A SURVEY OF INFANT AND CHILDHOOD MORTALITY IN MERU DISTRICT; KENYA

BY

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DECLARATION.

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

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DEDICATION.

Dedicated to my father

M'RIMBERIA M'MUKETHA

and my mother

JENIFFER M'RIMBERIA

for seeing me this far.

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To you all, I say "ASANTENI SANA".

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ABSTRACT.

This is basically a study of certain specified issues of infant and childhood mortality. Although the topic suggests that it covers a whole district, the data collected was from 3 divisions classified as low, medium and high potential zones. The results from these were then used to make inferences about the state of infant and childhood mortality in the whole district.

From the 3 sampled divisions, a sample of 100 women who had experienced an infant or a childhood mortality was drawn and a questionnaire administered to them. The data from these questionnaires were used to discuss the inherent infant and childhood mortality differentials in the study area. These differentials are discussed using the four variables namely; socio-economic, demographic, ecological and medical. The socio-economic variables include marital status and education level of the mother. The demographic variables include birth order of the dead child, birth intervals, age of the mother and the total population density; ecological variables include agricultural production in terms of cash crops and finally medical variables namely medical personnel and facilities and their accessibility and availability to the sampled population.

Another objective discussed in this research is the cause of infant and childhood mortality. These were categorized into pathological diseases namely broncho-pneumonia, malaria, meningitis, gastroenteritis and tetanus. Other causes of death considered are burns, prematurity and birth disorders. The data for this information was from hospital records and the District Registrar of Births and Deaths.

Among the major findings of this research was that broncho-pneumonia was the leading killer disease followed by malaria and measles. In the differentials, the married women had the highest occurrences of infant and childhood mortality followed by the single women and then the widowed and the separated. Women with some secondary school education had the lowest incidence of infant and childhood mortality, while those who had some primary school eduction contributed the highest numbers. In testing the hypothesis it was found out that socio-economic, demographic and medical variables had an influence on the occurrence and distribution of infant and childhood mortality and as such the null hypotheses were rejected.

This study concluded that infant and childhood mortality in the study area was basically as a result of non-immunizable diseases such as pneumonia and malaria. This may be attributed to the

Ministry of Health's KEPI programme which seems to have made an impact whereby immunisable diseases have been brought under control though by no means eliminated. Most parents were now taking child immunization seriously although they may relapse on the schedules. Nutrition and hygiene have a big role to play in the reduction of occurrences of infant and childhood mortality.

The study therefore recommends more education on nutrition, hygiene and child health with special emphasis on community based participation in providing health care facilities and even paying for health personnel. With meager Government resources, the only way health for all can be achieved is if the community becomes more responsible for its own health.

CHAPTER ONE.

INTRODUCTION.

1.0 INTRODUCTION.

No cold statistics express more eloquently the difference between a society of sufficiency and one of deprivation than the mortality rate of the under Five. (Newland, K. 1981). This is expressed as the number of children out of each thousand born alive who die before their fifth birthday. Among the most deprived people in the world, as many as 200 of every thousand live born infants die before their first birthday while as many as 120 of every thousand live born infants die after their first birthday but before their fifth birthday. At times of greater than usual crisis, the proportion is even higher. By contrast, rates of fewer than 10 deaths per 100 live births have been achieved in wealthy and educated societies (UN 1973).

One of the biggest problem planners have been grappling with in Kenya is the population growth rate. While this has been principally attributed to high fertility and often to a decline in mortality, high infant and childhood mortality is rarely linked to population explosion. If the population growth rate is to be brought under control, then both issues have to be addressed. The Kenyan Government objective of providing health for all by the year 2000, will hopefully achieve both a decline in fertility and mortality.

In its aim to achieve health for all, the Kenya Government Development plan 1988/93 cites the high population growth rate standing at an annual increase of 3.8 % (one of the highest in the world) as a strain to the economy. This and the inadequate distribution of health facilities, shortages of manpower and lack of public information are some of the problems that need to be tackled if the goal is to be achieved. It is hoped that if one of this is achieved, it will influence the levels and the trends of infant and childhood mortality to lower levels.

The importance of the above factor, is that high infant and childhood mortality will affect policies that tend to ignore it. For instance, why is it that most Kenyan communities find small families unacceptable. It is illogical to advocate for small families while the underlying factors that favour the preference for large family sizes are understood and such problems not tackled accordingly. For instance, the fact that children are an important addition to the labour force of the family. With high infant mortality and the low standards of living, a large number of children are needed in order that enough children survive to give the family the required social stability and future security. Even urban populations desire a given number of surviving children with the hope that through education, some might achieve higher social and economic status and thus improve the lot of the whole family.

While there are many causes of death, infants and children are particularly susceptible to pathological causes and therefore the need for an efficient medical system. This is because children's immunity system is relatively lower than that of adults and secondly, children are exposed to congenital diseases and thirdly environmental hazards are bound to affect children more.

It is therefore important that health services are available and easily accessible to this age bracket. However, it is notable that, health remains one of the most severely undermined social services in Kenya. Currently, 14 doctors to every 100,000 people, a meager increase from the 10 doctors to every 100.00 people in 1979. In contrast, the population has risen from 16.1 million in 1979 to 23.5 million to date. This implies that a large percentage of Kenyan Population is under 14 years. (Kenya Government Development Plan 1989/93). It is also deductible that even a large percentage are under five years.

Ewbank (1978), commenting on the infant and childhood mortality in Ghana states that general mortality in Tropical Africa ranks of course, among the highest in the world and Ghana is no exception. Like Ghana and most developing countries, Kenya has shared in the rapidly and unprecedented mortality decline occurring after the World War II. Significant reductions in infant and childhood mortality have played a major role in achieved life expectancy of 70 years and more in developed countries, he states. There is

therefore no reason why this should not apply to developing countries if only the right steps are taken.

As a strategy for curbing the high rate of population growth, the Kenyan Government has adopted the family planning program. However, it may be stated that as long as socio-economic conditions remain low, family planning even if it induces changes in the population structure is not likely to make much difference to the welfare of the people unless the welfare of the mother and the child is addressed, the program will have little appeal.

Infant and childhood mortality will not improve much with family planning measures alone, therefore, the need to integrate health policy with other efforts aimed at raising the social and economic levels of the people because so long as living conditions are low, high infant and childhood mortality will be inevitable.

Caldwell J.C (1988) argues that high mortality is the main obstacle to the large scale adoption of family planning in Africa. A large ratio of children is necessary even if not a large number, in order to ensure future economic help and particularly farm work, household chores, family continuity and the status enhancement. It is for this reason, among others, that infant and childhood mortality should be scrutinised more closely and means of bringing it under control sought.

1.2 STATEMENT OF THE PROBLEM.

In searching out the explanation to the infant and childhood deaths, two levels of analysis are needed. One to identify the immediate cause of deaths and another to examine the social, economic or environmental conditions that make infants more vulnerable to the immediate causes of death.

Meru district, the study area is vastly diverse in climate and general ecological conditions and is therefore likely to be just as diverse in its distribution of pathological diseases that cause infant and childhood mortality.

There are several common killer diseases in infants and children and their occurrence and distribution is also greatly varied. The killer diseases identifies in the literature review are broncho-pneumonia, measles, malaria, meningitis, malnutrition (and the related deficiency diseases), gastroenteritis, tetanus and pre-maturity.

Using the probability of dying before age 1 index and exact age 5 [q(5)], a mortality level can be drawn and these can be used to compare the occurrence and distribution of infant and childhood mortality in different ecological zones. Such a comparison would highlight areas of deficiency in natural providence and infrastructural development. These indices are therefore a measure of socio-economic development.

Inherent infant and childhood differentials can be worked out at various levels and using several variables. Commonly used variables are socio-economic, demographic and medical. When these variables are expounded on several sub-variables emerge. These are educational attainment of the mother whether primary, secondary, high school, vocational or none at all, then marital status of the mother whether single, married divorced or separated. It is understandable that there are several demographic aspects that influence the levels of mortality but this study narrows down to only birth order of the dead child, the birth interval (this will be the interval between the child and the one before and the one after), age of mother at the time of the death and the total population density an area.

The ecological variable,that is average rainfall totals, the agricultural production in terms of cash crop and food productivity both in acreage and tonnage all play a part in determining the health and mortality of infant and children.

Medical personnel such as doctors, clinical officers and nurses: the availability of medical facilities, namely hospitals, dispensaries and health centres all play a major role in explaining the occurrence of mortality and eventual mortality.

As will be evident from the literature review, the above mentioned variables have different bearings on the level of mortality.

However, these vary from one socio-economic setting to another and will be interesting to see what influences these variables have on mortality in the study area.

1.3 OBJECTIVES OF THE STUDY.

The principal objectives of this study are to:-

1) Analyze the major causes of infant and childhood mortality in the study area in terms of :-
   a) common killer diseases
   b) cause specific death rates

2) Determine the levels of infant and childhood morality in:-
   a) high potential zones of the study areas
   b) medium potential zones
   c) low potential zones

3) Examine and account for the infant and childhood deaths differences in the study areas in terms of:-
   a) Socio-economic variables such as:
      i) education level of the mother
      ii) marital status of the mother

   b) Demographic variables such as:
      i) birth order
      ii) birth intervals

iii) age of mother

iv) population density

c) Ecological variables with reference to:

i) Rainfall totals

ii) agricultural production (tonnage and acreage) of

- food crops
- cash crops

d) Medical variables namely the availability and accessibility of health services and personnel.

1.4 OPERATIONAL HYPOTHESES.

Due to the nature of this study, certain hypotheses will be subjected only to qualitative testing while others will be subjected to quantitative testing.

1. H_o : There is no significant association between the levels of malnutrition and the incidence of pathological diseases.

   H_1 :

2. H_o : There is no significant differences in the levels of infant and childhood deaths in the study region.

   H_1 :

3. H_o : There is no significant relationship between the selected socio- economic variables and occurrence of infant and childhood deaths in the study area.

   H_1:

4. H_o: The selected demographic variables have no significant effect on infant and childhood deaths in the study area.

   H_1:

5. H_o: The amount of rainfall received in the study area has no significant relationship to the infant and childhood deaths.

   H_1:

6. H_o: The number of medical service centres and personnel has no significant relationship to the infant and childhood deaths.

   H_1:

1.5 LITERATURE REVIEW.

1.5.1 INTRODUCTION.

Alot of studies carried out on the research topic have tended to use Geographical regions for comparison purposes. The result has been that the research done in different parts of the world have tended to come up with findings based on Geographic lines. To avoid

this, this review will take a topical approach other than the commonly used Geographical or regional approach.

It is notable that mortality in African has been falling despite droughts, natural disasters and wars. However, it is also evident that it is still higher on the average across the continent than for any other continent. Worse still, it is the fact that very little is known about mortality and this lack of adequate data and information about the cause structure hampers attempts to design and implement health intervention programmes (Hill 1984).

Data available can be used to study differentials in childhood mortality by characteristics of the mother such as education, urban or rural residence. Also estimates of child mortality can be derived for each group or data can be used for multi-variate analysis at the level of the individual mother.

The most efficient use of data is through the application of hazard model, which essentially estimates the average age pattern of a set of relative risks for certain characteristics of the mother and the child. (Hobcraft, 1985) Using this approach, the mortality risks and occurrences as pertaining to the mother and children under 5 will be examined.

In 1985, Hobcraft used a log-linear rate approach in comparative studies of child mortality from the world fertility survey but the cross-sectional focus of the study limited its depth. There is therefore very little application of hazard model in analyzing data for any African region. It is obvious that census data at local level and hospital and clinical reports have been underutilised. A multi-variate analysis of such data could throw light on a number of ecological and social factors influencing infant and childhood mortality.

There are several studies on infant and childhood mortality done in Kenya emphasizing on diverse ranges of issues. Anker and Knowles (1977) and Kibet (1981) correlated infant and childhood mortality with other variables such as percentage of urban population, total fertility rate, percentage malaria cases, female literacy, hospital beds per 1000 population, Km of roads per 1000 Km^2. Kibet used the 1979 population census while Anker et al used those of 1969. In conclusion Kibet states that malaria and mother's education are the two most major factors that influence child mortality levels.

Mott (1982) in his study of infant mortality in Kenya using the Kenya fertility Survey of 1978 found out that mortality was highest at first births and once again at higher parities. Nyamwange (1983) studying the child mortality in Nairobi found out that residents of high mortality areas, originate from high mortality

zones in the country despite the medical technological achievement of the city. He concludes that immigration plays an important role in urban mortality differentials.

Others Ondimu (1987), Rono (1982), Nyokangi (1984) and Otieno (1985) all have a common feature. In all these studies, the researchers' primary concern was the calculation of infant and childhood mortality using various methods of demographic analysis and computation of life tables. They may be excused as the majority are demographers interested more in the statistical aspects of infant and childhood mortality. The underlying phenomena as to the causes, the trends and the occurrences are down-played in these studies.

On the contrary, this study will emphasize more on non-statistical aspects such as variations and differentials in terms of social, economic, demographic and medical variables. This may not necessarily use the infant and childhood mortality levels computed using Brass Method.

1.5.2 SOCIO-ECONOMIC VARIABLES

A 1973 United Nation's report indicate that data on socio-economic variation in mortality tend to be scarce, the available studies show broadly consistent findings in status differentiation whether measured by income, occupation or education. For instance, Bangladesh data for a rural area in 1973, a famine year, shows a

crude death rate of 12/1000 among farming families owning more than 12 ha of land and 36/1000 for landless households.

Infant and childhood mortality differentials follow those of adult mortality with differentials narrowing though by no means eliminated with increasing public sector attention to health services.

Studies done at macro level in various parts of developing countries found that amongst socio-economic factors, parental education invariably emerges as being closely related to child mortality levels. In Africa, primary education appears to confer a substantial advantage in terms of reduced mortality risks on the children relative to the children of parents with no education. Hobcraft (1985) found out that paternal and maternal occupation are all related to child survival. Mott (1982), in a multi variate study of infant in Kenya found out that some primary schooling of the mother reduces mortality by over 10% and some secondary schooling by over 20%.

Education has long since been recognized as a major component of economic development. The role of education in reducing infant mortality may appear more obvious than other variables such as this study intends to prove, it is statistically the most powerful explanatory variable that has been identified.

A product-moment investigation of the connection between a mother and her children chances of survival was carried out by Hugs Behn (1976) in Latin American Demographic Centre. The study involving eleven countries showed that mortality rate of children whose mothers had ten years or more of schooling was only 1/2 or 1/5 of the rate of children whose mothers were illiterate. This impact is strong on post neo-natal mortality, suggesting that education enables a mother to meet the challenges of a hazardous environment more successfully.

In Pakistan, during the period 1969-73, " unschooled" women lost 142 infants for every 1000 born alive, whereares women who had education through the primary level or more lost 100 for every 1000 live births.

In Indonesia, the range was 93 for illiterate women compared to 62 for those who had at least completed primary school. What is most distressing about this factors is that 60% of all illiterate people in the world are women.

Children whose fathers are dead or absent have an addition stroke against them. Their mothers bear the burden of child care as well as having the sole responsibility for the family economic welfare. (Puffer et al 1973). Because most women commonly earn much lower wages than men, the female headed household is likely to be a poor household. The difficulties that confront the mothers are reflected

in the children's health.

Almost every child born out of wedlock is more likely to die in infancy than children of married couples. Bourgeois. (1980) in his study of Washington D.C states that; the fact that 48% of all births in 1980 were illegitimate is thought to be one of the reasons behind the city's high infant mortality rate. Among children whose mothers were legally married. Infant mortality rate was 22/1000 while it was 42/1000 among the children of single mothers.

A review of these studies indicate that education of the mother was closely linked to occurrences of mortality. It is however evident that, they assume all other factors such as the provision of social amenities foe example, health facilities, water and sanitation are constant. Yet in real life it likely to find an "unschooled" woman keeping very high levels of hygiene and who have a healthy source of income to supplement the government provided health services.

Methodologically, the sampled areas for the studies are too large. Whole districts such as Pakistan , Indonesia, Kenya are used to make generalizations about relationships between infant and childhood mortality and the socio-economic situation of the mother.

This study therefore intends to take an integrated approach to analyzing the occurrence of infant and childhood mortality unlike the above stated studies.

1.5.3 NUTRITION.

The effects of malnutrition and famine are more difficult to isolate than the effects of fertility principally because of the complex interaction between infections and nutrition status (Ellis, G.W.B 1965). Whilst the nutrition status of children prior to infection is frequently the decisive factor in their inability to survive many infections, eg measles are capable of killing indiscriminately well nourished children. There are, however, many different aspects of nutrition status which complicate the influence of nutrition on mortality. One of this is the fact that nutrition intakes and energy expenditure are difficult to measure. Secondly, nutritionists themselves disagree as to whether body size alone affects survival or reproductive capacity, but gross comparisons of the small but low mortality population of Punjab suggest that nutrition status is not the sole factor determining health (Payne, 1985).

Variations in the duration of breastfeeding and post-partum abstinence may be of considerable importance in the level of infant and childhood mortality. According to Caldwell (1979), short birth intervals are associated with high fertility and also an increase risk of morbidity and consequent mortality.

In Rwanda, where prolonged lactation is generally practiced, within nine months of delivery and, in Senegal where intervals between births tend to increase systematically with longer breastfeeding. postpartum amenorrhoea caused by extended lactation is the determinant of child-spacing. As earlier stated, Caldwell (1979) there is an inverse relationship between the length of birth spacing and the level of mortality.

It is also widely reported in medical literature that breast milk contains all the nutrients the baby needs during the first six months of life. The colostrum or first milk is also believed to include substances that help protect the baby against disease and subsequent milk is relatively free from harmful bacteria. Mutanda. 1976). The probability of dying is therefore highest during or within six months of weaning and declines systematically as weaning is delayed until the later ages. Breastfeeding is therefore of paramount importance to the health of infants and young children. lactation undoubtedly enhances the chances of infant and child survival and acts as an insurance against the risk of child death.

In a case study of mortality differentials in Malaysia, Davanzo and Nalsicht (1984) illustrate that the increase over time in mothers education and improvement in water and sanitation, especially for babies who did not breastfeed contributed impartially to a decline in infant mortality rate. However, they found out that decline in

breastfeeding since World War II kept the Infant Mortality Rate from falling as rapidly as it would have otherwise been, the detrimental effects of this decline offset the beneficial effects of improved water and sanitation.

1.5.4 DEMOGRAPHIC.

Biological studies done in West Africa (Caldwell, J.C 1979) have demonstrated that children born to women under the age of 20 and after birth intervals of shorter than two years suffer dramatically higher risk of child mortality than other births. Parity is also important where first births and births of order seven and higher have substantially higher mortality risks particularly in the neo-natal and post-natal periods.

Sex of the child has been found to be associated with child mortality with males having higher risks than females under the age one with a difference thereafter. (Kandeh & Dow, 1987)

Analyzing the sex differentials in infant and early childhood mortality in Ghana using Trussel modification of the original Brass Approach. Grounds (1984), found that the recorded infant mortality rate 1(q) was 23% higher for males than females. This also held for early childhood. these figures suggest that sex differentials is more pronounced in infancy than in early childhood years. on the contrary, studies in Bangladesh, Egypt, India, Pakistan, Sri Lanka and Tunisia have shown that ages 1-4 there is excess female mortality, Al Kabir, (1984). Since all these are developing

countries. it would be interesting to investigate the kind of sex differentials existing in the study area, being found in a developing country as well.

1.5.5 ECOLOGICAL.

Large regional differences often remain in infant and childhood mortality after individual effects have been allowed to account for mortality. Mortality rates will vary from a wet region to a semi arid one, reflecting probably variation in standards of living not incorporated into the analysis and also ecological factors associated with ideologies of important diseases of childhood.

Mott (1979), in his study found excess mortality risk for children in areas bordering the Indian Ocean and Lake Victoria. These are areas that are economically disadvantaged and where malaria is prevalent.

Commenting on the effects of climate and nutrition from a study of West African communities , Hill (1985) states that births occurring in the hot rainy season in Mali are subjected to higher neo-natal mortality rates amongst the agricultural and pastoral Fulani groups and are reversed in truly pastoral Tamasheq population. Post neo-natal mortality rates vary little by season although there are some indication of elevated risk in the cool and dry season amongst the Maaine Fulani and the Delta Tamasheq.

1.5.6 CAUSES OF INFANT AND CHILDHOOD MORTALITY.

With regard to patterns of disease in developing countries. UN attributed 43.7% to infection, parasitic and respiratory category, 14.8% to circulatory system diseases and 3.7% to cancer and 3,4% to traumatic injury. (U.N, 1963). The most common diseases were those transmitted by human faeces and many were intestinal parasitic and infectious diarrhoea diseases.

The World Health Organization (WHO, 1972) defines health as a state of optimal physical, mental and social well-being and not merely the absence of diseases or infirmity. The main interest on health of this study arises from an attempt to explain variations and trends in infant and childhood mortality, Ewbank (1985) sees the health problem in Africa as arising from the harsh environments, low levels of incomes and shortages of trained health personnel. Some areas of the continent have a very hot, humid climate which supports a large variety of diseases bearing insects and parasites. In other areas, desertification is a major threat and in large areas of the continent the success of agricultural harvest depends on the vagaries of the rainy season. In these areas, the prevalence of malnutrition among children is clearly linked to the harvest. This aspect directly influences mortality level. With the study area experiencing diversity in the climatic conditions, it will be interesting to assess whether mortality level in the, area corresponds or is similar with that of the rest of Africa as

advocated by Ewbank (1988).

