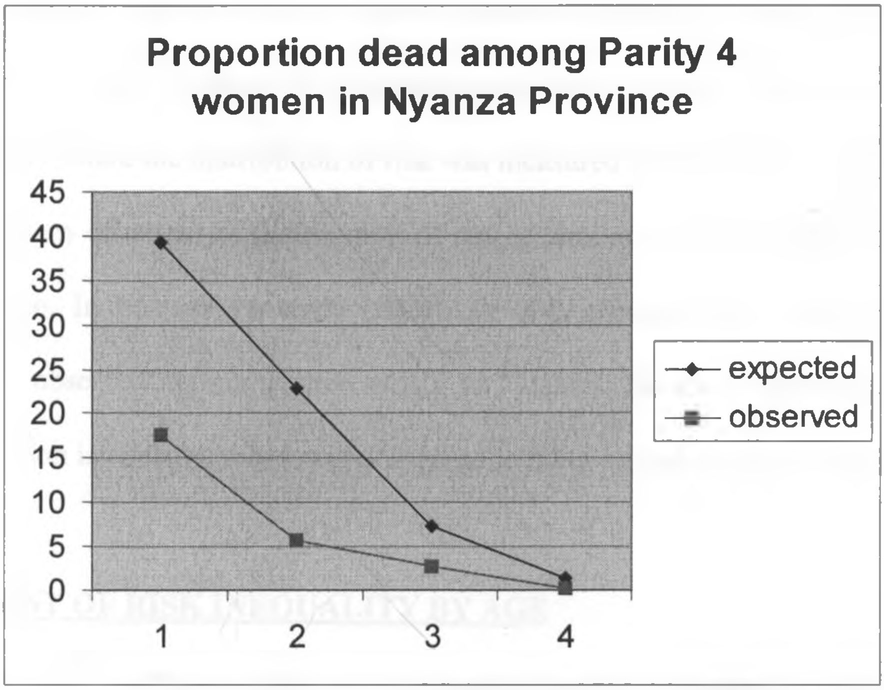


Figure 12: Observed and Expected distribution of child deaths for Nyanza Region

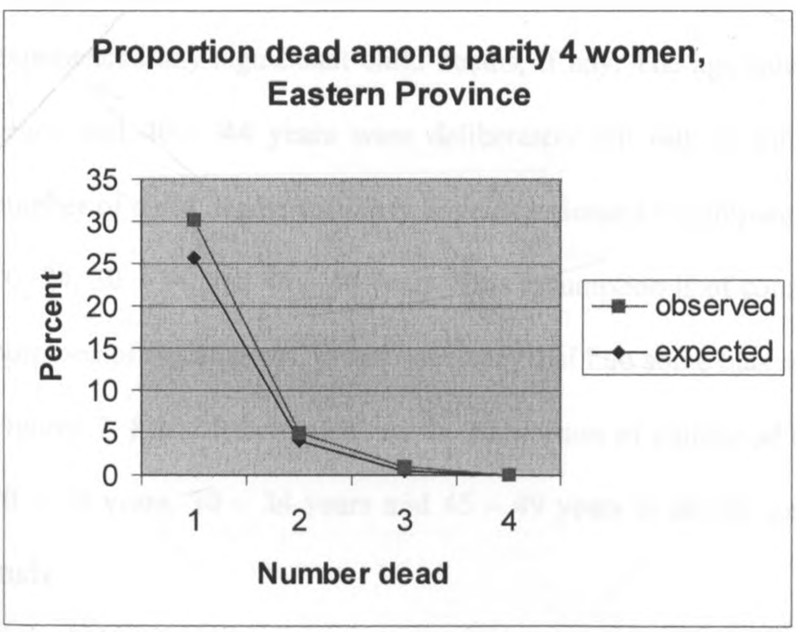


Figure 13: Observed and Expected distribution of child deaths for Eastern Region

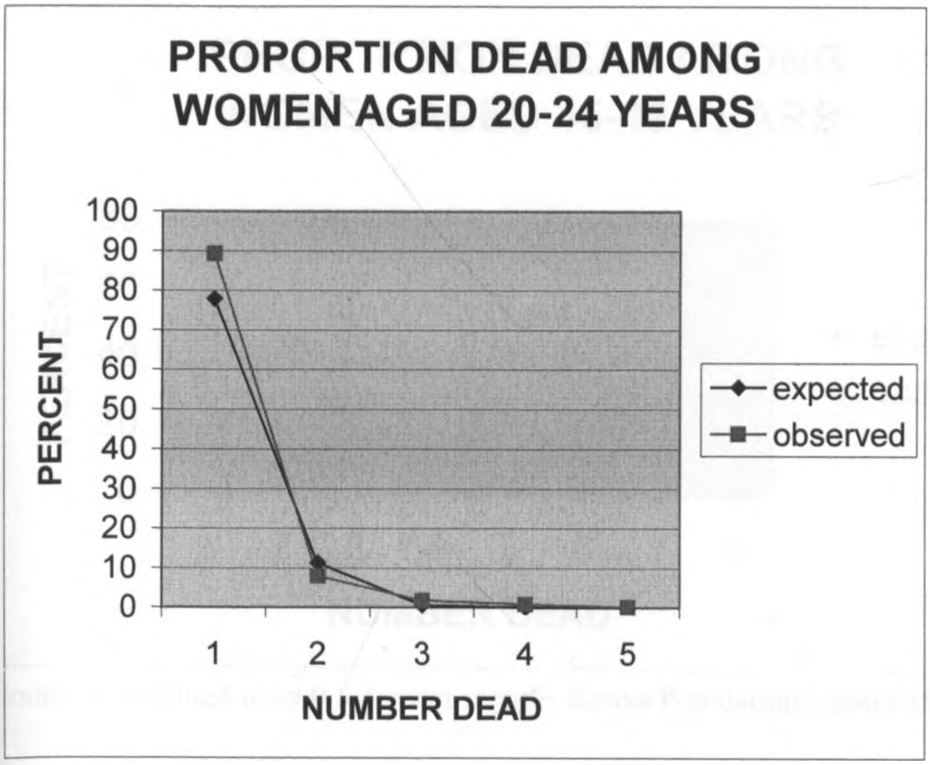
The highest concentration of risk for all the regions is Nyanza Province shown in figure 12. In this region, about 20 percent of mothers contributed over half the observed total deaths for the region, a clear evidence of death clustering as defined and measured in this study. The above findings for Nyanza are similar to the ones from previous analysis (see figure 6) where the distribution of risk was measured but without fixing parity. Generally, the pattern of extent of distribution of risk is similar in all the regions save for Central Province. In Eastern Province (figure13), risk concentration when parity is fixed is mainly observed among women with 1 to 2 deaths. However, the distribution of risk in this region is considerably lower compared to other regions such as Nyanza and Western.