Among the studies in Kenya using hospital and clinical records is that done by Grounds, (1964) who found out that respiratory track infection was the leading cause of death followed by gastroenteritis, malnutrition, malaria, tetanus, whooping cough, prematurity, burns and measles.

In a case study of Punjab India, a death rate of 34/1000 infants from acute diarrhoeal diseases was reported (Scrimshaw Tylor and Gordon, 1968). In Egypt, Iran and Venezuela, the incidents of diarrhoea among children of pre-school going age was estimated to be about 40-50%. (Feeney G, 1968)

The most tragic aspect about infant and childhood mortality in developing countries is that it is preventable. A study of Kerala, Sri Lanka and China demonstrates that poverty per se need not produce high infant mortality rates. The infectious disease that kill so many babies in this region are several kinds of diarrhoea, polio, diphtheria and whooping cough which hardly kill any in rich industrial countries. Two demographers (Mosley and Chen, 1970) who analyzed the major causes of death in Brazilian capital in 1970, concluded that 27% of the deaths from infectious diseases and parasitic diseases could have been prevented by vaccination and a further 52% by proper sanitation.

The WHO estimates that in 1980, 52% of all people of developing

countries including China lacked safe drinking water and 75% did not have proper sanitation. Human excretement and polluted water are the vehicles for a host of intestinal infections and parasitic diseases which are easily responsible for half the infants' deaths that occur in the highest mortality areas (WHO, 1981).

In such an environment, an infant is constantly exposed to agents of infection especially when the baby begins to crawl around and explore the surrounding.

1.5.7 OTHERS.

Although there is much in demography that is controversial, there is little dispute regarding an inverse relationship between economic development and mortality. Demography generally considers the major intervening factors to be increased access to food, improved medical care, sanitation and housing. The relative contribution of each of this and other factors has been difficult to qualify partly because the independent variables are so highly interrelated and partly because valid measures of economic development are not easily achieved.

Evidence has led to the widespread expectation that modernization precedes the higher rates of infant and childhood mortality, now characteristic of much of Africa, will fall. Indeed mortality rates are even falling of their own accord because of improved levels of living including better nutrition, health care and environmental

sanitation. Mortality in the Western world supports this. Their downward trend in infant mortality began before there were any specific therapies available for the common killers (Sagan, 1978). They attribute mortality decline primarily to increased resistance to infection and better nutrition.

In comparing the poorest and other states, Chen (1976) found that the difference in the preference of piped water and toilet sanitation and in mother's education in Malaysia was less important than the other two factors and, the smaller proportion of hospital births and the shorter average duration of unsupplemented breastfeeding in the less developed areas, also contributed to regional differences. Again the longer duration of unsupplemented breastfeeding in the less developed sample areas left the Infant Mortality Rate between the two samples from being even larger. However, ethnic mix was the most important factor in accounting for the higher average Infant Mortality Rate in the poorest states. Hence many of the variables that help explain the difference in the infant Mortality Rate between earlier and later years and between poorer and richer areas are the same.

An interesting aspect of the Malaysian study is that certain aspects of development that had been presumed to contribute, to the IMR, do not. These included decreases in overall fertility and childbearing by younger women aged less than 18 years, improvement in birth spacing and increases in household income.

Kass (1972) states that evidently, it is poverty, inadequate food supplies, poor environmental sanitation, lack of education and information and now indeed inadequate health care which account for the high levels of infant and child mortality in Africa today and will no doubt continue to do so until greater progress is made in distributing the fruits of modernization throughout the population.

Child mortality in Kenya can be said to have followed the Demographic transition trend. Before colonization and the coming of the White man, mortality was high. What with families, tribal warfare, poor medical care and malnutrition abundant, not to name the devastating slave raids that left hundreds dead; writes Kucyniski, 1949).

In the early 1920s and 1930s, we get the earliest possible data on mortality estimated crudely from that was obviously intended for other purposes. Kucyniski (1949) portrays infant mortality as ranging from 118 to 413 per 1,000 from different surveys taken by educational officers in Kenya.

Since the first census in 1948, Kenya has experienced a consistent decline in infant and childhood mortality. From the 1977 Kenya Fertility Survey, Mott (1979) reveals that age 15-34 had an infant mortality rate of 159/1000 prior to 1958,109/1000 in the period 1958-67 and 1968-70. Evidence from the study reveals that there is

a distinct regional differentiation with the highest in Nyanza, Coast and Western provinces, lowest in Central province and moderately in Eastern and Rift Valley province.

Commenting on population projections in Africa, Ohadhe (1988) states that assumptions about the future course of mortality assumes a decline everywhere in the continent at the rate of two years of improvement in expectation of life at birth for every year elapsed. Projections assume a decline in mortality has started and will follow a steady course in the future. However, these projections do not make allowances for a possible stagnation or reversal for mortality decline in certain regions as a result of economic, ecological crisis or even epidemics such as AIDS.

1.6 JUSTIFICATION OF THE RESEARCH.

As Hobcraft (1988) puts it, comparative studies of child mortality at micro levels have been subjected to a secondary position. While alot of study has been carried out at national and regional levels, none had been done at the district under study. The former mode of study not only generalizes issues but also limits their depths.

Risk of infant and childhood mortality strongly relates to the level of economic development. Children born under the vast unfavourable circumstances have a greater risk of death than those born in most favourable conditions. Indeed infant mortality is used as a measure of development. The purpose of this study is therefore

to examine from the already available data those variables that are associated with economic development, namely social, economic, demographic and ecological and to make deductions as to the magnitude of their contributions to infant and childhood mortality levels in the study area. This is one way of depicting social economic development of the study area.

As a social indicator, infant and childhood mortality illuminates much that a measurement of GNP obscures. It is particularly sensitive to destructive issues. It reflects not simply on capital, stocks of food,clean water, medical care and so forth, but actual availability of such amenities to all segments of the population. Deprivation among the people of a particular region may be masked by average income figures but it is likely to show up in infant and childhoods mortality statistics. It is for this reason that this study concentrates on a micro region so as to bring out the differences of deprivation or sufficiency of the people in the district under study.

Newland (1981) describes fertility and mortality as a "two way street". Among the facts that influence infant and childhood mortality, fertility is one of the most important. In most populations, high fertility and high mortality go hand in hand. With the current population problems facing Kenya, it is undoubtedly vital that mortality rates have to be reduced if fertility is to be the same. This study therefore aims at

understanding the causes of infant and childhood mortality and the inherent differences with an eventual aim of determining ways of curbing them.

As seen from the literature review, the major causes of infant and childhood mortality are disease related. This implies a high cost of treatment, a burden not only to the affected family but also to the nation as a whole, consuming the meager resources and exerting pressure on an already burdened economy.

It is hoped that this study will be of particular importance in as far as social and economic planning and drawing of policies is concerned. This is particularly important at District level where the District Focus for Rural Development is being effected as a means of propagating and implementing development policies. The differentials brought out in the study, particularly in as far as health, education and other related aspects are concerned, will be useful in formulating policies geared towards the improvement of socio-economic and health status of the district.

1.7 THEORITICAL FRAMEWORK.

The issues to be discussed in this study as far as mortality differentials and causes of deaths are concerned are centered around four variables namely:- socio-economic, demographic ecological and medical. These are variables that influence not only each other but other variables that determine epidemiologica

characteristics, morbidity and consequently mortality.

Several theories have been put forward to explain the occurrence of infant and childhood mortality in Kenya and the world at large. Grounds (1964) and Bonte (1978) in their separate studies on Kenya put forth a theory that respiratory tract infections are the leading causes of death, followed by diseases of the digestive system. Bonte went further to depict pneumonia as representing a quarter of all deaths in Kenyan hospitals. They went ahead to prove their theories using data from Kenyan hospitals. This study takes a cue from this theory and uses common pathological diseases to assess the major causes of infant and childhood mortality in Meru district.

The Biomedical Theory of Mortality.

The Biomedical theories are based on the work of Mckeown and shows that the incidence of morbidity has a circular pattern which involves three important agents or factors. These are environment, the host and the agent.

The environment factor emphasizes on the socio-cultural aspects of the environment which is important in that it creates conditions conducive for bacteria growth for instance, the malaria parasites. The environment in this theory provides the media of contact between medium and host. The agent aspect may be immune to measures taken to eradicate it or measures taken to curb its inhabitation

of the host. The final product is mortality. This theory is depicted as below:

	DISEASE	ACTION
ENVIRONMENT	Transmission	Sanitation/Hygiene
HOST	Resistant	Nutrition/modern diseases such as High Blood pressure, cancers
AGENT	Virulence	Medicine

Fig 1.1

Although this theory and model portrays the interaction between environment, host and agent, the model is unsatisfactory in that it leaves out the socio-economic dimension. This study therefore adopts the basic principle in the theory and adds the missing socio-economic dimension.

The theory of demographic transition.

this theory states that population tend to pass through different or more less well defined stages of development. in 1909. Landry identified three main stages or regimes of population. He used the assumption that if economic forces influence population, then the most important variable to examine is economic productivity. He came up with three major economic regimes. These are primitive regime, intermediate and modern regime.

In the primitive regime, mortality fluctuates depending on the environmental consequences. Mortality is therefore what limits population growth in terms of environmental catastrophes such as famines, earthquakes, floods etc.. The mortality levels lessens whenever the environment is friendly.

In the intermediate regime, economic factors influence the population growth through nuptiality as through postponement of marriage in order to achieve economic aspirations, population numbers are checked. Mortality in this regime tends to decline as the family is stable because the family size is checked by delayed marriages.

In the modern regime, man's aspirations to achieve economic goals are substituted for children. Diseases are brought under control, the population growth rate is minimal as contraception is practiced and mortality is equally under control as modern technology in medicine is at its peak.

The demographic transition theory emphasizes a great deal on the role that economic aspects play in determining not only mortality but also fertility. The socio-economic factor is underplayed while the demographic component is completely ignored. While not ignoring the economic component in mortality studies, this study will integrate not only social but demographic and environmental components in its theoretical framework.

Demographic variables notably population density influence epidermic transfers particularly the outbreak of near epidermic of meningitis in the study area in 1988. The parity and birth intervals influence the contraceptive use and birth intervals. Child's nutrition, infection and consequently morbidity and mortality. Socio-economic variables particularly the mother's education and marital status influence the mother's choice of contraceptive use. These and other variables especially breestfeeding period, determine nutrition intake and consequent resistance to infection and incidence of morbidity. Availability of medical personnel and facilities act as an intervening variable between morbidity and mortality. These variables also influence the population's accessibility to contraceptive supply and immunization. The former affects birth spacing and child's health, while the later arrests infection on immunization.

This study intends to relate nutrition and incidence of pathological diseases. The ecological variables to be considered are temperatures, rainfall, food crops and cash crops and how they influence availability of food for nutrition for mother and child health and mortality.

It is therefore conclusive that all the variables to be considered are thoroughly interrelated and interlinked in affecting child health, morbidity and consequent mortality.

From the above theoretical base, a model (Fig. 1.2) is developed.

THEORITICAL FRAMEWORK

A MORTALITY MODEL

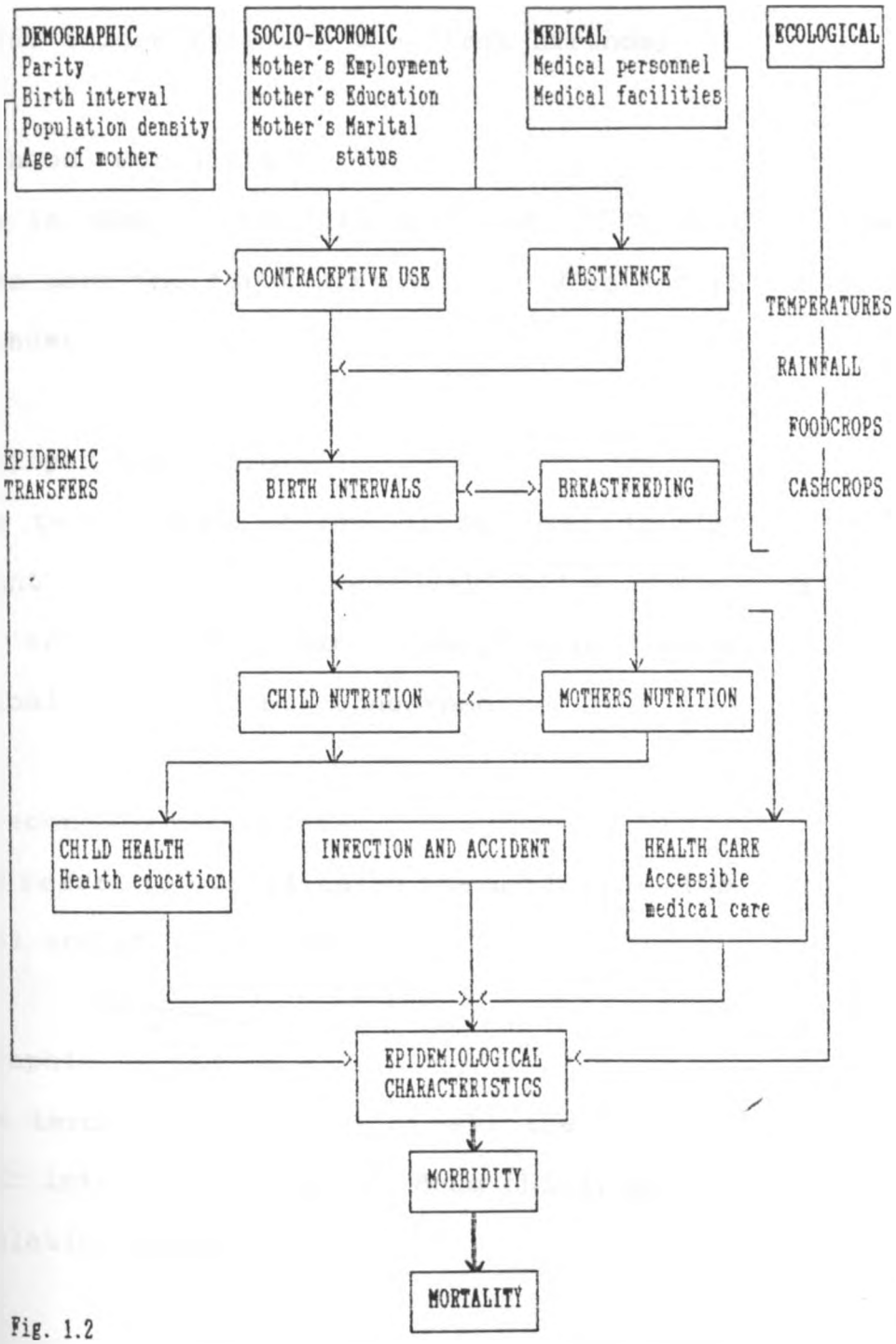


Fig. 1.2

Compiled from the study objectives; Researcher 1989.

1.8 OPERATIONAL CONCEPTS AND DEFINITIONS.

1. Infant mortality-

This describes the deaths of infant(s) born alive but who die(s) before reaching the first birthday.

2. Child(hood) mortality-

This is used to describe the death of a child(ren) who lives past the first birthday but dies before the fifth birthday.

3. Mortality differentials-

This term refers to the differences in the levels of infant and childhood mortality in the study area in so far as socio-economic, demographic, ecological and medical variables are concerned.

4. Socio-economic variables-

This refers to specifically the marital status, education level and of the mother.

5. Demographic variables -

This term refers to one or all the following; parity, birth interval, age of the dead child, age of mother and population density.

6. Ecological variables-

Where used, this term will refer to rainfall amounts received in the study area and agricultural production in terms of acreage under cash crops and also the productivity of the land in tones.

7. Medical variable-

These are limited to the number of health facilities namely hospitals, health centres and dispensaries and secondly to the medical personnel; that is doctors, clinical officers and nurses.

8. Birth interval-

This will refer to the spacing of children, the number of years between the dead child and the surviving ones of higher and lower parities.

1.9 SCOPE AND LIMITATIONS.

It will be appreciated that a study of mortality particularly that of infants and children in a whole district would be an enormous task. However, since the study has to be done, the scope within which this is done varies from one study to another. It is for this reason that this study's scope is defined.

As earlier stated, Meru District, the study area, has varied human and physiological aspects within its administrative boundaries. These phenomena also influences the agricultural potential and consequently the human population numbers.

The study area therefore is divided into high potential, medium potential and low potential areas. Of the administrative divisions, North, South and Central Imenti, Igembe and Nithi divisions are high potential, Tigania and Timau are medium potential while Tharaka is low potential.

A fore survey of the study and literature review on the socio-economic aspects of each of the zones, revealed multiple similarities. From that, a scope of this study was set. Considering the limited time and finances, it was not viable to conduct the research in each and every administrative division. This study therefore picked on a division in each of the potential zones to represent the other. In the high potential zones, North Imenti was sampled out, Tigania for the medium potential zones and Tharaka for the low potential zones.

The research was therefore carried out in these divisions and not on the whole district as the research topic may suggest.

Infant and childhood are relatively vague in terms of age limits. While a 2 year old may be considered an infant and a 10 year old

as a child, this study will only consider the under 1 as infants and those over 1 but under age 5 as children.

Thirdly, only the specified socio-economic, demographic and ecological variables will be considered, though it is evident that several other social and economic variables including sanitation, breastfeeding periods and others are important in determining the levels and trends of infant and childhood mortality.

This study relies on both primary and secondary data with the later being given more significance, especially hospital records where such data for figure and causes of death were got. While this is vital, use of questionnaires and interviews would have been most accurate but it was impossible to interview each and every woman who had experienced an infant and or a childhood mortality in the last 12 months preceding the research.

1.10 SUMMARY OF THE CHAPTERS.

Chapter one will be the introductory chapter presenting the problem to be studied, objectives and hypotheses and also literature review.

Chapter two reviews the Geographical background to the study area particularly in terms of the variables to be investigated namely socio-economic, physical and infrastructural.

The methods used in data collection, data analysis and presentation are examined in chapter three.

Chapter four examines the causes of infant and childhood mortality, the occurrence and distribution and draws up a cause specific deaths rate.

Chapter five of this study examines the inherent mortality differentials in the study area. It is also here that the hypotheses will be tested, relationships sort and explanations of the findings given.

The final chapter, six will give the conclusions drawn from the research findings and give recommendations as per the findings.

CHAPTER 2

GEOGRAPHICAL BACKGROUND TO THE STUDY AREA.

2.0 INTRODUCTION

This chapter aims at discussing in a general manner the physical and socio-economic dynamics of the study area. This is because although not all these phenomena will be considered in the analysis of the levels of infant and childhood mortality, it is vital to assess the environmental setting in which differing mortality levels occur. It is deducible that the environment has a bearing on many of the variables that will be under consideration in the text. The prevalent socio-economic and physical aspects in each ecological zone will be highlighted in the discussion.

It is for the above reason that Geographers such as Mcharg (1966) and Netcher (1947) state that nature in its diverse manifestation provides man with different varieties for possibilities for development and further emphasize on the importance of being in harmony with nature and the need to understand and co-ordinate resources of nature with those of human beings.

The purpose of this chapter is however not to discuss how these aspects influence infant and childhood mortality but to present them as they are. The impacts and other bearings will be discussed in a later chapter.

2.1 LOCATION AND EXTENT

Administratively, Meru District is found in the Eastern provinc lying between latitude 1 degree 30" South and O degree 35" Nort longitude 37 degrees 5" East and 30 degrees 20" East. It cover an area of 9,922 Km² and is bordered by the arid and semi-ari Kitui and Embu Districts to the South and Isiolo to the north, M Kenya, Kirinyaga and Nyeri District to the South East and Laikipi district to the West (see Fig 2.1).

For administrative purposes, Meru district is divided into distinct namely North Imenti, S. Imenti, Central Imenti, Nithi Tharaka, Igembe, Tigania and Ntonyiri. Out of these, there are 4 locations and over 141 sub-locations. Others are Mt. Kenya an Meru National Parks and the Meru Municipality with the latte covering an area of 207 Km².

2.2 TOPOGRAPHY

The topography of Meru District may be divided into five distric units, based on the presence of two dominant features namely Mt. Kenya on the western side, Nyambene ranges on the North Eastern side. The district physiological regions are:

1. The Western slopes of Mt. Kenya
2. The Nyambene range
3. The North Western Basement system
4. The Basement system unlier of Mbokoro
5. The lowlands of Tharaka and Meru National Park.

Mt. Kenya rising to a height of 5380 m above sea level and the Nyambene at a height of 2500 m above sea level are of volcanic origin and the general configuration of the physical structure of the district is greatly influenced by these two land masses.

The western part of the district lying at the foot of Mt. Kenya has yielded to precambrian basement whose surface descends gently to the Tana River leaving the district at an altitude of 300 m above sea level.

At the lower foot hills of Mt. Kenya, a number of parasitic cones younger than the main volcano, form distinctive features. These include features such as Goriga, Maitai Kiangondu, Ngori Kola, Kanyoiba and Kathumbi. The soils around these features are also noticeably shallow and therefore difficult to cultivate due to protruding volcanic rocks.

Although the gradient of the mountain is gradual, the large streams flowing from it have curved deep incisions in its indigenous bedrock particularly on the southern slopes.

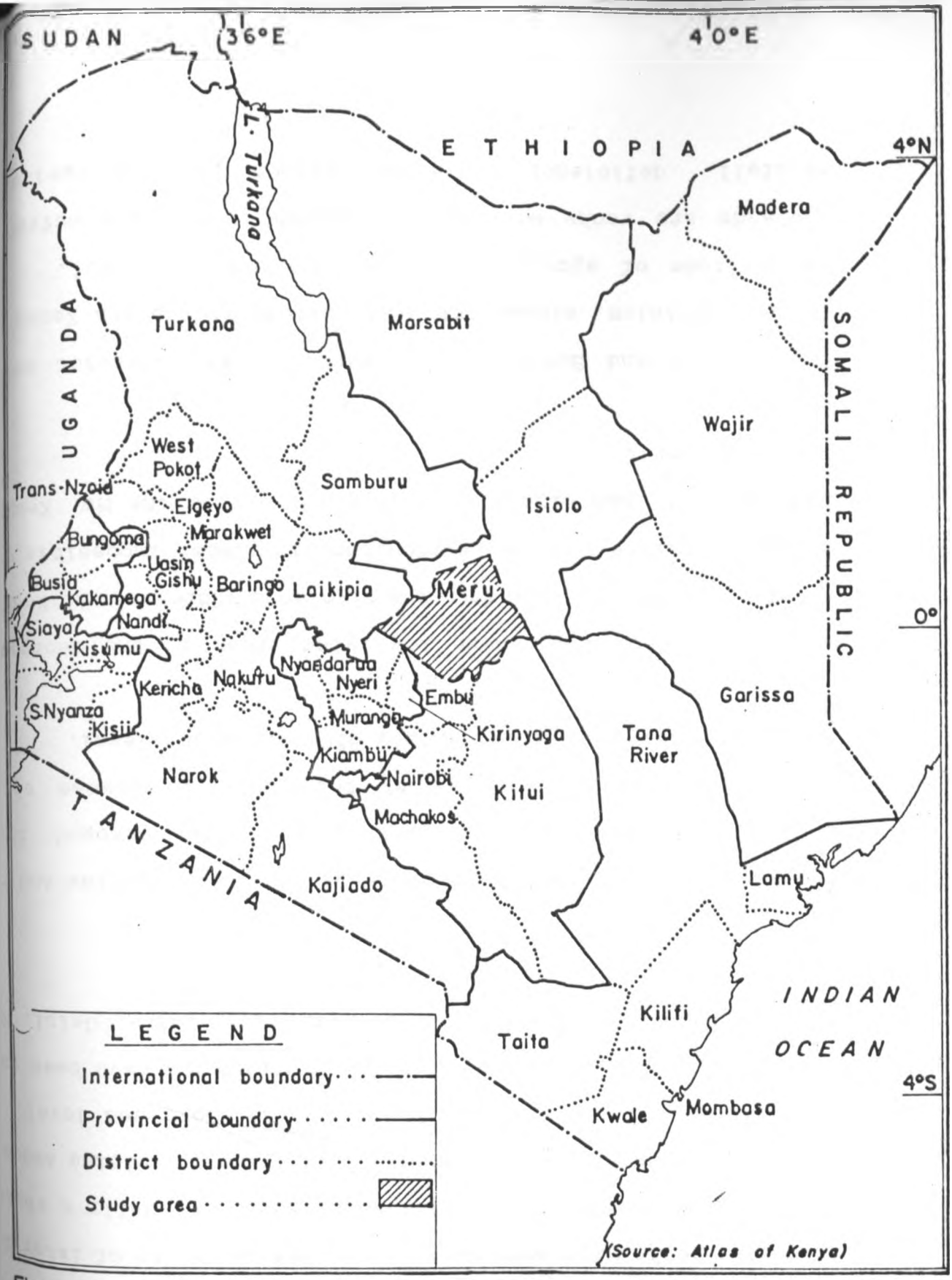


Fig. 2.1 LOCATION OF THE STUDY AREA

The second physiological unit is the Nyambene range. This rang consists of an accumulation of basic, alkaline and intermediat extrusive rocks with many parasitic cones and vents of later date It may be more accurate to call this feature actually a chain o mountains, elongated in a west-east direction and rising above th surrounding plateau to a height of 2500 m above sea level. Th craters and vents found on the mountain sides may have been forme as a result of "fountaining". They include Athiru, Gaiti, Njia Mbaria, Kirima and Itivu craters.

The lava plains to the North, made of low lying shallow and rocky soils cover the Northern grazing area and descend toward neighboring Isiolo which is at the boundary between the tw districts, lying at approximately 850m above sea level.

A notable feature of these low lying areas is the decrease i rainfall as the distance from the highlands increase. Although th soils are fairly fertile, agriculture is almost impossible due t low rainfall, the effect of rain shadows from the Mt. Kenya and Nyambene ranges.

The Eastern and South Eastern parts of the district covering Tharaka division, slopes into the plateau of eastern Kenya up to an altitude of approximately 300 m above sea level. These lowlands are rocky with steep basement rocks and suffer from rainfall deficiency hence the reason for low agricultural

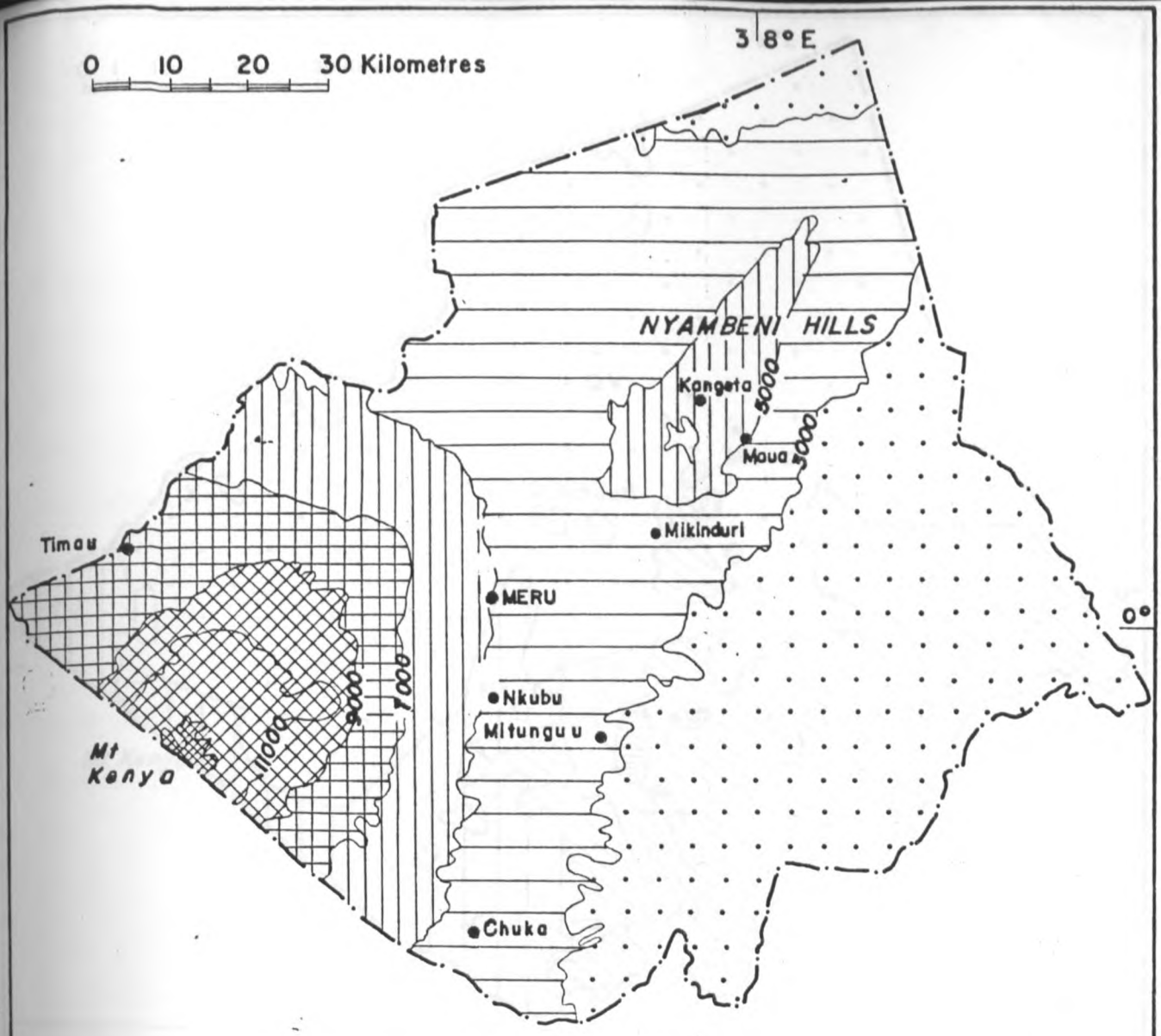
potential in the area.

The central part of the district is also a lowland either lava covered or float covered with the lower Nyambene Basalt extending over a more greater area than the Mt. Kenya Volcanoes. There, the sub-miocene erosion level is not visible owing to the fact that the comparatively thin terminal lavas of Mt. Kenya are unconfirmly overlain by the younger Nyambene exclusive rocks so that any evidence of the sub volcanic topography is effectively concealed. (see fig 2.3 and 2.4)

The kind of topography found in any place influences the other physical phenomena such as soils and drainage and consequently the productivity of the land. It is from a combination of all these factors that an area is described as high potential, low potential middle potential or marginal.

2.3 DRAINAGE

As earlier stated the topography of an area determines the drainage since the topography of Meru district is influenced by the presence of two massive volcanic masses namely Mt. Kenya and the Nyambene ranges, it is obvious that these two also influence the drainage pattern. The structure of the basement complex system also plays a part.



LEGEND

- Below 3000 feet (914M)
- 3000-5000 feet (914 – 1524M)
- 5000-7000 feet (1524-2134M)
- 7000-9000 feet (2134-2743M)
- 9000 – 11000 feet (2743-3353M)
- 11000 – 14000 feet (3353-4268M)
- Above 14000 feet (4268M)

(Source: District Environmental Report)

Fig. 2.2 TOPOGRAPHY OF MERU DISTRICT

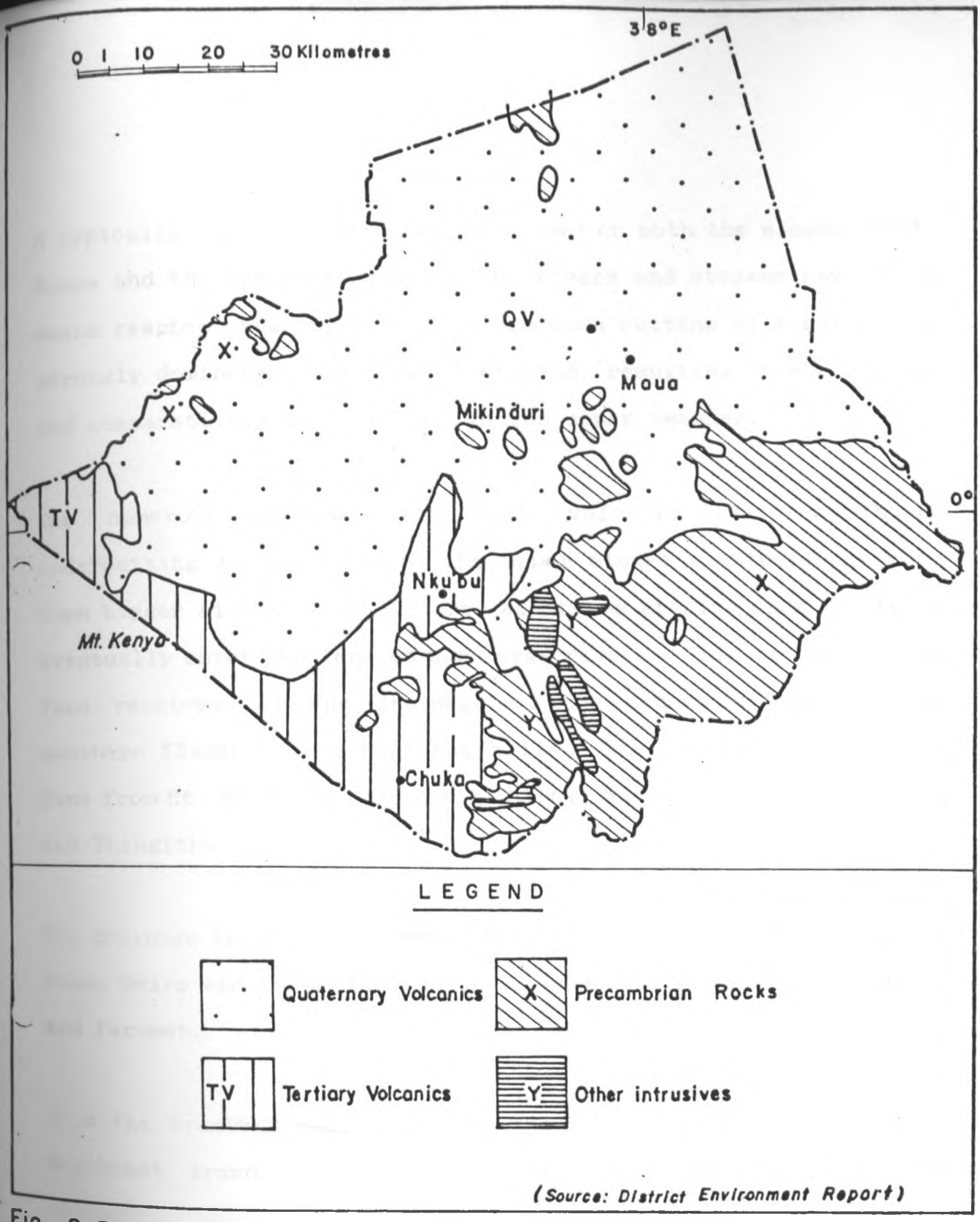


Fig. 2.3 GEOLOGY OF MERU DISTRICT

A typically radial pattern has developed on both the slopes of Mt. Kenya and the Nyambene ranges. The rivers and streams have by no means reached maturity and therefore down cutting of their course strongly dominates over lateral erosion, resulting in steep sided and comparatively deep valleys in the upper reaches.

The numerous streams from both volcanic features though undercutting individually on the upper slopes eventually join to form bigger rivers. For instance all those arising from Mt. Kenya eventually enter the Tana as two large rivers. This is because the Tana receives all the drainage of the mountain flow and the southern flanks of the Nyambene hills. The rivers drainage into Tana from Mt. Kenya include Thuci, Nithi, Mutonga, Ruguti, Thamango and Thingithu.

The drainage from the northern slopes of the mountain flows towards Ewaso Nyiro and these include the Engare Ndare, Sirimoni, Nanyuki and Keromet.

From the Nyambene watershed, streams have a general Northwest - Southeast trend flowing essentially at right angles to the elongation of the range. As may be expected from the distribution of the rainfall, more rivers of greater volume flow Southeast to the Tana river. On the North Western flanks, the streams are intermittent and seldom extend more than a few kilometers across the lowlands. The valley and the gullies on the flanks are often

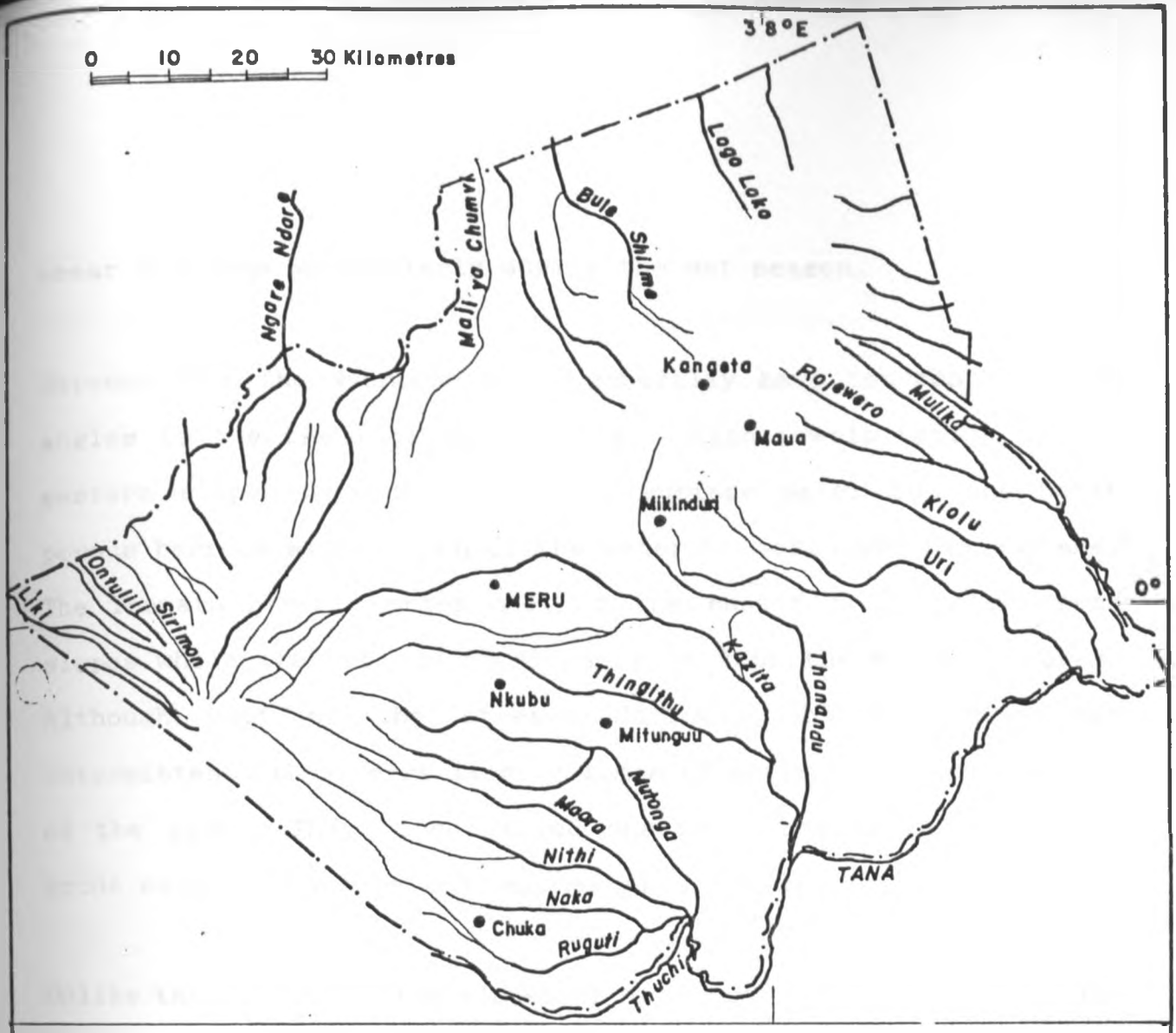


Fig. 2.4 DRAINAGE PARTERNS IN MERU DISTRICT

shear and deep particularly during the wet season.

Streams from the Nyambene hills generally have courses at right angles to the trend of the feature. High precipitation on the eastern slopes provides plenty of surface water but the North porous bedrock allows much of the water to percolate the surface. The Thanatu river carries most of the runoff from the southern slopes while the Uri and Ruuji carry it from the Eastern slopes. Although most of the streams Northwest of the range are intermittent, they carry large volumes of water for several months of the year. They have carried shear 'v'-shaped valleys which erode extensive swamps and marshes are formed.

Unlike the streams on the slopes of Mt. Kenya and the Nyambene, the drainage of the basement system is in a state of maturity. Recent uplifts have caused the removal of depths of over 30 metres of most of the material deposited so that the streams now flow along steep-sided channels.

Numerous rapids and low fall also resulted along the main streams. The most notable is the grand falls with a height of approximately 60 metres situated East of Kyegge on the Tana River.

2.4 CLIMATE AND VEGETATION

Once again, it is notable that the topography has an influence on another physical phenomenon, in this instance rainfall. The highlands of Mt. Kenya and Nyambene not only instigate temperatures but also the rates of evapotranspiration and also force the rain bearing winds upwards and cause them to loose much greater moisture than in the low-lying areas.

Meru district lies on the equator and for this reason has two rainfall maxima referred to as the long and short rains. The long rains are experienced from March to June and the short rains from October to December. However, due to physiographic differences these rains are not evenly distributed. For instance, the Eastern lowlands receive an average of 750-1000 mm per annum, the southern eastern slopes of Mt. Kenya and the Nyambene ranges 1250-2250 mm per annum while the northern grazing zones and the Tharaka regions receives an average of 500 mm per annum.

It must be noted that the annual rainfall is only of general utility in assessing agricultural potential, because it masks a pre-eminent characteristics of Meru's moisture regime, that is the extreme variability and unreliability from year to year. The rainfall pattern is only important in helping farmers determine when to expect the good rams and therefore what crops to plant.