EXTENT OF RISK INEQUALITY BY AGE

In this study, I opted to select only three age categories of women in reproductive ages 20 – 24 years, 30 – 34 years and 45 – 49 years. I left out the age category 15 – 19 years since this group has had very short period of child bearing, and as a result may not have experienced any significant child deaths, if any. The age category 25 – 29 years, 35 -39 years, and 40 – 44 years were deliberately left out on the assumption that whatever number of child deaths they may have experienced is comparable to that of age categories 20 -24, 30 – 34, and 45 – 49 years. This assumption is of course not quite correct, but for purposes of my analysis, it was necessary that I do some bias selection of categories.

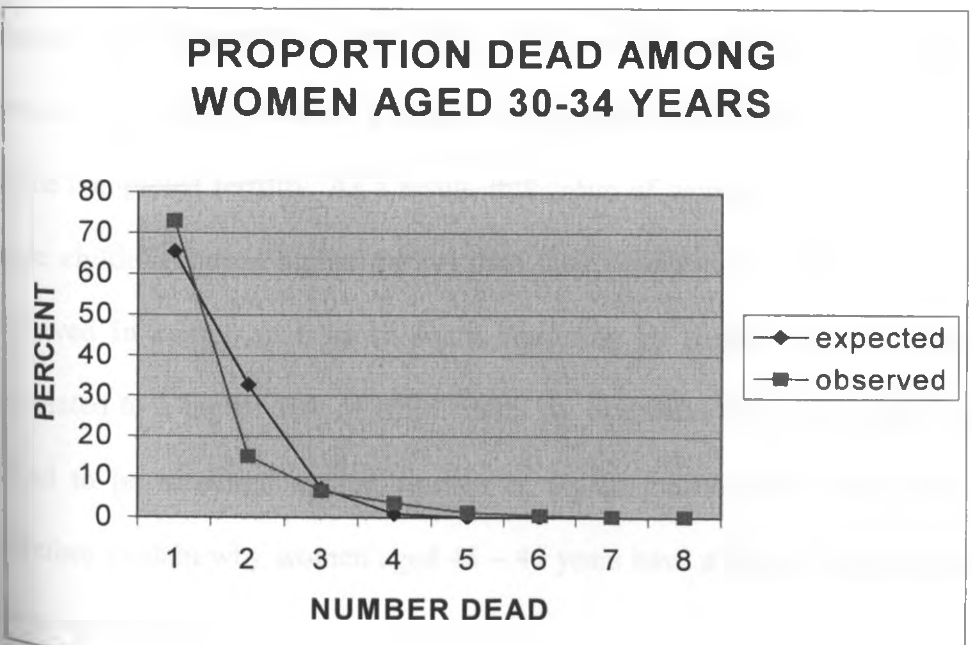
Figures 7, 8 and 9 below shows the proportion of childhood deaths among women aged 20 – 24 years, 30 – 34 years and 45 – 49 years in all the rural regions sampled in this study.