The bi-modal rainfall patterns determines seasonality, rather than the temperature ranges since Meru is on the Equator and therefore only a weak annual temperature cycle would be expected.

The long rains are as a result of the south east trade winds which bring moisture from the Indian Ocean while the short rains are brought by the north east trade winds from the Indian subcontinent.

During the long rains the north and north eastern portion of the slopes of Mt. Kenya, especially the Timau area and the north eastern slopes of the Nyambene ranges, particularly Tigania and the Northern grazing areas, suffer rain shadow effects and only receive rains during the short rains from N.E. trade winds. However, this is very small in amount and greatly varies from season to season.

Variability of rainfall over time and space is greatly felt in the district while the highlands receive high amounts of rainfall due to topographic effects. The lowlands suffer rainfall deficiency due to the effect of temperature inversion experienced along the Nyika Plateau. This zone in Meru is the projection of that effect which stretches from lower Meru district through Kitui and worsens as it enters the Tana River district.

The effect of Mt. Kenya and the Nyambene on the leeward sides of the two volcanic masses is evident as the rainfall amounts decrease sharply altering the agricultural potential in these areas.

Conditions favorable for production of crops that require heavy rains such as tea suddenly change into dry zones. This is evident in areas such as Ntirimiti and Mbaria.

Reduction in moisture is also evident towards the eastern side of the district. These parts of the eastern lowlands receive amounts ranging from 750-1000 mm per annum, with the parts bordering Kitui, Tana River and Isiolo receiving even less. This scarcity of rainfall, and associated high temperature render the environment here very hostile and what we get is semi-arid marginal lands which are poor for crop cultivation.

On the highlands especially with land above 2000 m above sea level, there is dew precipitation and due to moderate temperatures and consequently low evapo-transpiration, rainfall is very effective and these are the most productive parts of the district found mainly in parts of central and north Imenti and the Nyambene regions. (see Fig. 2.6)

Table 2.1 OCCURRENCE OF RAINFALL

DIVISION	DAYS OF RECORD	AMOUNT (MM)
NITHI	106	2242.84
N. IMENTI	132	1564.5
S. IMENTI	113	1615.7
IGEMBE	152	2371.27
TIGANIA	183	1913.8
NTONYIRI	87	1700.1
THARAKA	67	983.8
C. IMENTI	174	2280.5
KIMAU	-	1036.3

Source:- Compiled from field Data by Researcher 1989.

With snow-covered Mt. Kenya, Meru district has temperatures ranging from sub-zero degrees Centigrade on the top of Mt. Kenya to an average of 20 degrees Centigrade on the slopes of the mountain and the Nyambene ranges to a mean of 35 degrees C on the lowland dry areas of Tharaka, Tigania, Meru National Park and the Northern grazing district.

Just as the topography and climate is varied, so is the vegetation ranging from equatorial type forest on the slopes of Mt. Kenya and the Nyambene ranges to semi-desert scrub-land in Tharaka, Meru National Park and Northern grazing area.

The forests form part of the central highland zone. These forests occur on the slopes of both Mt. Kenya and the Nyambene ranges with a few forest zones scattered within the district in the range of 1,970m to 2,736m above sea level. Above 2,435m, the forest offers coniferous trees such as cedar and podo with denser stands of bamboo occurring in higher altitudes. Broad leaf evergreen forest species community are dominant below 2,438m. These include Olive camphor and "Mukuego".

Between 1,524m and 1,981m is most dry and intermediate forest. Trees in this zone are shorter about 200m and largely evergreen. The trees get shorter and mix with deciduous trees in the lower parts. Fig trees, "Muhuti" and "Muuti" as well as the famous Meru

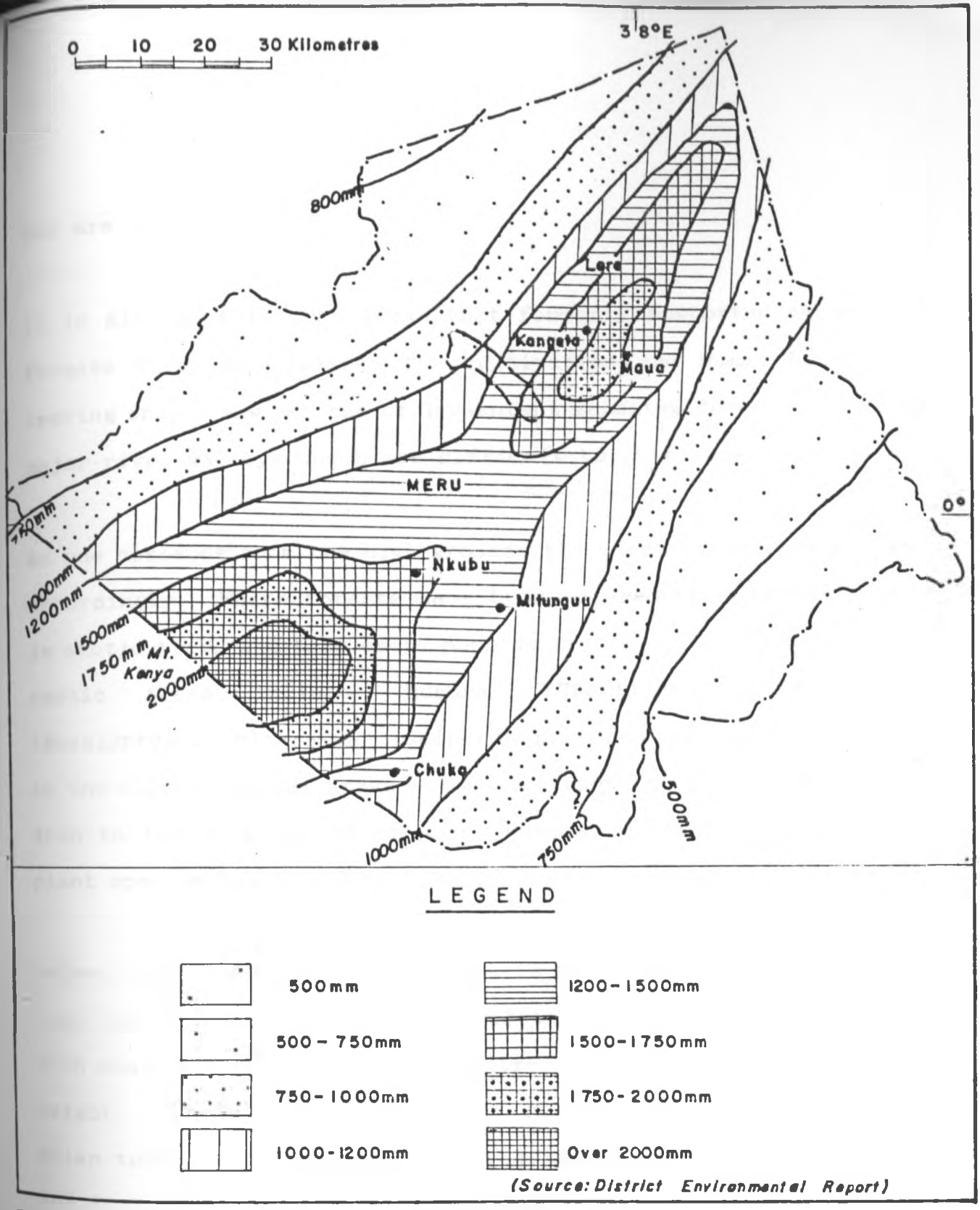


Fig. 2.5 MEAN ANNUAL RAINFALL IN MERU DISTRICT

oak are found.

It is also notable that areas that formerly supported equatorial forests have been cleared for cultivation and human habitation leaving only a few patches of Government gazetted forests and along major river valleys which are difficult to cultivate.

As one descends from the high grounds the vegetation cover changes accordingly. Where forests have been cleared the vegetation now is exotic trees and tree crops such as fruit, coffee and tea. The exotic trees include "Mukura" (Grevillea), "Mubaurmauta" (Eucalyptus), "Mitarakwa" (Jumperus procera) and casuarina found in the high potential areas which also spot the above tree species down to the marginal areas where acacia comberutum and comphora plant species are abundant.

Between the forest and the dry area is a transitional zone of bush-land and wooded grassland. The vegetation here is tall grassland with scattered low semi-deciduous trees generally less than 10m in height. Common trees are acacia, "Mugaa", "Murama". If it gets drier towards the lowlands, the vegetation changes to more grass and few trees - the wooded grasslands.

In the Western part of the District particularly those bordering Laikipia, High steeple is evident composed mainly of acacia, abyschnia, vernoma, Hyparnicum, maximum (guinea grass), penesetum,

schimperi (wire grass) Themida, trianda (red oat grass) and hyparrhea species. (See fig 2.6)

2.5 AGRO - ECOLOGICAL ZONES AND AGRICULTURE POTENTIAL

Soils in Meru are moderately to highly fertile loams except for the two massifs which have upland soils. Dark loams are derived from volcanic turf and are predominant in the Timau area. Dark peaty loams are traceable in the alpine meadow between 2800m and 4200m. These soils are derived from complex earth formation and volcanic rocks from the two massifs the soils in the wet parts of the district are volcanic in nature and good for agriculture. The soils in the northern and eastern parts of the district originate from tertiary basic igneous rocks and hold little potential for irrigation. The soils in the south and east are formed by sedimentation and are high potential for agriculture. The typical red colour of the soils in the greater part of Meru district indicates accumulation of iron oxide in the soil. The potential of the soils is strongly related to the climatic conditions whereas climate also influences the soil formation in the long run.

Meru district has practically all the agro-ecological zones of Kenya, the altitude variation from 5,199m at the highest to about 300m at the lowest point, ranging from the cool upper highlands to low in the lowlands. To the northern side of Mt. Kenya rainfall is scattered because of the maintain shadow. This is mainly in the

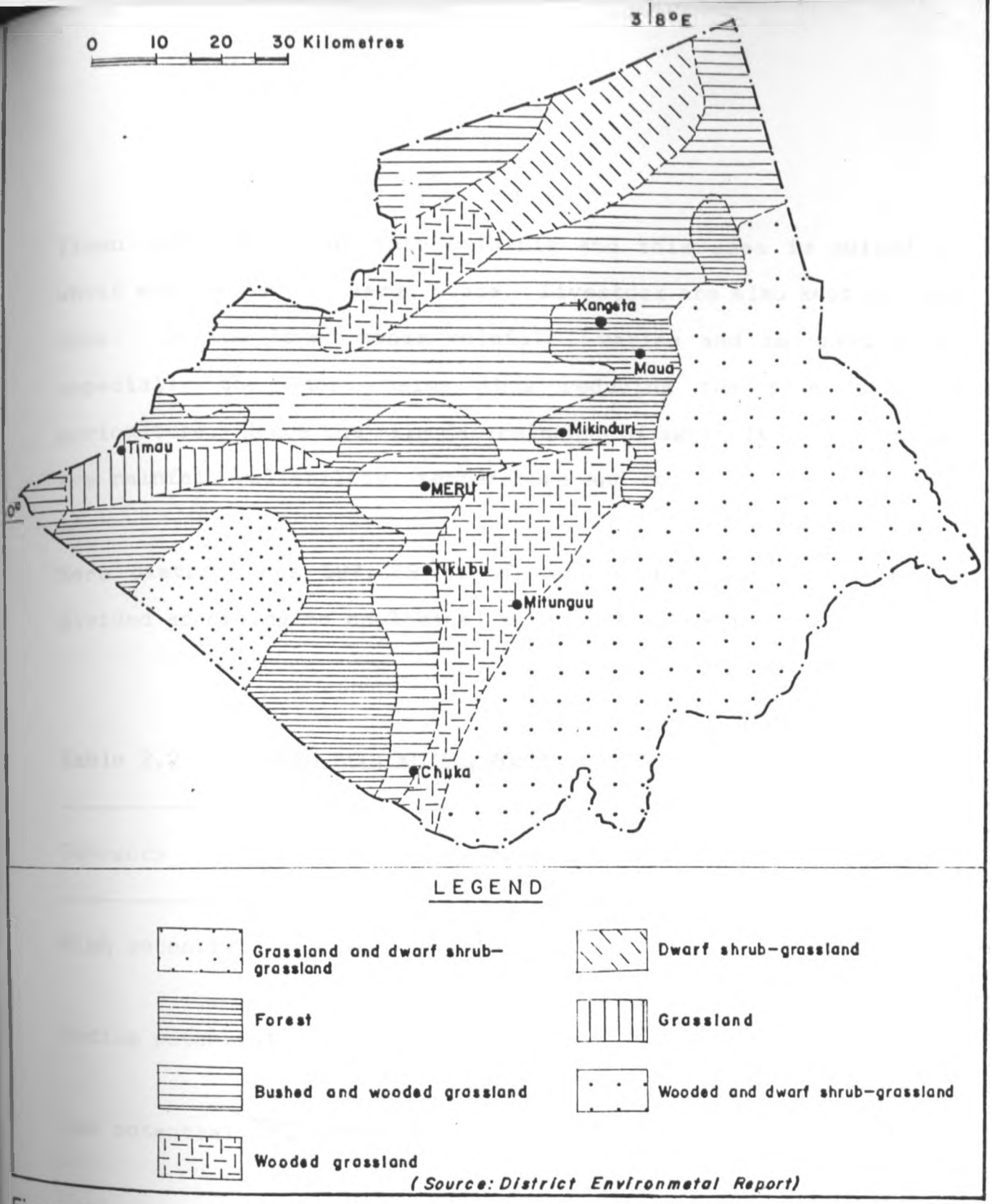


Fig. 2.6 VEGETATION ZONES OF MERU DISTRICT

Timau area, extending into Laikipia and this area is suited to wheat and barley on a large scale. Livestock are also kept in this zone. In the lower zones rainfall varies and is unreliable, especially the short rains thus reducing the potential for agriculture. Hence the main determinants of agricultural potential are rainfall reliability, temperature and soils.

Meru district has 597.689 ha of agricultural land and this is divided according to ecological potential as below:-

Table 2.2 AGRO-ECOLOGICAL ZONES - MERU

Category	Agro-ecological zone	Area (ha)
High potential	1 and 2	155000
Medium potential	3	250000
Low potential	4 and 5	127000
Rangelands	6 and 7	189
TOTAL		597689

Source:- Ministry of Agriculture (Kenya) Annual Report (1986)

Table 2.3 LAND POTENTIAL IN MERU DISTRICT ('000' ha)

Category	Area (sq km)	Per cent
High potential	241	24.3
Medium potential	95	9.6
Low potential	315	31.8
Other (parks & forests)	341	34.2
TOTAL	992	100.0

Source:- Meru District Devt. Plan 1989/93

The Meru people practice a mixed economy of crop cultivation and animal husbandry but with various degrees of intensity. Cash crops include coffee, tea, cotton, maize, beans, sorghum and millet are also used as staple crops. Miraa is an uncommon cash crop grown in the Nyambene area. The crop is a mild stimulant and much favored by certain communities especially the Somali, coast pepple and many urban dwellers.

The high potential areas mainly grow tea, coffee, potatoes and maize and support high breed dairy farming while cotton, tobacco, sunflower, sorghum and millet are grown in the marginal potential areas and mainly support native cattle.

Table 2.4 AGRO-ECOLOGICAL LAND USE CLASSIFICATION OF MERU

Category	Agro-ecological Zone	Farm Produce
High Potential	I and II	Dairy cows, tea, potatoes, maize coffee
Medium Potential	III	Dairy cattle, tea, cotton, potatoes, maize, coffee.
Marginal Potential	IV and V	Millet, sorghum, native cattle
Irrigated Rangeland	VI and VII	Native cattle

Source:- Meru District Devt Plan 1984/88

The irrigated area is under productive and haunted by lack of appropriate and adequate technology. The productivity of the land other than being determined by climatic and pedological situation which has been used to categorize the land depending on its agricultural potentiality is dependant on the population density and consequently the later determines the size of the holding which also determines the land productivity. It is all a vicious circle.

Distribution of cash crop and food crop production by division is depicted below:-

Table 2.5 FOOD AND CASH CROP PRODUCTION IN MERU DISTRICT

Division	Area size of Holding	Cash Crop	Subsistence Crop
N. Imenti	4.5	Tea, coffee, Dairy cattle, pyrethrum	Maize, cabbages, beans, peas, potatoes.
S. Imenti	3	Tea, coffee, dairy cattle,	Maize, cabbages, sorghum, beans, bananas, yams, potatoes. peas.
Nithi	5	Coffee, tea, Tobacco, cotton	Maize, beans potatoes.
Igembe	4.5	Miraa, coffee, tea, pyrethrum, goats and sheep	Millet, peas, maize, bananas
Tigania	4.5	Coffee, tea, tobacco, cotton, goats.	Millet, peas, maize, bananas.
Tharaka	13.5	Cotton, tobacco, Native cattle.	Pigeon peas, Millet, green grams.

Source:- Kenya, Meru District Devt Plan 1979/83

The socio-economic standing of the district can also be evaluated by looking at the agricultural productivity of the main cash crops and also food crops in terms of tonnage and also hectarage as below:-

Table 2.6 CASH CROP PRODUCTION IN MERU DISTRICT

Cash crop	Ha	Production (tones)	Value (Kshs)
Coffee	36,052	16,136,169	494,667,264
Tea	7,437	31,661,857	189,309,891
Cotton	15,000	2,594,895	13,191,089
Pyrethrum	1,189	91,234	1,325,481
Miraa	4,993	4,065	32,250,000
Tobacco	680	868	13,000,000
Sunflower	18,000	9,000	21,240,000
Barley	1,820	6,624	13,248,000
Wheat	8,700	217	40,028,277
Potatoes	10,139	12,304,875	201,352,500

Source:- Extracted from Ministry of Agriculture Annual Report Meru (1988)

Table 2.7 FOOD CROP PRODUCTION IN MERU DISTRICT

Selected Food Crops	Ha	Production (tones)	Value (Kshs)
Maize	53,815	163,952	36,433,778
Beans	43,826	31,554.75	15,777,360
Millet/Sorghum	23,133	31,238.75	27,734,733
Bananas	14,500	49,000	81,666,663
Pigeon Peas	6,788	5,980.28	35,881,600
French Beans	120	630	15,750,000

Source:- Extracted from Kenya Ministry of Agriculture Annual Report 1988.

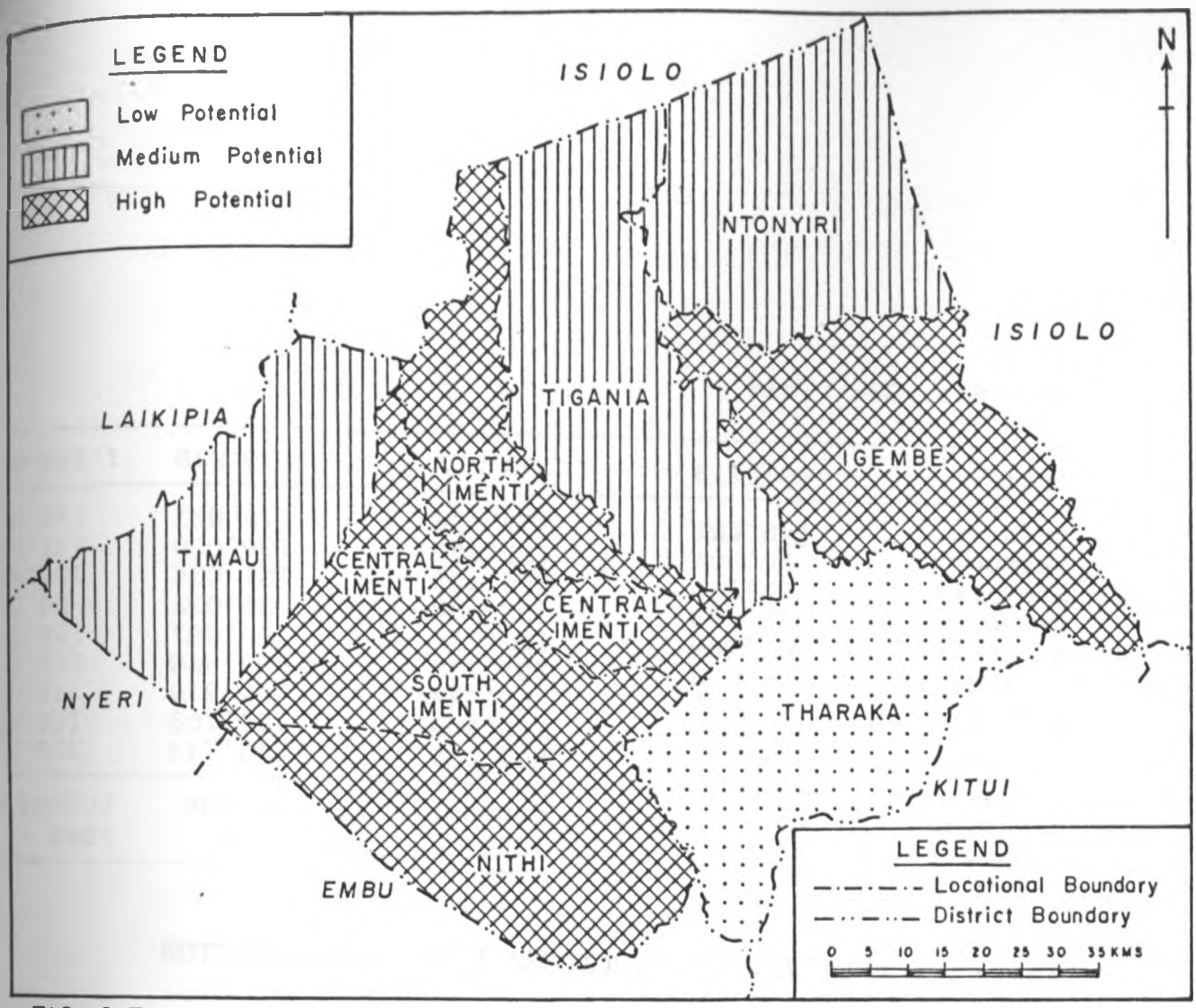


FIG. 2.7 : MERU DISTRICT : POTENTIALITY OF THE STUDY AREA.

2.6 DEMOGRAPHIC PROFILE

The 1979 population census put Meru District Population at 830,179 compared to the 1969 census of 596,506 representing an intercensal increase of 3.36% pa.

The 1984/88 development plan gave the projected district population for the year 1988 at 1,214,950. This estimate was based on the assumption that whereas the level of mortality of the country was expected to continue on a downward trend the fertility level would remain constant over the period 1980-90.

Table 2.8 POPULATION PROJECTIONS 1988-93 BY DIVISION

Census Division	1979 census	1988 census	1989 census	1990 projections
Nithi	142,288	205,590	213,149	220,937
S. Imenti	103,543	149,608	155,109	160,776
Tharaka	50,277	72,644	75,316	78,068
C. Imenti	91,038	131,539	136,376	141,359
N. Imenti	107,396	155,174	160,881	166,759
Timau	23,389	33,795	35,037	36,317
Ntonyiri	80,790	116,732	121,024	125,447
Igembe	90,807	131,205	136,030	141,000
Tigania	140,651	203,224	210,697	218,396
TOTAL	830,179	1,199,511	1,243,619	1,289,059

Source:- CBS (1979)

However, it has been observed that there has been a marked decline over the period in the level of fertility as well. The patterns of population distribution between the divisions is in response to the agricultural potential where we have Nithi and Tigania Divisions with largest number of people, while Tharaka and Timau have the lowest. Tharaka, although physically the largest in the District, it has a relatively small population because of its aridity and consequently low agricultural potential. Timau's population on the other hand is the lowest because it used to be a scheduled area with mainly large scale farms.

The District's population density worked out from an area of 6,590 sq km of land is given as 126 persons per sq km in 1989. 182 in 1988 and this is expected to rise to about 218 persons per sq km by 1993.

Table 2.9 POPULATION DENSITY BY DIVISION 1988 - 93

Division	Area (Km^2)	Population 1989	Density 1988	Persons/Km^2 1993
Nithi	640	222	321	384
S. Imenti	392	264	382	456
Tharaka	1496	34	49	58
C. Imenti	458	199	287	343
N. Imenti	460	233	337	403
Timau	790	30	43	51
Ntonyiri	1167	69	100	120
Igembe	535	170	245	293
Tigania	652	216	312	372
TOTAL	6590	126	182	218

Source:- Kenya Population Census 1979.

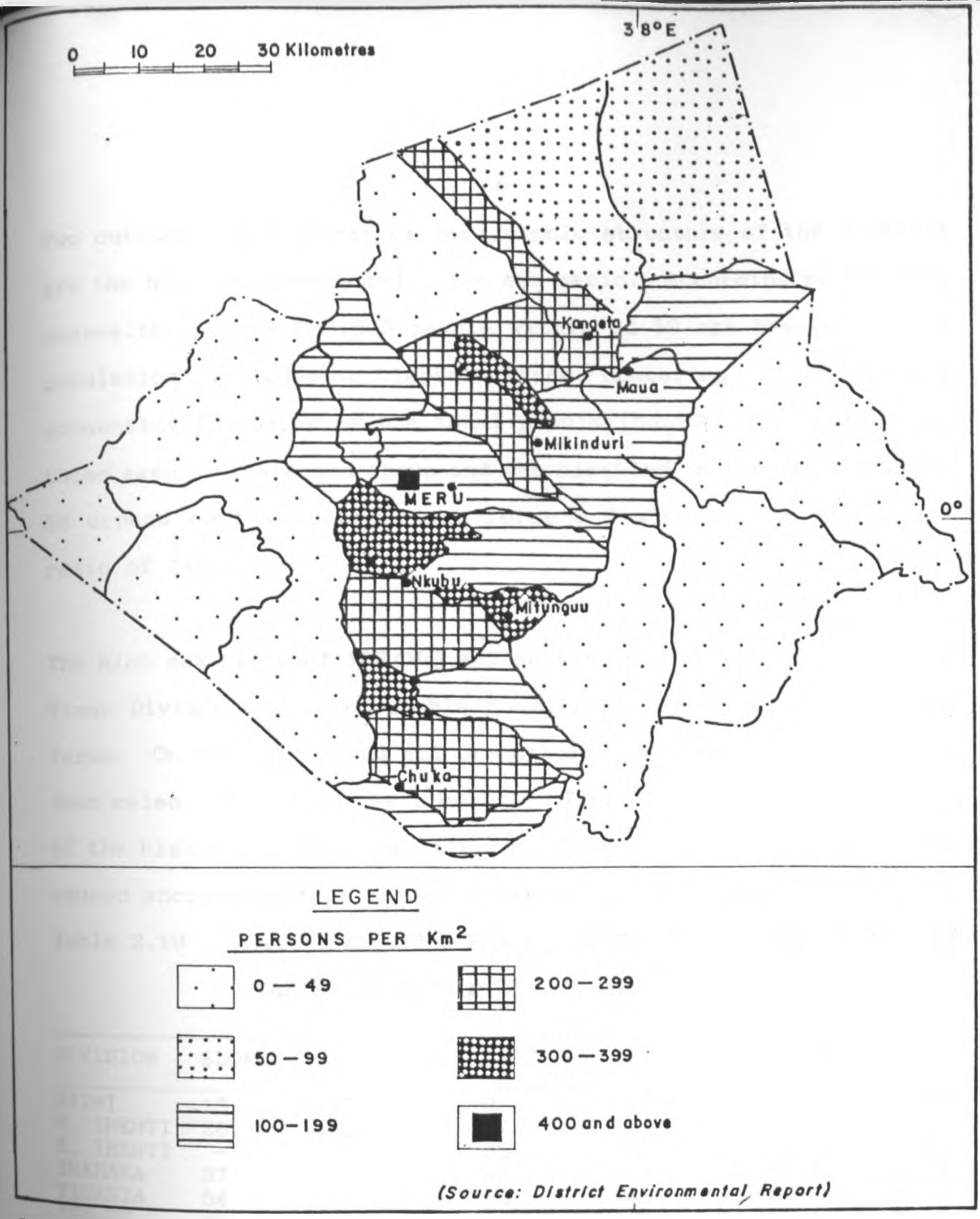


Fig. 2.8 POPULATION DENSITY IN MERU DISTRICT

Two outstanding features of demographic structure of the district are the high dependency ratio and sex ratio. According to the 1979 census,there were 386,606 people within 15-59 age bracket. This population included a labour force numbering about 328,676 accounting for 39.6% of the total population. Children aged 0-14, those aged 60 years and above and the disabled in the age group 15-59 depend on the above labour force and give an age dependency ratio of 115%.

The high sex ratio of 103/100 and an even higher one of 118/100 in Timau Division is attributable to migrant labourers in the large farms. On the other hand all the other Divisions had more females than males. The recent settlement in Timau Division is as a result of the high population densities in other divisions which has also caused encroachment on forest reserves and land fragmentation.

Table 2.10 LAND AVAILABLE PER DIVISION, PER HOUSEHOLD AND PER CAPITA IN MERU DISTRICT (HA)

DIVISION	SLOPES	FORESTS	ROADS H/STEAD	AGRI.	HEE/HOLD	
NITHI	16	25	98	479	207	0.36
N. IMENTI	28	14	157	1377	5.10	0.92
S. IMENTI	-	-	65	325	1.80	0.32
THARAKA	37	89	92	1272	13.46	2.53
TIGANIA	54	47	88	461	1.76	0.33
IGEMBE	87	54	113	1381	4.70	0.83
TOTAL	222	229	573	5322	3.97	0.71

Source:- Kenya Ministry of Agriculture (1983)

2.7 PROVISION OF INFRASTRUCTURE FACILITIES

The pattern of infrastructure distribution is important when considering the District's development. Not only do these facilities provide important services, but the various facilities' complimentary role in enhancing regional and sectoral development. The absence of one type of infrastructure in a region for instance, may handicap the development of other facilities and result in regional imbalance in infrastructure provision.

In a rural economy with a higher population growth rate (3.36 pa) as indicated by the 1979 census, the provision of basic infrastructural facilities is very essential. Except for North and Central Imenti which enjoy a relatively fair level of social amenities the rest of the district may be termed as being constrained in economic development due to lack of adequate facilities.

The high rate of population growth calls for similar growth on the side of facilities in order that the resource potentials of the district can be tapped. Tharaka, Igembe and Tigania divisions are the worst hit by this problem. Although projects are underway to ease these problems the rate of implementation is widely out-paced by the demand.

Table 2.11 PROVISION OF BASIC INFRASTRUCTURAL FACILITIES (%)

DIVISION	HOUSING	MEDICAL	WATER	TRANSPORT
N. Imenti	50-60	50-60	60	60
S. Imenti	50-60	50	50-60	50
Nithi	50	50	50-60	40-50
Igembe	40-50	40-50	30-40	30-40
Tigania	30-40	30-40	30-40	40-50

Source Kenya:- Meru District Development Plan 1984/88

Communication by road is very important in the district not only for accessibility to health facilities but also marketing agricultural produce and general transportation. The classified road form an estimated 2,060 Km with about 230 Km being of between standard 900 Km, gravel standard, 610 Km earth roads and 320 Km rural access roads.

However, most of these roads are in a very poor state due to heavy use. Erosion and lack of sufficient funds for maintenance.

By division South Imenti has the largest network of roads amounting to a total 434 Km, Central Imenti and Tharaka divisions have the smallest network each amounting to only about 180 Km.

Destruction of roads bridges and culverts is quite frequent during the floods and the cost of replacing bridges that have been washed away has risen so much that only a fraction of the destroyed bridges can be replaced each year. This makes road communication in certain sections such as Igembe very difficult with only a few bridges in operation.

Table 2.12 CLASSIFIED ROADS DISTRIBUTION BY DIVISION

DIVISION	LENGTH (KM)
N. Imenti	430.9
S. Imenti	434.4
C. Imenti	179.2
Tigania	295.8
Tharaka	179.2
Igembe	277.6
Nithi	262.9
TOTAL	2060.0

Source:- Meru district infrastructure inventory (1987)

With a population of about 1.2 million, Meru is one of the largest districts in the country. The district is served by an equally large number of schools both in secondary and primary schools; totalling 131 and 822 respectively. This takes care of approximately 399,970 school age population.

Division-wise, Nithi has the highest school enrolment with 52,840, Tigania has a total of 52,138 in primary school, secondary school enrolment totals 23,130 with Nithi division having the highest and Timau the lowest. It is evident that school distribution in this district corresponds to the regional population distribution discussed earlier.

Table 2.13 PRIMARY SCHOOL DISTRIBUTION, TEACHERS AND ENROLMENT

DIVISION	SCHS.	TEACHERS		ENROLMENT	
		TRAINED	UNTRAINED	MALE	FEMALE
Nithi	166	1454	315	26421	26419
S. Imenti	95	1089	211	18171	18169
Tharaka	120	465	295	8662	8661
C. Imenti	70	733	244	13718	13716
N. Imenti	102	1133	292	20741	26738
Timau	20	169	61	3496	3496
Ntonyiri	63	332	188	11190	11191
Igembe	65	446	205	11195	11193
Tigania	121	870	472	26070	16068
TOTAL	822	6691	2283	139664	139651

Table 2.14 SECONDARY SCHOOL DISTRIBUTION AND ENROLMENT

DIVISION	SCHOOLS	MALES	FEMALES
Nithi	36	4407	3312
S. Imenti	22	2732	1765
Tharaka	6	520	422
C. Imenti	9	1014	1402
N. Imenti	24	1821	1748
Timau	1	200	124
Ntonyiri	6	265	181
Igembe	8	503	556
Tigania	19	983	1173
TOTAL	131	12447	10683

Source:- Meru district infrastructural inventory, 1987.

2.8 HEALTH FACILITIES

Relative to other Districts in Kenya, Meru is well served with Health facilities. However, their accessibility is still an issue and this study hopes to discuss it in later chapters. There are over 104 health facilities including 7 hospitals and 8 health centres. The rest are dispensaries and 2 nursing homes. Their divisional distribution is given below:-

Table 2.15 DISTRIBUTION OF HEALTH FACILITIES BY TYPE AND DIVISION

DIVISION	HOSPITAL		H/CENTRE		DISP		N/HOME		TOTAL
	No.	%	No.	%	No.	%	No.	%	
Nithi	2	28.6	1	12.5	29	33.3	-		32
S. Imenti	2	28.6	-		18	20.7	-		20
Tharaka	-	-	2	25.0	8	9.2	-		10
C. Imenti	-	-	1	12.5	5	5.7	-		6
N. Imenti	1	14.3	1	12.5	12	13.8	2	100	16
Timau	-	-	1	12.5	2	2.3	-		3
Ntonyiri	-	-	1	12.5	2	2.3	-		3
Igembe	1	14.3	-		5	5.7	-		6
Tigania	1	14.3	1	12.5	6	6.9	-		6
TOTAL	7		8		87		2		104

Source:- Meru District Development Plan 1989.

2.9 NATURAL RESOURCE POTENTIAL

Other than forestry, water, fisheries and solar energy, Meru district like most other districts in Kenya are not well endowed with natural resources. There are extensive forest resources in the district with a total gazetted area of 1377 Km^2. These forests form part of the central highland zone. These forests occur on the slopes of both Mt. Kenya and the Nyambene range with a few other

forest zones scattered within the district in the range of 1,976m to 2,736m above sea level.

Above 2438m the forest offers coniferous trees such as cedar and podo with denser stands of bamboo occurring in higher attitudes. Below 2,438m we find broad leaf evergreen forest species communities which include olive camphor and "Mukuego". "Mukuego" is very important in the construction industry in Meru.

Other important trees are the "Muhuti", "Mvuli" and the world famous Meru oak (used in furniture making) which are found between 1,624m and 1,981m above sea level.

Also notable and exploitable resource base in the forests are the national parks camp sites found particularly in the Mt. Kenya forest.

Fisheries are a large untapped industry in Meru district. Partly due to lack of large water bodies and partly due to the dietary habits of the Meru people who are non-fish eaters. There are however 510 fish ponds ranging in size from 1/10 of an acre to one acre and the introduction of exotic fish such as common carp. Mirror carp and silver carp has improved the production and the demand now especially in the hotel industry is growing. The fisheries department has succeeded in generating some interest in

the culture. Farmers are encouraged to utilize free flowing waters by leading them into ponds. The major hindrance has been lack of extension services and ignorance as to the importance of fish in nutrition. Rivers such as Thuci, Ruguti, Nithi, Mara, Malonga, Kathita, Kithinu, Thingithu are high potential for fisheries which remain under-utilized.

Nearly 1/3 of Meru district is either gazetted forest or national parks the later covering an area of 870 Km^2. The wide range of ecological systems creates a home for a wide range of animal species in a largely undisturbed state. Almost all the wild animals in Kenya are found in these parks particularly Meru National Park which hosts the rare white rhino. This is not only a tourist attraction but a conservation area.

Solar energy is excessively abundant but this has not been exploited as a source of energy in place of the dwindling tree resources and electricity due to financial constraints of the rural peasant communities to raise the initial installation capital. This source of energy which could easily transform the social economic standing of the district is bound to remain under utilized for quite a while.

The mineral resource potential in Meru District is not yet explored therefore, it cannot be exploited economically. Sand, building stones are largely mined in Tharaka and S. Imenti but the presence of corundum near River Tana, Iron ore near Marimanti, Mica in Kiera

ridge, Limetite in Kinna area, crona in Magundu crater and beryl in Mitungu are not yet exploited.

Table 2.16 MINERAL POTENTIAL IN MERU DISTRICT

Type of mineral	Area found
Corundum	Near Tana River
Iron Ore	Marimanti
Mica	Kiera Ridge
Limetite	Kinna
Crona	Magundu crater
Beryl	Mitungu
Sand	Tharaka
Building stone	South Imenti

Source:- Geological survey of Kenya, 1979.

2.10 CONCLUSION

The importance of these socio-economic valuables lies in the fact that they all have a direct or indirect bearing on morbidity and mortality. Further discussions will be undertaken in later chapters and reference to its contents.

CHAPTER THREE.

METHODOLOGY

3.1: INTRODUCTION.

This chapter aims at discussing the various methods used in preparation of the research, the method used in the field to collect data, the method of data analysis and finally presentation of the findings. For the suitable methods to be arrived at, available methods of data collection and analysis were considered and evaluated taking into account the size of the study area, the meager time and financial resources available for the research.

The importance of methodology rests upon the fact that the outcome of this research largely depends on the methods used in the data collection and to a lesser extent the techniques of analysis. The methodology therefore adopted took all the above into consideration and was found to be best suited for the topic under study. The methodology thus consisted of field work which involved sampling, designing and administering questionnaires and obtaining health and mortality records, analyzing, interpreting the data and other information.

3.2 Sampling Design.

In most studies, it is impossible for the whole population to be enumerated either because the population is too large or the operation too expensive or the time limited for the research. This thus necessitates the use of a sample. Sampling involves drawing

3.3 DATA COLLECTION.

3.3.1 Primary data.

The acquisition of primary data involved designing and conducting recording and interviews.

A recording schedule was designed with the aim of getting detailed knowledge of the various vital aspects of the individual both socially and economically. The questions were phrased in such a way that they led to an open discussion. They were designed to probe into the issues of general mortality of infants and children. This way it was possible to expose any contradictions that arose from the respondents.

A prepared standard questionnaire was used to collect information pertaining to the sampled individuals, social economic and demographic behaviours. The questionnaire had to be administered in vernacular and the responses translated into English. This, thus called for training of the research assistants so that the questions were uniformly interpreted.

In each sub-location visited, the Assistant Chief was asked to identify 1 or 2 persons who had participated in the 1989 Kenya population census and were familiar with most of the families in the sub-location. These persons and the sub-location administration were then able to identify women who had experienced an infant and

or a childhood mortality. In instances where the identified women were more than the number allocated to the particular area, simple random sampling was carried out.

The research assistants then underwent a days training going through the questionnaires question by question and discussing any clause they may not have understood. Standard vernacular interpretations were arrived at. The training covered the purpose and focus of the study approaches to interviewing, recording techniques, possible error points and the observation of basic rules.

Another aspect covered in the training was emphasis on the interviewer/interviewee relationship and in particular on factors that might jeopardize validity. The purpose of the research and the general usefulness of the information were clearly outlined to the assistants. Besides, it was pointed out that the questionnaire carried very sensitive information and therefore should be kept confidential. This is especially so considering the fact that mortality is a relatively sensitive issue.

The task of data collection was eased further by the fact that the research assistants were residents of the particular location and in many instances were well known to the respondents which eliminated shyness and withdrawal.

After training, the assistants were then sent out to conduct the interviews and a date set for them to return the filled questionnaires to the Assistant Chief's office for collection.

3.3.2 Secondary sources.

Secondary data was also collected from the various Government Departments and these included the Meteorological Department, Ministry of Agriculture , Meru District Hospital and the Registrar of Births and Deaths.

3.4 METHODS OF DATA ANALYSIS.

The aim of this analysis was to summarize the research findings in such a manner that gave answers to the questions fielded. Interpretation involved the search for broader meaning to answers given by linking them to available knowledge and making inferences on the basis of established patterns, the study drew conclusions and raised questions.

This part of the chapter therefore concentrates on the methods used in data processing and statistical analysis used in order to draw conclusions about the sample data. It discusses methods used in preparing data for statistical analysis and the actual quantitative techniques used in the analysis. The preliminary process in data analysis involved, editing, coding and tabulation.

3.4.1 Editing, Coding and Tabulation.

Editing and coding involved putting the information in codes for computer entry, word classification were translated into numbers and this entered into code sheets . using appropriate numerical codes for various answers given. Cross and counter checking ensured that no omissions or mistakes were made.

In the presentation of findings, the study concentrated on the description and interpretation of research questions. The data collected was edited , coded and run on a computer using the SPSS programme (Statistical Package for Social Scientists) to obtain descriptive and inferential statistics.

The program gave various statistical measures as per variable. These included the range, the mode, the median and the mean, the variance and the standard deviation. Both parametric and non-parametric tests were used in analyzing the data. Parametric tests mainly assume certain conditions in the population and are used only when those assumptions are met. On the other hand, non-parametric tests do not make any assumptions about the population except that there is continuity in the data.

Although the statistics gave an overall picture of the study question, they do not show any relationship between variables. Inferential statistics were used to guide further interpretation and elaboration of findings. These measures were particularly used in the test hypothesis.