Figure 14



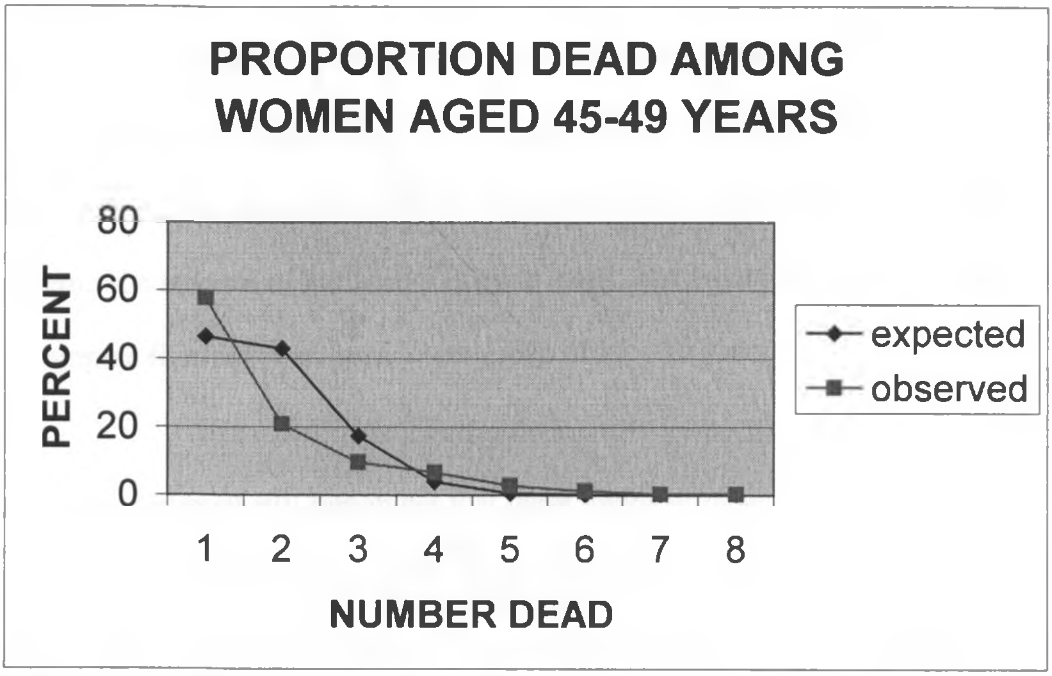
Source: Computed from 0.5 percent sample, Kenya Population Census data, 1999

Figure 15



Source: Computed from 0.5 percent sample, Kenya Population Census Data, 1999

Figure 16



Source: Computed from 0.5 percent sample, Kenya Population Census Data, 1999

As would be expected, my analysis of death clustering which was done for each age group separately shows that there's overwhelming evidence of risk in childhood deaths among women aged 45 – 49 years. The possible explanation fore this may appear obvious. First and foremost, this age category represents the last phase in child bearing, hence completed fertility. As a result, this group of women naturally have given birth to more children (hence higher parity) than their counterparts in lower age categories. As observed in earlier analysis of death clustering by parity, a higher parity was highly correlated to a higher risk of child death. By extension therefore, more child deaths are found to be clustered among women of higher parities than lower ones. This could therefore explain why women aged 45 – 49 years have a higher clustering risk than other lower age groups.

Secondly, women aged 45 – 49 years have had a longer period of exposure to the risk of child deaths compared to lower age cohorts. A better illustration of this is demonstrated by comparing the figures of 45 – 49 years with those of 20 – 24 years. In fact for the latter group, the observed and the expected child deaths appear to follow a similar pattern. The amount of variability is quite small, and would in fact be negligible were we to compute figures for an even lower group of 15 – 19 years.

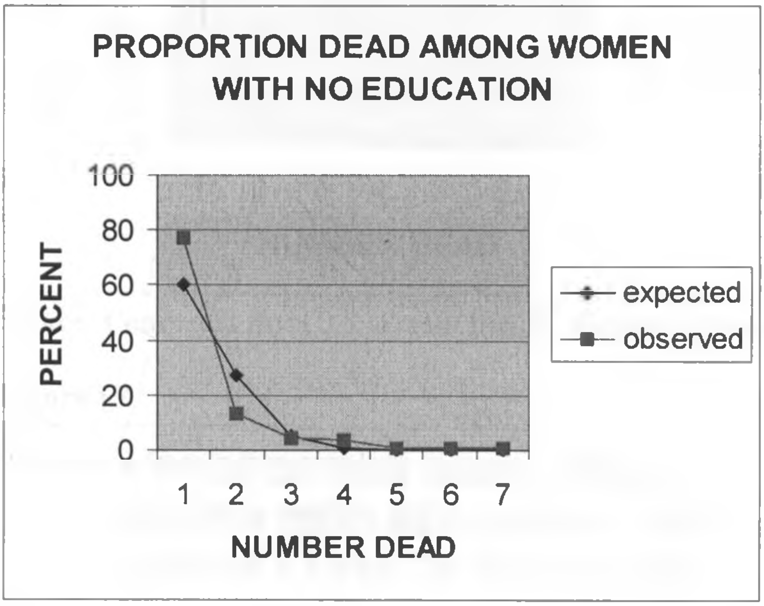
However, we must still remember that these trends or results are not rigid. Inter – woman variability could still change with age because of time trends in other factors (education for example), which may make younger women more or less homogenous socially than their older counterparts. Since many studies have singled out mothers' education as a risk factor for child deaths, we would naturally expect that introducing a control for education would also remove some of the inter-woman variability in census data set used for this study.

On the whole, it still should be borne in mind that parity and age, (and not education) convey a good deal about whatever factors contribute to regularly increasing risk patterns among mothers or families. This is true despite the other known differentials in mortality that have been observed in Kenya such as urban – rural, regional and ethnic differentials.

EXTENT OF RISK INEOUALITY BY EDUCATION LEVEL ATTAINED

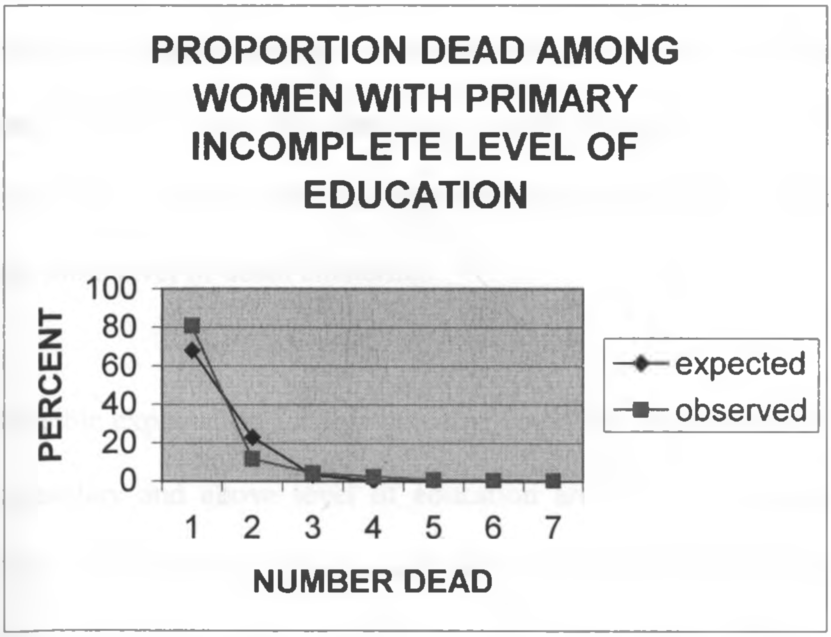
In this study, I compared data for women with no education (fig17), women with primary incomplete level of education (fig18), and women with secondary and above level of education (fig 19).

Figure 17



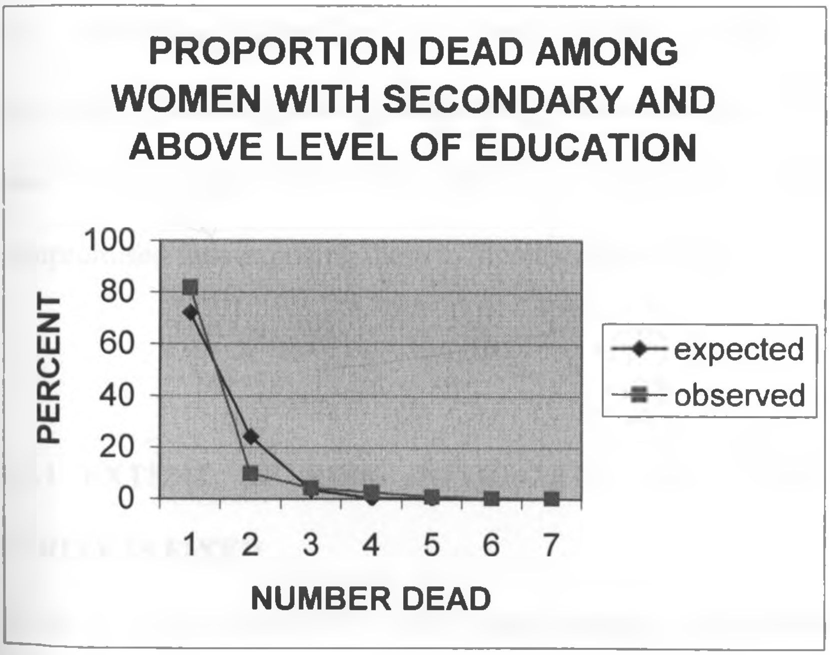
Source: Computed form 0.5 percent sample, Kenya Population Census Data, 1999

Figure 18



Source: Computed from 0.5 percent sample, Kenya Population Census Data, 1999

Figure 19



Source: Computed from 0.5 sample, Kenya Population Census Data, 1999

According to the findings, women who had not attended school at all (i.e. those with no education) experienced the highest occurrence of death clustering, (see fig 17). Compared to their counterparts who had at least some primary level of education, this category of women exhibited the largest observed variance of risk of childhood deaths.

Interestingly, from my analysis, women who had not completed primary level of education, and those who had secondary and above level of education appeared to share the same level of death clustering.

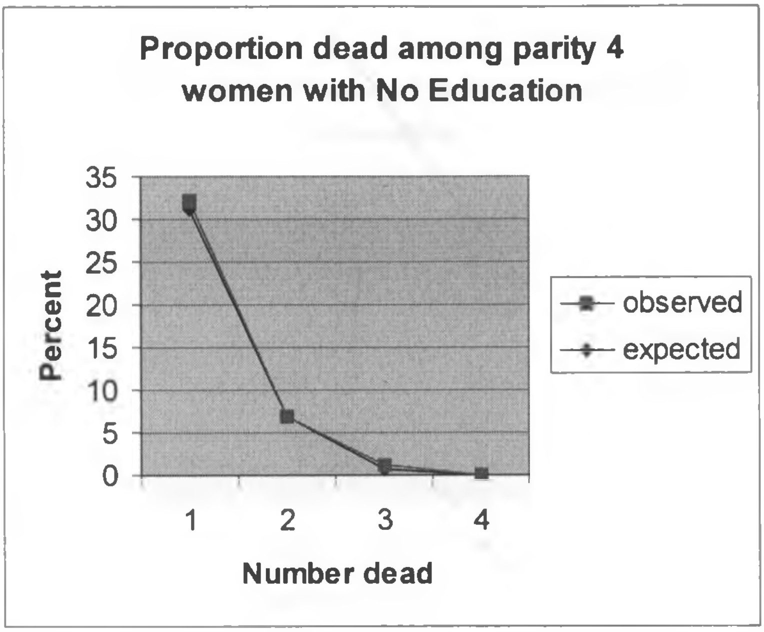
Possible explanation for this outcome could be due to one reason. A larger group of the secondary and above level of education are likely to be aged between 20 -29 years. Majority of women in this age category have no stable means of income, possibly unmarried and possibly have given birth to two children or more.