3.4.2 The Contingency Co-efficient.

The contingency tables were used to investigate sets of relationships. This involved cross-tabulation of selected variables. The cross-tabulation involved bi-variable nominal level variables and two inferential statistics were employed. Whenever interval level variables and two inferential statistics were used the statistics used were assumed to be nominal and thus the distance was unimportant (Nie et al 1988).

The two statistics used were the contingency co-efficient which was used as a measure of the extent of association or relation between any two attributes (Siegel 1980).

This statistical method has a value of between 1 and 0 and for this particular study and value of 0.5 and above was found to be a strong relationship. The contingency co-efficient (c) was used because of its ability to cover tables of any size. The formula is computed as shown below.

$$C = \sqrt{\frac{X^2}{n + X^2}}$$

where X^2 = the chi-square

n = the sample size

out of certain units of the population in such a way that the selected units are representative of the parent population and from the drawn sample one can make inferences about the parent population. This being the rationale behind sampling, the sample should also provide maximum accuracy for the available time and money and also minimize sampling and non-sampling errors.

The aim of this study is to arrive at a mortality level for the study areas and give the inherent differentials in Meru District. One implication of this is that the whole District would be covered. This was not possible. The solution was therefore to come up with a sample that will be representative of the whole District. This was carried out by use of a stratified random sampling procedure conducted in several stages as illustrated below. Using the Meru District Agro-ecological zone map, the District was stratified into three namely; high, medium and low potential divisions. This placed North, South and Central Imenti, Nithi and Igembe Divisions in the high potential category, Timau and Tigania in the medium potential and Tharaka in the low potential zones. (see Fig 3.1). These groupings were also co-incidental to population densities which were later used to determine how many questionnaires were administered in each zone. From each of the zones, one division was randomly drawn to represent all the other in same category. North Imenti was drawn to repreeent high potential zones, Tigania the middle potential zones and Tharaka,

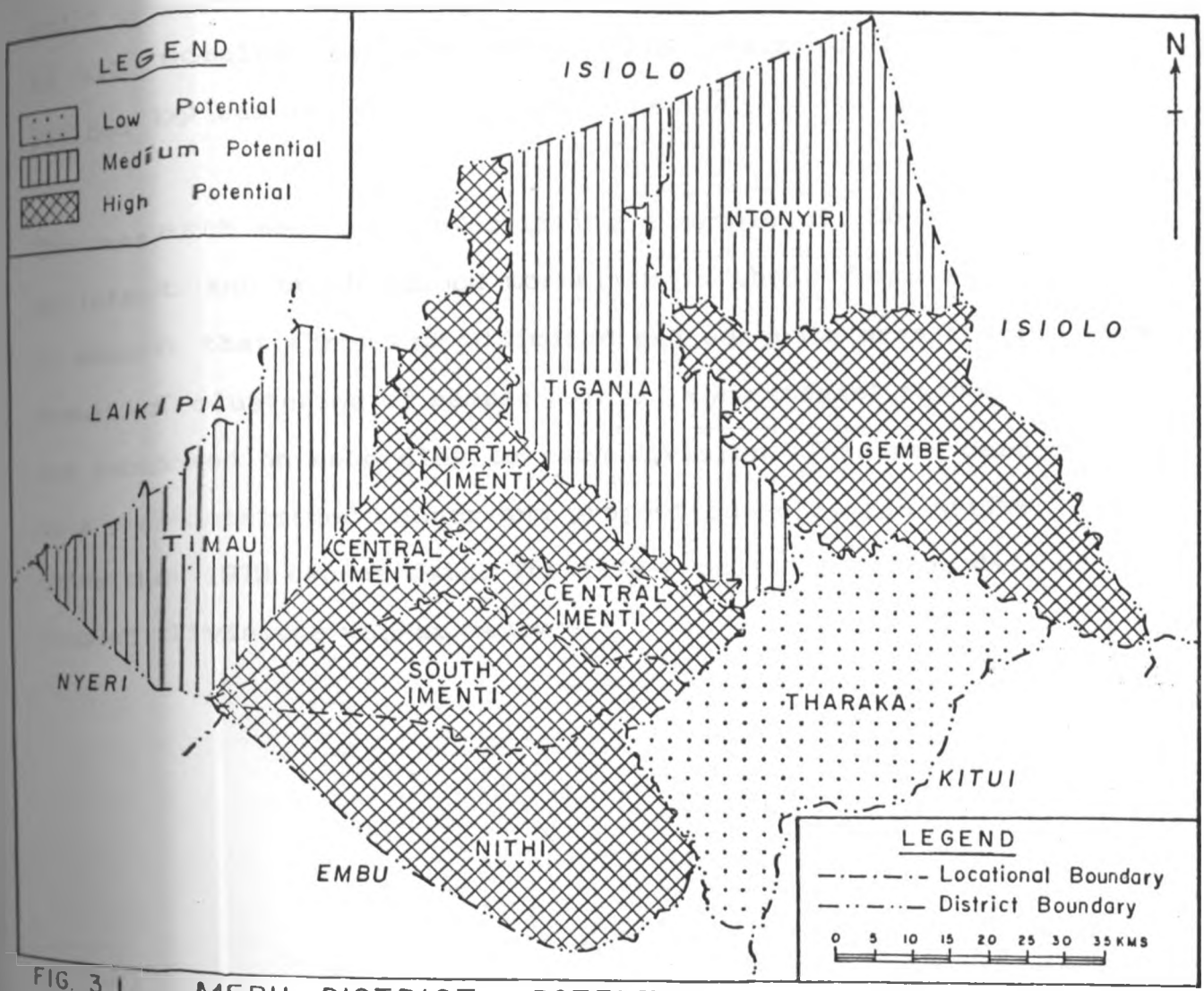


FIG. 3.1 MERU DISTRICT : POTENTIALITY OF THE STUDY AREA.

the low potential zone. Having delineated the three areas, the next step was to draw up a sampling procedure whereby samples taken would be used to draw inferences to the characteristics of a set of all possible measurements on the basis of the information yielded by sample of the measurements.

The research aimed at interviewing a sample of 100 women who had an infant and or childhood mortality in their fertility history. To ensure that error was minimized and adequate area covered as a result of clustering of sample points, a strategist random sampling was embarked on according to each division. This was carried out in a pre-determined manner and proportionate sample arrived at by using the 1979 census data. The 1979 population census data of the sampled divisions was as below:-

TABLE 3.1 1979 POPULATION CENSUS DATA FOR STUDY AREA.

DIVISION	POPULATION	HOUSEHOLD NUMBERS
NORTH IMENTI	221,823	41,319
THARAKA	50,277	9,463
TIGANIA	140,651	26,157
MERU	830,179	150,662

Source: CBS, 1979 POPULATION CENSUS VOL. 1.

Using the above information, it was calculated that North Imenti had 53.74% of the population and 53.7% of the households, Tharaka has 24.36% of the population and 12.18% of the households and Tigania has 34.0% of the population and 33.9% of the households. A compromise was reached whereby the population was used and proportionate number of questions were administered in each division. 54 in North Imenti, 12 in Tharaka and 34 in Tigania. For each of the sampled divisions, research assistants were asked to identify women who had experienced an infant and or childhood death in their fertility history. This cluster of women formed a secondary population from which free random sampling was performed to draw the statistically determined sample size of 54 in North Imenti, 12 in Tharaka and 34 in Tigania and to these the set questionnaire was administered.

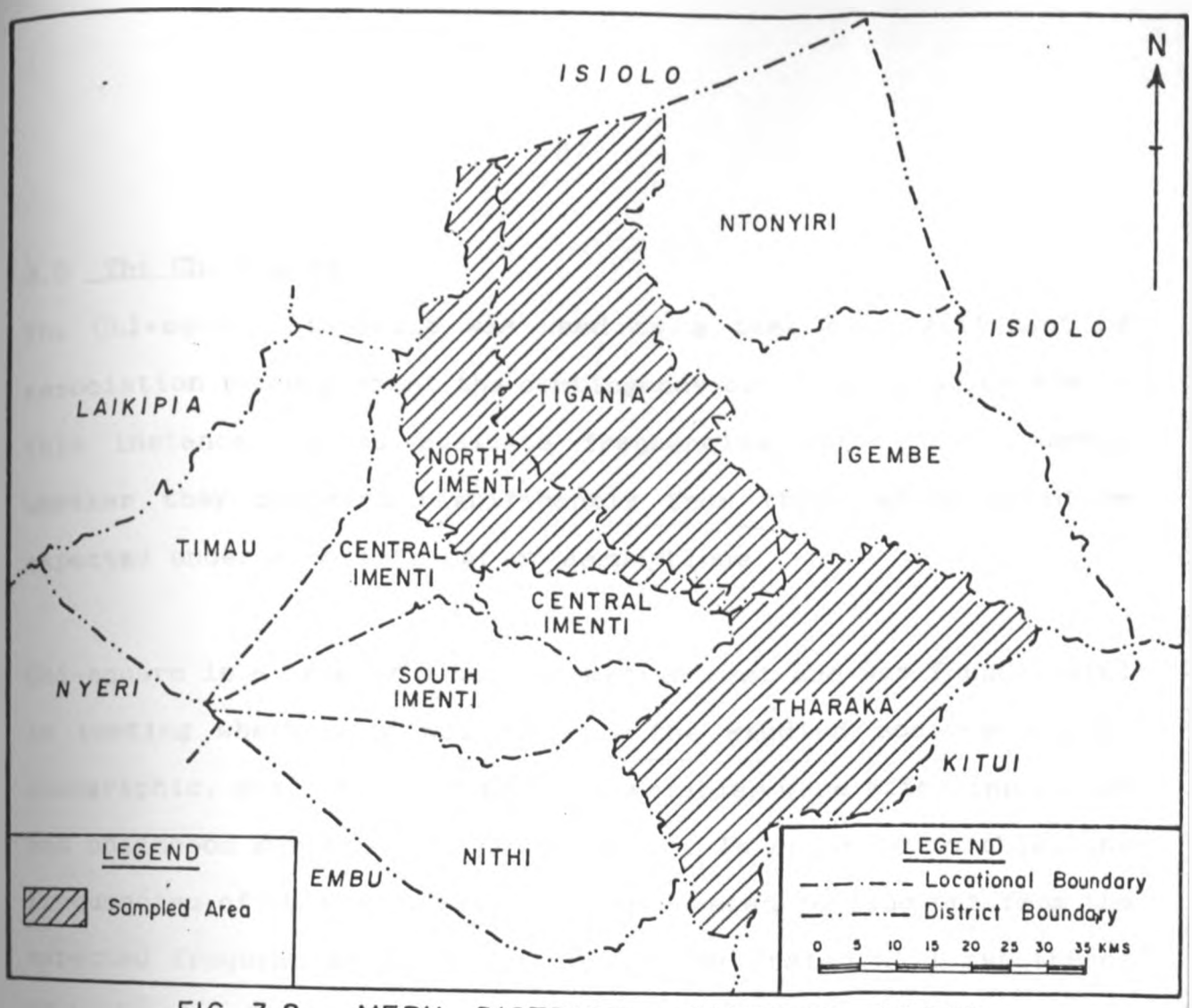


FIG. 3.2 MERU DISTRICT : SAMPLED AREAS

3.5 The Chi-Square.

The Chi-square statistic was used as a test of significant of association to complement the contingency co-efficient. The aim in this instance was to evaluate frequencies attained to assess whether they differed significantly from those which could be expected under a certain set of assumptions.

Chi-square is a type of a non-parametric test and was found useful in testing whether or not some of the studied socio-economic, demographic, ecological and medical variables were affecting infant and childhood mortality in the district. In order to do this, the frequencies of observed fertility were tested to find out from the expected frequencies on the basis of some stated null hypotheses (H_0). In computing X^2 several steps were followed.

1. The null hypothesis (H_0) to be tested was stated.
2. Levels of significance at which the hypotheses was to be tested were stated.
3. The degrees of freedom were worked out using K-1 in some sample test or (r-1) (K-1) in two sample test where r was the number of rows or the number of columns or the number of independent sample.
4. The null hypothesis (H_0) was rejected only when the calculated value of X^2 was equal to or more than the tabulated value of X^2 at the specifies level of. significance. (Dhillon & Goldstein 1984)

In this study, 90% and 99.9% levels of significance were used to test the stated null hypothesis.

Chi-square was selected because of its flexibility in relation to levels of measurement.

This test is computed as below:-

$$X^2 = \frac{(O - E)^2}{E}$$

Where O = The observed frequency

E = The expected frequency

3.6 Multiple Linear Regression Analysis.

Since correlation co-efficient do not predict the outcome of a relationship, the multiple linear regression was used to explain the amount of variation when a set of predictors jointly act upon a criterion establishing the relative importance of predictors and discussing the predictive value of each independent variable. This method is also used in this study to uncover spurious relationships locating intervening variables and making inferences.

Other than analyzing data, regression analysis is concerned with relationships between variables and the contribution of different variables to the overall variability observed in the dependent variable. The linear mode; assumes that the explanatory or

independent variable(s) or predictor(s) (x) affects the dependent variable (Y) in a systematic way that is distorted by more or less random scatter of disturbances. In other words, the observed or less of the data would have been perfect if there were no disturbances. In a simple regression model, it is assumed that the variability in a dependent variable is accounted for partly by a single explanatory variable and partly by the effect of unconsidered variables. Hence in simple regression analysis one attempts to predict a dependent variable from one independent variable. It is computed as below:-

$$Y = a + bx + e$$

where:-

Y = the dependent variable

a = intercept

b = the slope

e = the disturbance or error term

However in many geographic studies, like this one more than one variable is involved. Hence one finds that many interrelated variables have to be considered in order to explain fully the variability in the dependent variable. This study among other things aims at relating one variable, the level of infant and childhood mortality with several explanatory variables namely; Socio-economic, demographic, ecological and medical. By using the multiple-regression analysis each of these explanatory variables with its sub-variables are fitted in the x component of the model

and this way each sub-variable doesn't have to be tested independent of the others.

At a higher level, all the independent variables are tested against the dependent variable ; the level of infant and childhood mortality. Having been found to be superior to the other methods of data analysis, this study therefore made use of multi-regression model which attempts to explain or predict a dependent variable from many independent variables.

Taking into account all the assumptions that regression analysis model makes, it was found that all of them were taken into consideration and the study qualifies to undergo a multi-regression analysis.

$$Y = a + b_1 x_1 + b_2 x_2 \ldots\ldots b_k x_k + e$$

where:-

Y = the dependent variable

b = slope

a = intercept

x_1, x_2, x_k = the independent variables

To best describe the trend of the data, the regression model tries to select and fit a particular straight line through a set of points that minimizes the sum of the squares of differences between the observed and the predicted "Y" values for each value of "X". From the best fit line, one can predict the values of the

dependent variable.

Moreover, the regression model is used to measure the strength of relationship and the amount of variation explained by the independent variables. This is done by the use of correlation co-efficient which simply measures the degree of association between the variables, correlation co-efficient is symbolized by "r" in simple regression and "R" in multiple linear regression. All correlation co-efficient range from -1 to +1. If the values are closer to -1 or +1 it indicates that a high correlation exists while values equal to zero indicate a complete absence of correlation. If the values of correlation are r or R squared, they show what percentage of variability in the dependence variable is explained by the independent variable(s).

However, the regression model makes certain assumptions that must be fulfilled before it can be said to be valid.

1. The relationship between the dependent variable Y and the independent X is linear.
2. The observation must be at least 20. This is in order to allow for a large number of degrees of freedom in testing the statistical significance of each independent variable.
3. The variable used need not be random or normally distributed.
4. The mean disturbances or error term is zero. This implies that the error term do not affect the rising and the

lowering of the Y values in the overall relationship.

5. The error "e" is uncorrelated with the independent variable(s) X. This means there is no systematic association between positive and negative disturbances of high or low values of the independent variable(s).
6. Homoscendacity, which means that for each independent variable there is a conditional distribution for the values and that this distribution is constant all over the linear relationship.
7. The independent variable should not be strongly interrelated.
8. The data use must be in interval scale.

(Segel, 1980)

In this study, both the simple and the multiple regression analysis were used in analyzing the data. Simple and multiple regression analysis were also carried out to show the relationship between mortality and various other social, economic, demographic and medical variables. In order to test whether the relationship was spurious or not the student "t" test was carried out and tested at 90% and 99.9% levels of significance.

3.7 The student "t" test.

The student t test was used to test the statistical significance of the regression co-efficient obtained. The t ratios expresses, the difference between the observed value of the co-efficient and its

mean as a ratio of the standard error.

This is computed as below;-

$$t = \frac{by_x}{S_{EB}}$$

where:- by_x = regression co-efficient

S_{EB} = standard error of the partial regression co_efficient.

The value of "t" is therefore the ratio of a regression co-efficient to its standard error and indicates the relative scaler of points around a regression line so that it gives some suggestion of the accuracy of a partial regression as best fit to the data point. It therefore indicates the relative strength of the relationship. Large values of "t" indicate a strong relationship while small values show a weak one.

Other than the analysis of data, this study used certain methodology to collect the raw data and compute certain statistics before relationships and explanations were sort. Collection of mortality data can be tricky as there are numerous approaches to the study of mortality each with its own advantages and disadvantages in terms of cost precision and simplicity. This study therefore combined both retrospective and prospective modes of data collection as no single method was seen as ideal for all circumstances.

3.8 PROSPECTIVE APPROACHES.

3.8.1 Vital Registration.

This involves the registration of demographic events at the time or shortly following its occurrence. In this case it was the use of registration of infants and childhood deaths at the hospital and office of the District Registrar of Births and Deaths with details on age, sex, the cause of death and usual place of residence . (see appendix 2).

Registered deaths provided estimates of rates and causes and indicated the presence of a disease as an important cause of death even without appropriate denominators. The registration of deaths provided the basis for estimating the frequency of episodes of crisis of mortality such as the near epidermic of meningitis.

3.8.2 Retrospective Approach.

This approach made use of material with births and deaths for all children born to women in the population grouped by woman's age group. This data is the basis for using the Brass Child survival method. Since this method does not rely upon the dates of births and death for each child upon current age of mother, the reference period being the mother's life time, it is not affected by reference periods error or dating problems and is therefore less sensitive to age misreporting. (Population Studies No. 84, 1981)

National population census is an important source of mortality measurement providing data on the age composition of the population from which level of mortality can be estimated. Direct data on deaths are generally inaccurate as it is difficult to gather information on deaths by including a question relating to those who had died in the year immediately preceding the census. This is because the recording of a death depends in the household and whether the survivors of the deceased in the household recall the event as having occurred during the correct time period. The reporting of deaths of young children is therefore particularly sensitive to such problems. This therefore intend to use an indirect method of estimating infant and childhood mortality from child survivorship data ,namely the Brass Method.

3.9 THE BRASS METHOD.

The procedure converts the proportions of children Ever Born (CEB) reported by women in successive five years age groups in the reproductive period into probabilities of dying before attaining exact childhood ages.

Thus

$D_{(i)}$ denotes the proportion of children among children ever born to women in the i^{th} age group and

$q_{(x)} = 1-1_{(x)}$ is the probability of dying between births and the exact age x.

The basic relation is as below.

$$q(_x) = k_{(i)} - D_{(i)}$$

k(i) is the multipliers obtained and in the relation:

$$k_{(i)} = [a_{(i)}] + [b_{(i)}]\ [P_{(1)}/P_{(2)}] + (c)\ [P_{(2)}/P_{(3)}]$$

$a_{(i)}$, $b_{(i)}$ and $c_{(i)}$ are constant estimated by regression analysis of a large number of model cases for different model life table. In this study, the West Model will be used as it was envisaged to be most appropriate.

$P_{(i)}$ is the average parity among women in the 1st age group. The values $q_{(x)}$ obtained by applying the Brass Method to the child survivorship data will then be adjusted using a logical transformation of the Brass general standard life Table. The values of $q_{(x)}$ will then be converted into mortality levels in the Coale and Demeny West Model Life Table.

3.9.1 Table System.

Other than giving a general mortality level for both sexes, this method is also important in that it demonstrates a sex differential in the levels of both infant and childhood mortality.

3.10 RESEARCH LIMITATIONS.

1. The research was carried out at a time of the heavy rains. This made transportation very expensive especially in Tharaka and Tigania Divisions. The use of public means of transport

for the interviewers often led to wastage of time as they often got stranded in the impassable roads.

2. The chiefs and their assistants were helpful in identifying suitable research assistants and women who had experienced an infant or childhood mortality. They were also helpful in requesting the women to be co-operative with which most complied. However, quite a number of the chiefs demanded payment for the interviews being conducted in their locations and this added to the research expenses.

3. This study required alot of data from hospitals but it was to the researcher's utter dismay to find that most of the Government hospital and health centres do not compile data or even keep proper records. The researcher therefore had to go through the daily registers to pick out the relevant data. This was terribly tedious and time consuming.

4. Some of the death and medical records were written in medical jargon which also took time to interpret.

5. Medical and death records in the Government hospitals were in many instances incomplete. For instance, the omission of the exact place of death and the interval between the onset of illness and the time of death. This was a bottleneck to accuracy.

CHAPTER FOUR.