As a result, these women have no enough resources to take care of their children's basic needs (food, health, clothing and shelter). This exposes the children to the vulgarities of malnutrition, hunger and death. Further, the children's immune system is considerably compromised thus exposing them to increased morbidity.

4.5.1 EXTENT OF RISK INEQUALITY BY EDUCATION LEVEL WHEN PARITY IS FIXED

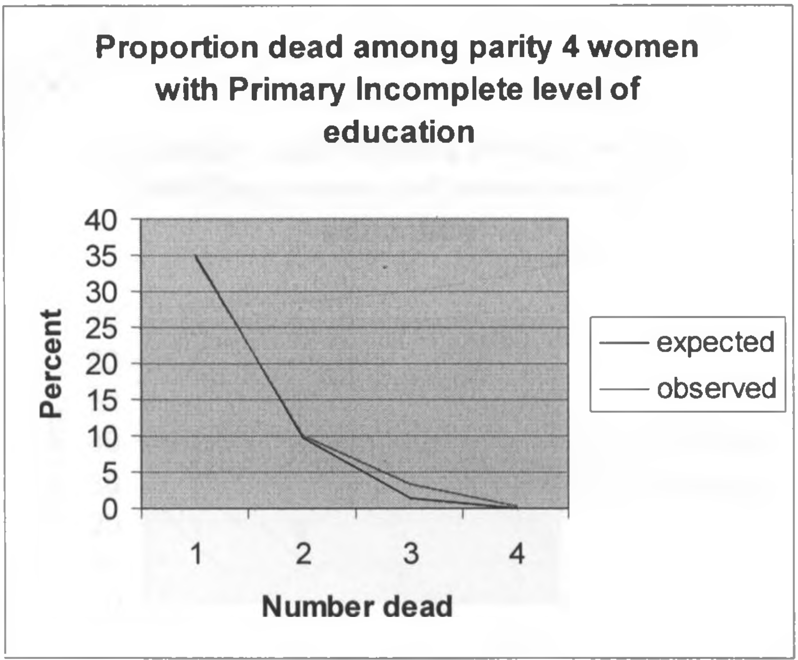
At this stage, the distribution of risk among women with different levels of education has been examined. However, parity has been fixed at 4 children for all the cases analyzed.

Figure 20



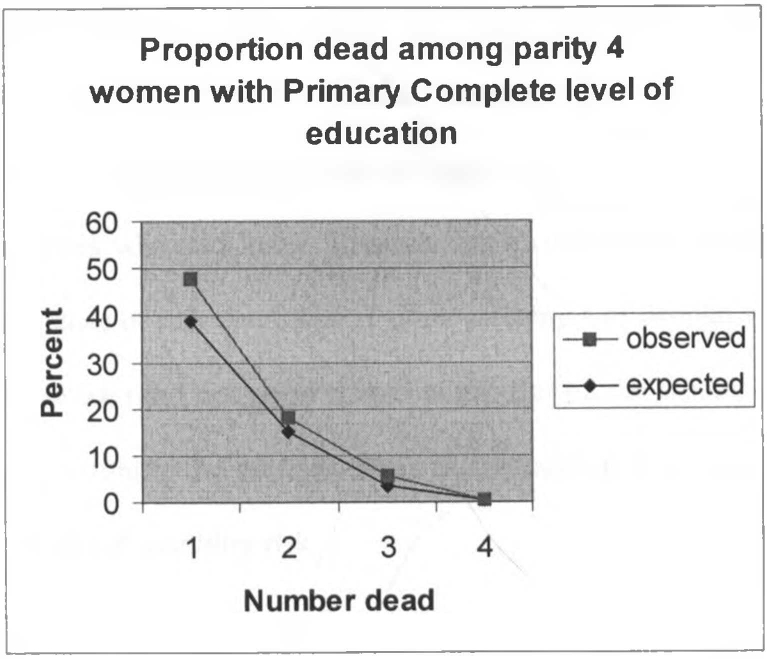
Source: Computed from 0.5 sample, Kenya Population Census Data, 1999

Figure 21



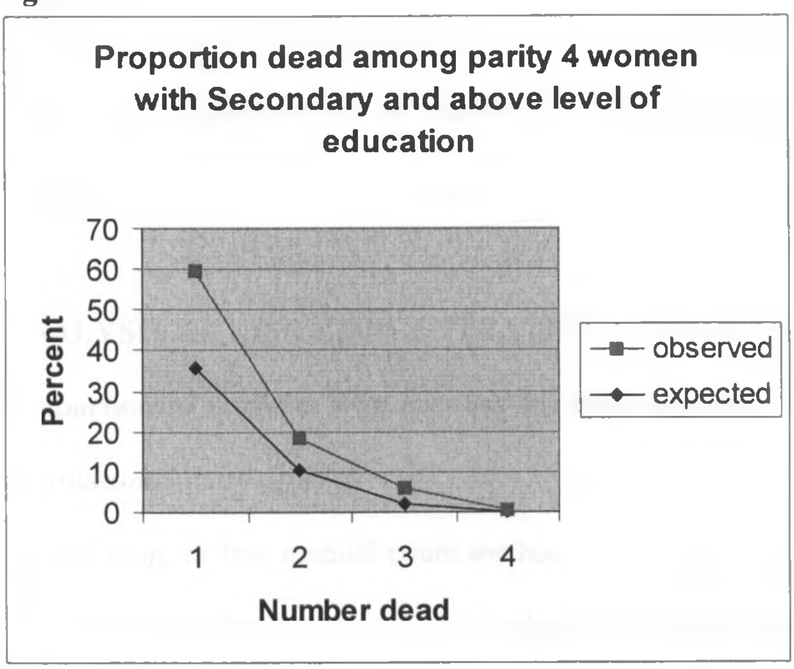
Source: Computed from 0.5 sample, Kenya Population Census Data, 1999

Figure 22



Source: Computed from 0.5 sample, Kenya Population Census Data, 1999

Figure 23



Source: Computed from 0.5 sample, Kenya Population Census Data, 1999

The above results for women with No Education are similar to those of figure 17 where the distribution of risk appears to be more concentrated among mothers who experienced 1 and 3 child deaths. However, when we look at the results for women who did not complete their primary level of education (figure 21), risk is more pronounced among mothers who had lost 3 children. On a comparative scale, this group experienced little evidence of risk compared to other categories of women who completed primary or even those who did not go to school at all. But on the whole, these findings seem to support very strongly the popular thesis that education level still has a significant influence on childhood mortality risk.

The results to some extent compare quite favorably with death clustering exhibited in figure 18, i.e. among women with same level of education but without fixing parity. Therefore, generally we can confidently argue that education level continues to play a crucial role in determining the extent of risk in childhood mortality. The results also confirm my hypothesis on the influence of socio-economic variables vis a vis death clustering.

ANALYSIS OF RISK CONCENTRATION USING OTHER METHODS

Proportion of mothers who account for half the number of observed events in the population.

In this more or less manual-count method, we simply count the number of women who have experienced at least two child deaths, and whose experience of child deaths account for more than half the total number of the observed events in the population.

Table C below shows the number of women cross-tabulated by parity and number of deceased children.

The number of women who experienced more than one child death is 2221 out of a total of 5429 women who experienced child deaths. The data suggests that more deaths (over half the total) are contributed by less than 35% of the total female population experiencing child deaths. This data is similar to the findings of Meegama (1980) and Das Gupta et al (1989) who reported that 12 per cent of women who experienced multiple child deaths accounted for 62% of all child deaths in her sample. The tabulated information in Table C below, further suggests that more deaths are clustered among women of particular age groups. Of the total number of women with multiple deaths, it is interesting to note that mothers in the age categories of 15-19, 20-24, and 25-29 account for only 8% of the total number of child deaths in the sample. Inversely, this is a pointer to the fact that more deaths are concentrated among women of older ages (30 years and above). It is this older age category that comprises over 90 per cent of all women with multiple childbirths.

Table C: Women by parity and number of deceased children

Number of Deceased Children	Children Ever Born									
	1	2	3	4	5	6	7	8	9+	Total
0	4179	3425	2545	1915	1427	1000	660	379	324	15854
1	313	395	450	448	407	368	330	260	238	3209
2		96	107	139	183	176	191	154	173	1219
3			50	65	84	114	107	103	157	680
4				5	12	23	38	48	80	206
5					4	7	11	21	30	73
6						2	2	4	19	27
7								1	9	10
8								1	4	5
9+										
Total Women	4492	3916	3152	2572	2117	1690	1339	971	1035	21284
Total Births	4492	7832	9456	10288	10585	10140	9373	7768	9315	79249
Total Deaths	313	587	814	941	1093	1201	1252	1213	1734	9148

Source: Calculated from 0.5 per cent sample, 1999 Census of Kenya

Table D: Number of children dead by parity and mother's age group, Kenya, 1999.

Parity	15-19	20-24	25-29	30-34	35-39	40-44	45-49	All Ages
1	198	546	591	578	524	428	344	3209
2	48	250	386	502	504	428	320	2438
3		159	351	411	459	324	336	2040
4		16	100	188	156	172	192	824
5		5	35	85	70	70	100	365
6			6	30	48	48	30	162
7				7	00	28	35	70
8				16	00	24	00	40
9+							09	09
TOTAL	246	976	1469	1817	1761	1522	1366	9157

Source: Calculated from 0.5 per cent sample, 1999 Census of Kenya.