CAUSES OF INFANT AND CHILD MORTALITY.

"Ignoring causes of death in the study of mortality is somewhat akin to ignoring fecundity, conception effectiveness and fetal wastage in the study of fertility"

(PRESTON, S.H. 1976)

4.0 INTRODUCTION.

This chapter aims at critically assessing the occurrence and spread of diseases causing mortality in the study area. It will also expound on the way in which the particular disease causes mortality. It is also in this chapter that the Ho: There is no significant association between the levels of malnutrition and the incidence of pathological diseases; will be tested.

The child has little or no control of the environment. Social and environmental factors all play even greater part in determining the well being or ill health in the early years than they do in adult life. Often such factors as diseases are extremely combined and it may be impossible to determine the relative importance of any one of them. Thus, if a particular disease is found to be closely associated with poverty, it may mean that malnutrition, overcrowding, cross infection, faulty hygiene, cold and exposure all play a part in its causation.

Studies carried out on mortality tend to treat the issue as an isolated single element with variations and differentials occurring with age, sex, place of birth, maternal histories and so on. However, this study other than looking at the variables will consider infant and childhood mortality as a collection of forces which culminate in a particular cause of death. It is for this reason that this chapter is dedicated solely to the causes of death.

Using Bourgeois-Pichat (1978) classification of death, we find there are two categories. One is exogenous and the other endogenous. Exogenous deaths are further classified as :-

i) deaths due to infective and parasitic disease

ii) deaths due to diseases of the respiratory system

iii) deaths due to accidents and poisonage and violence.

Endogenous deaths are those due to:-

i) neoplasms

ii) diseases of the circulatory systems

iii) all other causes.

In his study, Bourgeois-Pichat (1978) found out that exogenous causes were declining rapidly in the developing countries, while deaths due to endogenous causes are on the rise. He further noted that some diseases are caused by climatic conditions, diet of the child or work in which a person is engaged in.

Causes of death therefore vary depending on the state of the standard of living, the environment, public health measures and the demographic structure of the society under study. In areas where there are a youthful age structure, tropical climate and poor environmental conditions. The overriding causes of death are infective and parasitic diseases with peri-natal and respiratory diseases as a major cause of death.

The data used for the above is based on the field surveys (questionnaires) whereby the respondents were asked to state the causes of death of the dead children as per death certificate where available or by the doctors treatment cards. Secondly, hospital records and local administration (chief) certificates were obtained from the District Registrar of births and deaths where the researcher went through the relevant records and noted the cause of death as registered by a medical practitioner or by a witness (see Appendix 1 and 2)

4.1 MAJOR CAUSES OF INFANT AND CHILDHOOD DEATHS.

It is important to point out at this juncture that this study will concentrate on the following major childhood diseases namely broncho-pneumonia, malaria, measles. meningitis, prematurity and birth disorders, malnutrition and related deficiency diseases, gastroenteritis, burns and tetanus. The data for this section, was from the registrar's records of October 1988 to October 1989 which

reviewed the following.

TABLE 4.1 OCCURRENCE OF INFANT AND CHILDHOOD MORTALITY FROM HOSPITAL RECORDS.

YEAR/MONTH	NO OF ADMISSIONS	DEATHS	% DEAD
1988 OCT	550	110	20
NOV	595	119	20
DEC	572	103	18
1989 JAN	568	108	19
FEB	570	97	17
MARCH	671	94	14
APRIL	625	100	16
MAY	606	97	16
JUNE	606	103	17
JULY	574	109	19
AUG	572	103	18
SEPT	562	73	13
OCT	643	90	14
TOTAL	7714	1306	

Source: Meru District Hospital Records - 1989.

When the above table was broken down into specific diseases cause specific rates, the following was obtained.

FIG. 4.1 NUMBER OF ADMISSIONS AND DEATHS

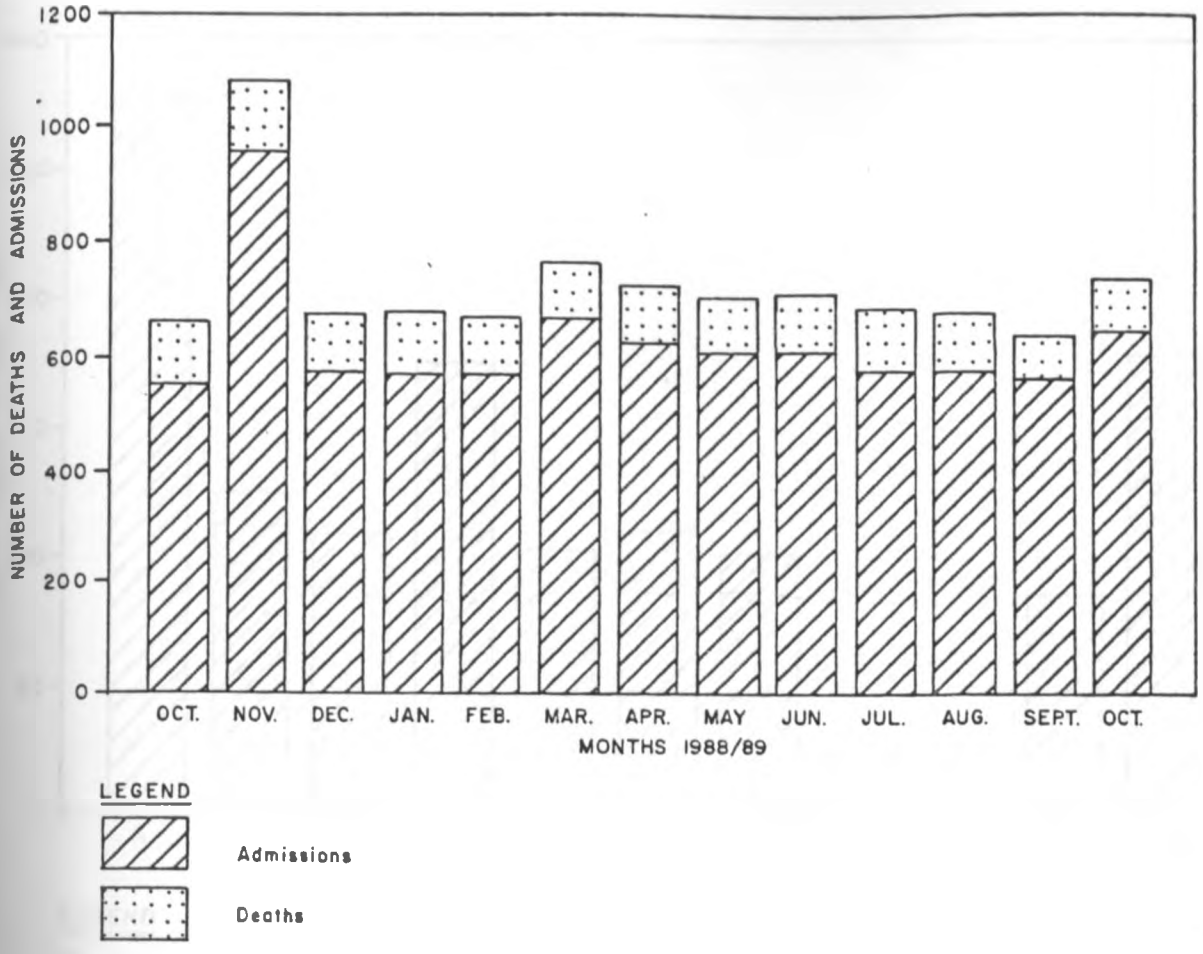
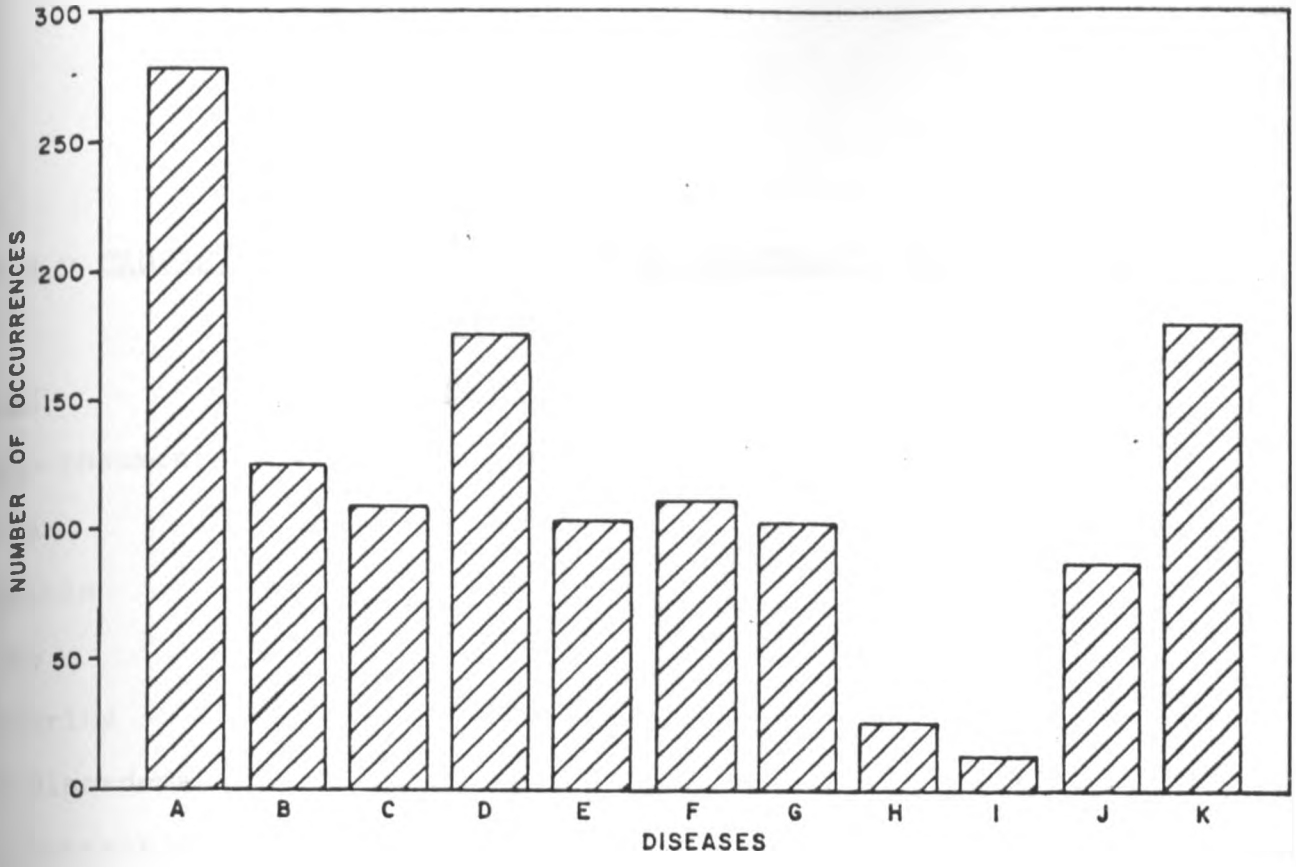


FIG. 4.2 OCCURRENCE OF DISEASES



LEGEND

A — Pneumonia
B — Malaria
C — Menengitis
D — Measles
E — Prematurity
F — Birth Disorder
G — Gastroenteritis
H — Burns
I — Tetanus
J — Malnutrition
K — Others

TABLE 4.2 CAUSES OF INFANT AND CHILDHOOD MORTALITY FROM HOSPITAL RECORDS.

DISEASE	DEATHS	% OF TOTAL
Broncho-pneumonia	278	21.3
Malaria	124	9.5
Meningitis	108	8.3
Measles	176	13.5
Prematurity	103	7.9
Birth disorders	110	8.4
Gastroenteritis	102	7.8
Burns	26	1.9
Tetanus	14	1.1
Malnutrition	86	6.6
Other Diseases	179	13.7
TOTAL	1306	100.00

Source: Meru District Hospital Records, 1989.

4.1.1 BRONCHO-PNEUMONIA.

The above table information indicates that broncho-pneumonia is the major cause of infant and childhood mortality , accounting for over 21% of all deaths occurring during the study period. Broncho-Pneumonia is one of the respiratory tract diseases. The respiratory tract includes the nose, pharynx, larynx, trachea, bronchi and bronchioli; alveoli and the surrounding structures. Pneumonia is an infection of the lungs which involves the bronchi and the alveoli. Even when a very small part of the lungs is infected, the

baby may fall very sick especially those between 1/2 and 3 years. Unlike other disease causing germs, the bacteria causing germs are found in the surrounding and on the skin of completely healthy children. Malnutrition or other diseases therefore decrease the general resistance, if not controlled. The infection may develop into a lung abscess which may cause septicaemia in the bloodstream. As a result the heart may have difficulty in pumping blood through the diseased lungs, and this may result in death. (Forfar & Arnell, 1973)

Following the tract of the bacterial infection, severity of the infection may be curbed if the disease is treated early and need not result in mortality if other opportunistic diseases and particularly malnutrition are kept abay.

Inferences about the determinants of mortality drawn mostly from inter-district variations indicate that the principal determinant of mortality in Kenya is the prevalence of malaria thus giving the lake Victoria Basin and the Coastal Region the highest infant and childhood mortality rates. However, in the absence of endemic malaria throughout the year, the varied climatic conditions and particularly the cold wet Mt. Kenya and the Nyambene ranges zones, broncho-pneumonia stands out as the major infant and child killer in Meru District.

Broncho-pneumonia, may follow a cold or occur suddenly without previous evidence of infection. However, cold and exposure are

medically regarded as the predominant causes with the conditions only slightly more frequent amongst malnourished children than in those who have previously good health. Look at the occurrence of these diseases in the 3 study zones. The following figures were obtained.

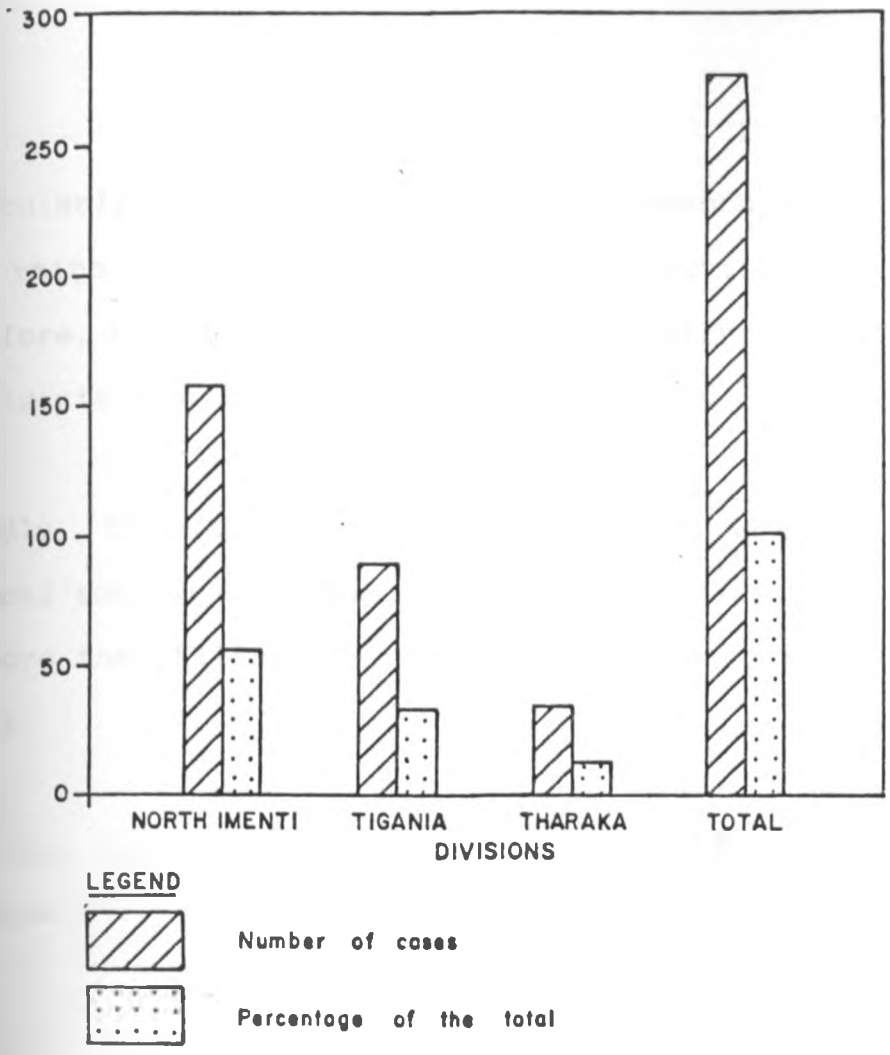
TABLE 4.3 DISTRIBUTION OF INFANT AND CHILDHOOD MORTALITY IN THE STUDY AREA.

ZONE	NO. OF CASES	% OF THE TOTAL
N. IMENTI	156	56.1
TIGANIA	88	31.7
THARAKA	34	12.2
TOTAL	278	100.00

Source: Compiled from the field data.

Taking the above information into account and the climatic conditions (see chapter 2), the figures may be explained in two ways. Broncho-pneumonia is prevalent in two ways. Broncho-pneumonia is prevalent in areas of low temperatures. Tharaka ia an arid and semi-arid zone with temperatures ranging between 27° C and 35° C and therefore the cold aspect is ruled out. The rainfall of the zone is also relatively low with an average of 500 mm per annum (see Fig 2.4) and this cannot be classified as wet. On the other hand, temperatures in N. Imenti and Tigania can be as low as 17° C in the Mt. Kenya and Nyambene ranges and rainfall as high as 2250mm per annum. These are by all standards wet and cold areas

FIG. 4.3 DISTRIBUTION OF INFANT AND CHILDHOOD MORTALITY IN THE STUDY AREA



particularly during the peak rainfall season in March to May for long rains and October to December during the short rains. Therefore, broncho-pneumonia is more readily infective in N.Imenti and Tigania than in Tharaka.

Secondly, the population numbers and density are highest in N.Imenti and Tigania than in Tharaka. The higher the population , the more the children and therefore the higher the number likely to die.

The cause specific death rate for broncho-pneumonia was computed as below:-

$$Di_{(0-5)} = 278$$

$$P_{(0-5)} = 1306$$

$$= \frac{278}{1306} * 1,000$$

$$= 212/1000 \text{ deaths}$$

4.1.2 MEASLES

Broncho-pneumonia is followed by measles with 13.5% of all deaths occurring as a result. This is a common killer disease in both infants and children, especially after the 10th month of life . This may be explained by the fact that, although most of the mothers took their children for post-natal clinic and immunization, as soon as they showed steady growth and health, they abandoned clinic

attendance. It is for this reason that this study found out that 27% of the surveyed children did not receive the measles vaccine which is given at 9 months.

Children are particularly susceptible to some common communicable diseases which often occur in small epidermics. If the children survive these diseases, they usually develop a lifelong immunity against these infections, preventing them from getting them again.

Measles is an excellent example of how an infection which is usually very mild in well nourished children becomes a very serious, often fatal in malnourished children whose bodies have a limited capacity to fight against the infection.

Measles is a very dangerous general infection caused by a virus.It is extremely contagious and is spread very rapidly from one person to another by fine, invisible droplets which contain viruses.

The mortality as a result of measles infection is particularly high in malnourished children due to complications mainly in the respiratory tract. This is because of complications which occur more frequently causing death. Measles also interferes with food intake, particularly when there is a sore mouth or the sick is too sick to take food and fluids. Children also loose quite alot of weight as a result of this infection and it often takes them weeks to regain their former weight. Finally, kwashiorkor or marasmus

results after major infections if the child escapes death. (Anon, 1968)

Following an acute attack of measles, a child may develop gastroenteritis; diarrhoea sometimes with blood and mucus, vomiting and broncho-pneumonia which may accelerate mortality. WHO estimated that 1.5 million children die annually of measles and its complications (Assad, 1983).

In the early 1960s measles was recognized as a major cause of child mortality in Africa. Initial studies focussed on hospital data which indicated that in-patient measles cases were as high as 25% (Mosley, 1963). In as much as high measles and measles related mortality occurs in cases where undernutrition is common, this study documented an altered immune response in undernourished children. This is because the immune response determines severity of initial infection, susceptibility to secondary infections and the ability to handle secondary infections. Other factors not withstanding, it is evident that mortality as a result of measles infection often occurred in the presence of malnutrition, anaemia and or kwashiorkor.

TABLE 4.4

MORTALITY CAUSED BY MEASLES AND RELATED COMPLICATIONS

DISEASE	NO. OF CASES	% OF TOTAL
Measles alone	25	14.2
Diarrhoea	49	27.8
Malnutrition	33	18.8
Bronco-pneumonia	51	29.0
kwashiakor	18	10.2
TOTAL	176	100.00

Source: Compiled from field data: 1989.