As can be observed from our analysis, age comes out clearly as an important source of inter-woman risk differences. The data seems to suggest that the degree of risk of childhood mortality increases with an increase in mother's age. This could be explained further by the fact that older mothers have had a longer period of childbearing hence more of their children have been exposed to risk of death than their younger counterparts.

At very older ages, hence high parities, women who have experienced larger numbers of child deaths must, of course, contribute a very considerable excess , since the risks continue to rise steeply despite a larger than expected number of mothers who have not experienced any child deaths. A similar result was reported in 1972 by Stoeckel and

Chowdhury, who found that contrary to their expectations, neo natal and post neo natal mortality rates were lower among women with the largest families. Further investigation revealed that this was due to a concentration of child deaths among mothers who had lost several previous children; the overall rate was reduced by the very low rates for children of mothers who had not lost any children.

DISCUSSION ON THE RESULTS

In this chapter, the extent of death clustering during childhood in rural Kenya has been assessed. Similarly, some of the factors (i.e. demographic) that affect the excess risk of infant and child deaths have been investigated.

The extent of death – clustering has been examined using basically two methods. The first involved looking at women within parity groups. Observed distributions of child deaths were then compared with those expected on the basis of a normal binomial distribution, allowing risk to vary with parity. The comparison then allowed for the assessment of how much differences in the variability in risk between women contributed to observed child deaths, after allowing for chance factors.

Thus in figures 2 to 5, we compared the theoretical binomial distributions with the observed distribution of deaths for women of parities 4,5, 6, and 7 in the 1999 Census of Kenya. Clearly, the observed distributions are not binomial. From the results, as parity increases, more women than expected have no deaths. On the contrary, more have a large

Chowdhury, who found that contrary to their expectations, neo natal and post neo natal mortality rates were lower among women with the largest families. Further investigation revealed that this was due to a concentration of child deaths among mothers who had lost several previous children; the overall rate was reduced by the very low rates for children of mothers who had not lost any children.

DISCUSSION ON THE RESULTS

In this chapter, the extent of death clustering during childhood in rural Kenya has been assessed. Similarly, some of the factors (i.e. demographic) that affect the excess risk of infant and child deaths have been investigated.

The extent of death – clustering has been examined using basically two methods. The first involved looking at women within parity groups. Observed distributions of child deaths were then compared with those expected on the basis of a normal binomial distribution, allowing risk to vary with parity. The comparison then allowed for the assessment of how much differences in the variability in risk between women contributed to observed child deaths, after allowing for chance factors.

Thus in figures 2 to 5, we compared the theoretical binomial distributions with the observed distribution of deaths for women of parities 4, 5, 6, and 7 in the 1999 Census of Kenya. Clearly, the observed distributions are not binomial. From the results, as parity increases, more women than expected have no deaths. On the contrary, more have a large number of deaths, and fewer than expected fall in the middle of the binomial distribution. These differences occur in spite of the fact that allowance is made for the increased parity-specific risk.

The observed variances are considerably larger than the binomial model would predict, so that these distributions are wider than their model counterparts. This is particularly pronounced for the higher-parity women, which indicates that as parity increases, women become increasingly polarized in the apparent risks their children experience.

At first glance, the pattern of observed binomial variance differences, which increases with parity might be interpreted as indicating increased inter-woman variability in risk with parity – as if each increase in parity, and its observed rise in risk, were associated with a wider dispersion of other risk factors, which polarized women further and further into the extreme ends of the death distributions. This apparent polarization is a long way short of the extreme case (as is clearly shown in the binomial models), which are much larger than the observed binomial differences.

This trend in variance difference could be explained by the fact that parity "amplifies" whatever inter-woman risk variability exists in the population: if sequential binomial trials from populations with different underlying risks are analyzed on the assumption that they come from a homogenous population, long sequences will appear to diverge more radically from a binomial distribution than short ones.

The above results also concur with the study hypothesis that background factors such as a mother's level of educational, act jointly or singly through parity or age to determine the risk of childhood death among women in rural Kenya.

Other mortality risk factors

Although in this study we have only looked at and considered parity and age as being the greatest direct contributors in increasing risk patterns among women, other known differentials in mortality have also been observed in Kenya (Awino S. O. 1989; Socio-economic and Health Factors Affecting Child survival in Kisii District; un-published thesis) such as regional, educational attainment levels and differentials in housing and sanitation. These are also possible significant mortality risk factors and it would therefore be of great academic and health interest if further research and literature review were carried out in this area.

This study has attempted to factor in educational level and region of residence (i.e. whether Western, Nyanza, Eastern, Rift Valley, Coast, North Eastern, or Central Province) to asses their influence on the distribution of risk patterns among women in rural Kenya.

CHAPTER FIVE

5.0.0 CONCLUSION AND RECOMMENDATION

A number of studies have shown that deaths, particularly infant and child deaths have a tendency to cluster or concentrate among certain women who share particular characteristics. These characteristics are but conditions which may range from socio-economic, socio-cultural, environmental, health to demographic factors which determine the direction or magnitude such clustering may take (Das Gupta, 1990; Khasakhala 1993; McMurray 1997).

From the results in this study, a number of observations quickly come to the fore. The first is that there is overwhelming evidence that death clustering actually exists among women in rural Kenya. This phenomenon is more pronounced among women of higher parity, and older ages (i.e. 30 years and above).

When we look for woman-based measures of mortality risk, parity is a potential confounder for two reasons. First, it contributes to an observable increase in risk, which may be partly accounted for by selection factors. Secondly, we observe an over-dispersion of the distribution of deaths between women in parity groups. Since this over-dispersion increases systematically with parity, it can be allowed for, and the regularity used to obtain a measure of risk variation between women. Our analyses have further shown that there is a true increase in risk concentration (and risk variability) among women at the highest parities within each age group – a real indication of death clustering.

From our exploration, the findings about variability between women are important because they suggest that we might learn more about the causes of inequality in both fertility and mortality by analyzing differences between women's families rather than by looking for differences between births.
Although this study has shed some significant light on the issue of clustering of childhood deaths among a certain group of mothers in rural Kenya, more still needs to be done in the same area. For instance, my study only focused on rural women. A similar study should be carried out among urban women and families in Kenya because I believe there exists very critical issues of childhood mortality among this population sub set.

Identifying sources of variability in disease occurrence or death is an important task for health policy. The approach of preventive medicine is to focus on members of high-risk groups and to alter their risk status. Going by the results of this study, Nyanza Province stands out as a region that needs more concentrated attention by health authorities. The approach for this region should be a comprehensive one that combines both promotive as well as curative interventions in order to make a significant impact.

REFERENCES

Anker R and J.C. Knowles, 1977, "An Empirical Analysis of Mortality differentials In Kenya at the Macro and Micro Levels," Population and Employment Working Paper No.60, Geneva; International Labour Office

Caldwell J C, 1979, "Education as a Factor in Mortality Decline: An Examination of Nigerian Data." Population Studies 33 (3): 395-413.

Central Bureau of Statistics (CBS), 1996; "Kenya Population Census 1989 Analytical Report Vol.III. Nairobi: Office of The President and Ministry of Planning and National Development.

Cleland J and J Van Ginnelen, 1989, "The Effect of Maternal Schooling on Childhood Mortality; The Search for An Explanation," J. Biosocial Science (suppl.)

Ewbank, J. Kekovole and R. Henin, 1986; "An Integration of Demographic and Epidemiological Research on Mortality in Kenya." In Determinants of Mortality Change and Differentials in Developing Countries; A Five-Country Case Study Project. Newyork: United Nations.

Katende J 1983, "Housing Conditions and Some of Their Related Socio-economic and Demographic Aspects: A Case Study of Bushenjo-Uganda." M.A. Thesis, PSRI, University Of Nairobi

Khasakhala A 1998; "Death-Clustering In Families In Kenya; Implications for Child Survival and Maternal Health". PhD Thesis submitted to The International Institute for Population Sciences, Mumbai. India.

Mondot-Bernard J M (1977), "Relationships between Fertility, Child Mortality and Nutrition In Africa." OECD. France.

Mosley and Chen, 1984. " An Analytical Framework for The Study of Child Survival in Developing Countries," Supplement to Population and Development Review, Dec.: 25-45

National Council for Population and Development (NCPD) 1989; Kenya Demographic and Health Survey, 1989,Nairobi; Kenya. And Institute for Resource Development /Macro-systems, Inc.Columbia, Maryland, USA.

National Council for Population and Development (NCPD) 1998; Kenya Demographic and Health Survey, 1998,Nairobi; Kenya. And Institute for Resource Development /Macro-systems, Inc.Columbia, Maryland, USA.

NCPD, 1993. Kenya Demographic and Health Survey. Nairobi. National Council for Population and Development.

Newman, P 1969; "Malaria Eradication and Its Effects On Mortality Levels; A Comment." Population Studies 23 (2): 285-286

Ocholla-Ayayo, A.B.C. 1992; Annotated Bibliography of Research Projects Undertaken by PSRI Master of Arts/Science Graduates 1982-1992.Nairobi; PSRI

Ocholla-Ayayo, A.B.C., J. Oucho, V. Lema, R. O. Obudho, Z. Muganzi, C. Suda, W. Njau, A. Khasakhala, and L. D. Ikamari, PSRI, 1991. "Sexual Practices and The Risk of the Spread of STDs and AIDS in Kenya, *PSRI Research Reports, 1989/91.*Nairobi. PSRI.

Odhiambo, S. A. 1991; " Socio-Economic and Health Factors Affecting Infant and Child Survival in Bogusero sub-location of Kisii District," M.SC. Thesis, PSRI, University of Nairobi.

Otieno A.T.A. 1999, " Timing And Spacing of Births In Kenya." Unpublished PhD thesis submitted to the International Institute for Population Sciences, Mumbai. India.

Ouma F.O. 1991; "Environmental Risk And Socio-Economic Factors Influencing Infant And Child Mortality In Siaya District: A Case Study of Jera sub-location," M.Sc. Thesis, PSRI, University of Nairobi.

UNFPA The State of World Population (1998)

UN Economic Commission For Africa (ECA). 1993. "Correlation of Changing Infant and Child Mortality and Fertility in Relation to Development Programmes in Selected ECA Member States.

UNICEF "The State of The World's Children." 1998. *Focus On Nutrition.*

United Nations, 1986; "An Integration of Demographic and Epidemiological Research on Mortality in Kenya." In Determinants of Mortality Change and Differentials in Developing Countries.NewYork: UN PP. 33-85.