The cause specific death rate was as below:-

$$D_{1(0-5)} = 176$$

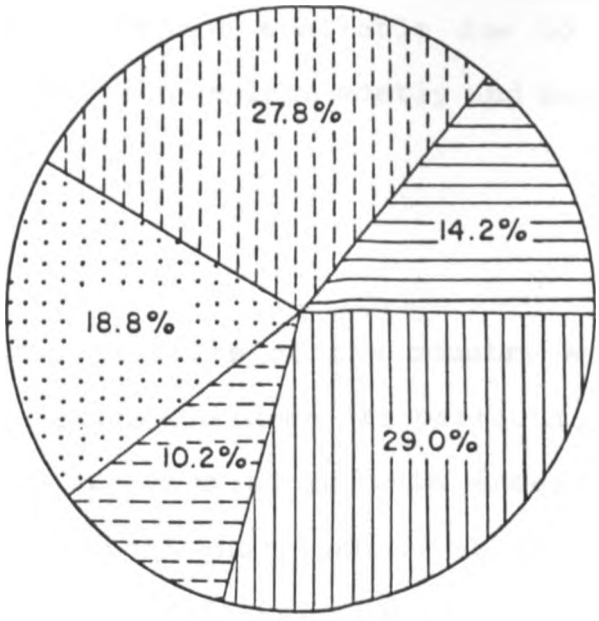
$$P_{(0-5)} = 4,693,161$$

$$= \frac{176}{1306} * 1,000$$

$$= 134/1000 \text{ deaths}$$

Most of the measles deaths are associated with complications most of which are treatable. The availability of medical care, diagnosis and treatment is a determinant of survival. The study however revealed that accessibility to health care was low. Of the 100 women interviewed, 39% had to travel more than 10 Km to get access to dispensary health care, while 58% were at least 5 Km from any health facility. Low standards of living and unavailability of medical care perpetuated the problem. Even where the health facility, particularly the dispensary was easily accessible,

FIG. 4.4 MORTALITY CAUSED BY MEASLES AND RELATED COMPLICATIONS



LEGEND

Measles alone		14.2%
Measles and Malnutrition		18.8%
Measles and Diarhoea		27.8%
Measles and Kwashiokor		10.2%
Measles and Pneumonia		29.0%

immunization vaccines were not available due to lack of storage facilities, yet immunization is less costly and more effective than treatment.

4.1.3 MALARIA.

Malaria is common in most parts of the country and in areas with continuous endemics, young children are particularly susceptible. In the study area, occurrence of malaria endemic are common in Tharaka than in North Imenti and Tigania. Malaria in children may be present if the child has fever , is sickly, has diarrhoea or vomiting, is jaundiced, has anaemia or drowsiness and/or mental disturbances. Though all these may not manifest themselves in a single patient, many of the reviewed death certificates had them as symptoms noticed prior to death. (Ebrahim, 1978)

The South Eastern section of the district and particularly Tharaka are more prone to malaria endemic. This is particularly so after the rains when the scanty vegetation cover blooms and the high humidity offers fertile breeding grounds for mosquitoes. The infants and children are not spared and consequently suffer malaria infections. The occurrence of malaria caused mortality of children under five was found to be as below:-

TABLE 4.5 MALARIA CAUSED MORTALITY.

ZONE	NO. OF DEATHS	% OF TOTAL DEATHS
THARAKA	43	34.7
N. IMENTI	57	45.9
IGANIA	24	19.4
TOTAL	124	100.00

Source: Field data; 1989

The above data gave a cause specific death rate of:-

$$P_{1(0-5)} = 124$$

$$P_{(0-5)} = 1306$$

$$= \frac{124}{1306} * 1,000$$

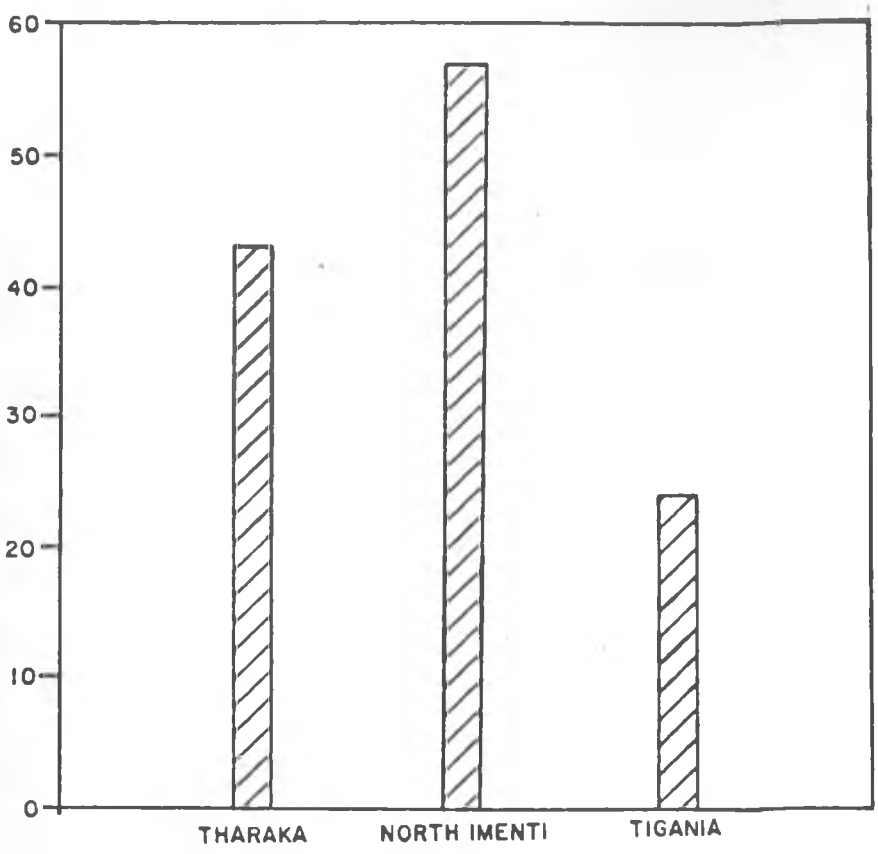
=94/1000 deaths.

4.1.4 MENINGITIS.

Meningitis is not a common occurrence in Meru but when it does ,it takes its toll. This study was carried out after a time when there had been an outbreak of meningitis and therefore the high figure.

One of the reasons that responding mothers gave for their children dying from meningitis is that, they often confused the meningitis symptoms with other diseases and before it was diagnosed, it had reached an advanced stage. Many of the respondents stated that they thought their children had malaria and therefore preceded to medicate them on these grounds and before they could proceed to the hospital, it was too late.

FIG. 4.5 MORTALITY CAUSED BY MALARIA



Meningitis is a disease of the nervous system. Meningitis means inflammation of the meninges, the membranes that cover the brain. It may be caused by bacteria or less commonly by viruses. Meningitis is a very serious disease and unless adequate treatment is given, death or permanent complications such as blindness or deafness are likely. Although commonest among young children. the younger the less obvious the symptoms. (Kaas, 1971)

The symptoms in meningitis are very similar to those of malaria and/or broncho-pneumonia especially in the early stages of infection. It is small wonder that the disease was confused with malaria fever by many respondents. The symptoms are generally fever, headache, loss of appetite, vomiting, drowsiness, stiff neck and convulsions may be present in children older than 2 years while in babies under 1, the above symptoms may be accompanied by inability to suckle. (Child Health, 1975)

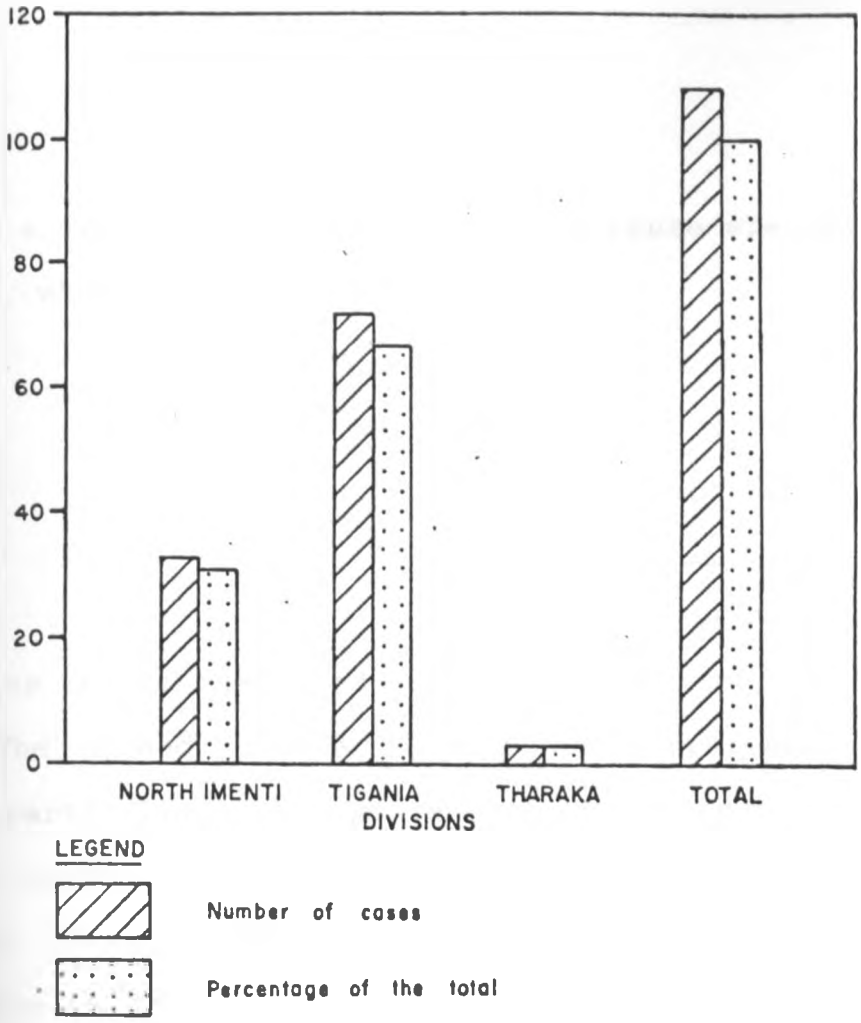
TABLE 4.6

MORTALITY BY MENINGITIS.

ZONE	NO. OF CASES	% OF TOTAL
NORTH. IMENTI	33	31
TIGANIA	72	66.7
THARAKA	3	2.8
TOTAL	108	100.00

Source: compiled from field data.

FIG. 4.6 MORTALITY CAUSED BY MENENGITIS



Death as a result of meningitis gave a cause specific death rate of 0.083, where

$$D_{1(0-5)} = 108$$

$$P_{(0-5)} = 1306$$

$$= \frac{108}{1305} * 1000$$

$$= 83/1000 \text{ deaths}$$

As earlier stated there had been an outbreak of meningitis in the study. The spread of the disease was perpetuated by the cold weather particularly in Tigania when the children bundle together to warm themselves either in bed or at the fireplace. The spread was also through mother to children when mortality was more noticeable in the young children than in adults.

4.1.5 BIRTHS DISORDERS AND PREMATURITY.

The new born period, which in this instance is taken as being the first month of life in which the infant is subjected to a variety of hazards which are peculiar to this time. The effects of birth trauma and anoxia, of congenital malformations of premature delivery and of hemolytic disease are all likely to be manifest during the first days or weeks of life. (Ellis, 1965)

At the same time, the infant is required to live suddenly from ultra-uterine life to independent existence, a change which involves a major readjustment of both respiratory and circulation with the possibility of mishap. All the tissues are in a state of

functional immaturity and can be disorganized more readily than at any other time, thus the new born infant, though carrying a passive immunity (from the mother) to certain specific infections, has little capacity for independent formation of antibodies and is particularly vulnerable if exposed to infection against which he bears a congenital protection. (Forfar, 1973)

prematurity.

In conformity with the standard code, international use for the comparison of records, a premature infant is defined as one weighing 2.5 Ib or less at birth irrespective of the estimated period of gestation.

The causes of death in premature infants is usually unknown. However, in the survey carried out, toxaemia and twin pregnancy were the two most important causes followed by antepartum hemorrhage, placenta previa and foetal deformity. The same causes of anoxia operate as in the case of full term infant, but in addition, the general feebleness of the premature may take the initial respiratory effect which is necessary to expand the lungs, a task beyond his powers

Infections are an important cause of morbidity and mortality during the neonatal period when they may culminate and cause death within hours. The newborn infants increased susceptibility to infection can partly be explained by the immaturity of his immune systems.

The male children show a higher incidence of morbidity with the survey depicting 61% of the deaths as a result of prematurity being male. A scientific observation by Malenga G.J (1982) states that this is due to lower IgM levels in males than females, suggesting a sex linked in immune responses.

Postnatally, the infant meets an environment full of bacteria thus increasing chances of heavy colonization and possible infection on the skin, umbilicus and the alimentary tract. Bacteria which are non-pathological in the older children, can be pathogenic to the infant. The situation is even worse for the infant born prematurely.

The occurrence of deaths to premature babies was found to be highest in Tigania , followed by tharaka and lowest in North Imenti. From the statistics obtained from the hospital records and the registrar's office, the following is depicted.

Cause specific death rates:-

$$D_{1(0-5)} = 103$$

$$P_{(0-5)} = 1306$$

$$= \frac{103}{1306} * 1000$$

$$= 79/1000 \text{ deaths}$$

Using the questionnaire response for mothers who have an infant or child; 16% of the children died from premature deaths, 9 of them had been born at home either under the attendance of a traditional birth attendant or a family member.

BIRTH DISORDERS.

Deaths resulting from birth disorders unlike those resulting from prematurity are not confined to infants only. Children as old as five or even older have died from malformations or disorders at birth. These disorders include stenosis which is the narrowing of the hollow organs such as the trachea, intestines or failure to enlarge with growth. (Apley, 1973) Other disorders include underdevelopment of body organs such as the brain or the heart. In such circumstances, whereas the child may survive neonatal death or the first year of life, death may result sooner or later.

TABLE 4.7

DEATHS BY BIRTH DISORDERS

ZONE	NO. OF CASES		TOTAL	% OF TOTAL
	MALE	FEMALE		
N.IMENTI	27	10	37	33.6
TIGANIA	41	25	66	60
THARAKA	6	1	7	6.4
TOTAL	74	36	110	100.00

Source: compiled from field data.

This gives a cause specific death rate of 84 per 1,000 infants and children's deaths in the study area, computed as below:-

$$D_{1(0-5)} = 110$$

$$P_{(0-5)} = 1306$$

$$= \frac{110}{1306} * 1000$$

$$= 84/1000 \text{ deaths}$$

The occurrence of high mortality due to birth disorders in Tigania may be explained by the fact that alot of babies in the area are not born in health centres and therefore any disorders, malformations or malfunctions may go undetected for a very long time. Of the 34 women who experienced a mortality, 27 or 62% had not attended antenatal clinic nor given birth in a hospital.

4.1.6 GASTROENTERITIS.

Gastroenteritis is diarrhoeal disease in young children where six or more watery stools with or without blood are passed in 24 hours (Mutanda, L. 1976). There are many causes of acute diarrhoea in children. Vomiting is an associated symptom. The nutrition state is very important, children who are not growing properly getting diarrhoea easily and when they do, it is more severe than in children with good nutrition.

Often a direct connection between diarrhoea and definite cause is difficult to establish. However for practical purposes, diarrhoea

may be as a result of parenteral infections, enteral infections, combination of factors and often certain causes are unknown.

In children, almost any acute infection outside the digestive tract can cause diarrhoea with or without vomiting. These are usually fever. The most common causes are malaria, measles, pneumonia, tonsillitis and urinary tract infections. All these are referred to as parenteral infections. (Leeuwenburg, 1978)

Direct infection of the intestinal tract itself may be caused by certain bacteria particularly the bowel parasites. These can be pathogenic in infants. Such infections are referred to as enteral infections.

The term, weaning diarrhoea is normally used to describe a combination of factors causing diarrhoea in children between 6 and 18 months of age, the so called weaning period. A weanling is a child in progress of transition from breastfeeding to an adult type of diet. In this particular group, new foods are introduced which contain large number of microorganisms (pathogenic or non-pathogenic). The new foods may be unsuitable, undigestible or ill cooked. There may already be a varying degree of malnutrition and lower resistance to infections. There may have been insufficient breast milk or breastfeeding may have been stopped abruptly.

Bottle feeding is another important hazard which occurs during the weaning period. The bottle usually can not be cleaned properly and contamination with bacteria or any other organism is inevitable. Many children in the survey died either directly or indirectly due to diarrhoea as a result of bottle feeding.

15% of them died as a result of acute diarrhoea. Out of these 15, 9% of the mothers had breastfed their children for eight months or less. As a result they had put them on the bottle feed which very likely contributed to the infection resulting in diarrhoea. Often these mothers, not knowing the risks involved, stopped breastfeeding and introduced the bottle for prestige reasons.

Defects of intestinal enzymes (these are essential for the breakdown of carbohydrates, proteins and fats to enable a proper digestion of food). Sometimes in children with malnutrition, there is temporary lack of lactase, an intestinal enzyme which splits the sugar lactose into glucose and glucotose. If this enzyme is lacking, children get diarrhoea and the stools contain alot of undigested sugars.

There is a minimum of fluid required to maintain the basic body functions and to make up for those loses which occur through the skin, lungs, urine and stool in every child every day. This basic fluid requirement can just maintain the basic body functions at rest and is called maintenance fluid. Children are particularly

dependent on a proper fluid balance. Their normal daily fluid turn over per Kg weight is about 5 times as much as in adults. Fluid turn over means that a certain amount of fluid is passing through the body every day. (Masembe, 1977) If diarrhoea occurs, the child can rapidly lose a considerable amount of his body fluid and clinical sign of dehydration will develop rapidly. If the fluid loses are not replaced in time, dehydration will result in death very fast.

Diarrhoea stools do not contain just water but also a considerable amount of electrolytes mainly sodium, potassium chloride, and bicarbonate are lost. The baby tries to compensate for this water and electrolyte imbalance whenever fluid loss occurs. The kidneys retain water and electrolyte and the urine output is reduced. As long as the kidneys can be supplied with enough fluids to produce sufficient urine, the compensation mechanism works alright but if fluid and electrolytes are not replaced in time, death then is inevitable. (Masembe, 1977)

Going back to the death records, we find that diarrhoea related diseases accounted for 7.8% of all diseases during the study period. These were 102 out of the total 1306. Diarrhoea is definitely one of the most common symptom and important cause of death during the first five years of life. Other than the incidence where it was listed in the death certificate as being the main cause of death. Many of the other diseases had diarrhoea as a

symptom or having occurred just before death. The occurrence is as indicated below:

TABLE 4.8 MORTALITY AS A RESULT OF GASTROENTERITIS AND OCCURRENCE OF DIARRHOEA IN OTHER INSTANCES.

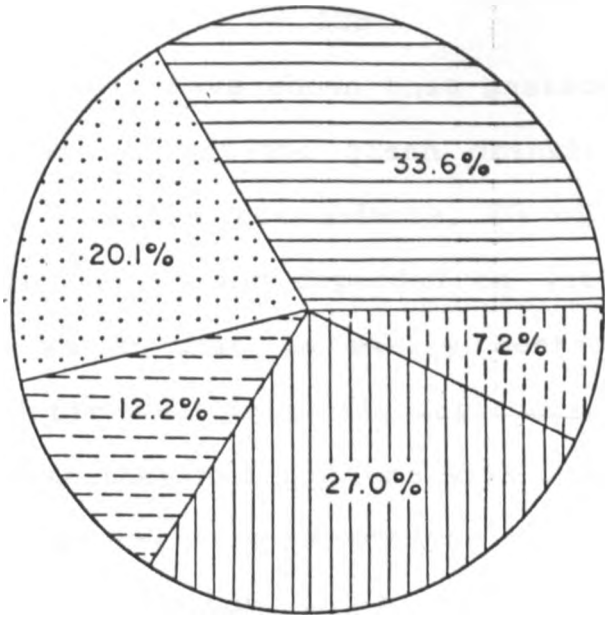
DISEASE		NO. OF CASES	%OF TOTAL*
Gastroenteritis alone		102	7.8*
Broncho-pneumonia)		61	21.9**
Malaria)	and	37	29.8**
Measles)	diarrhoea	82	46.6**
Kwashiorkor)		22	25.6**

Source: Compiled from field data.

* - % total number of deaths occurring during the study period.

** - This is % of the total number of those that died as a result of the disease being the main cause of death.

FIG. 4.7 DEATH CAUSED BY GASTROENTERITIS AND DIARHOEA OCCURRENCES IN OTHER INSTANCES



LEGEND

	Gastroenteritis alone	33.6%
	Diarhoea and Pneumonia	20.1%
	Diarhoea and Malaria	12.2%
	Diarhoea and Measles	27.0%
	Diarhoea and Kwashiako	7.2%

Studies (Newland 1981) have shown that gastroenteritis is caused by lack of proper sanitation, clean drinking water and poor feeding habits. From the respondents, 69 of them did not have access to running water and depended on water from rivers or wells. This is water that is easily contaminated. 97 of the respondents used firewood primarily for cooking and even then, 82 of them stated that they had problems with procurement of the wood because they had to trek long distances to get it. Others stated that it was expensive to buy, while others expressed restrictions to enter the forested areas as contributing to their woes. It is no small wonder then that so many children suffered from diarrhoea because even boiling the drinking water required extra inputs which were often not available.

Contamination from toilets was another cause of diarrhoea in children. 72 of the respondents had latrines with earthen floors. 10 shared latrines with neighbours (that is they did not have any of their own). Considering that this survey was carried out in a basically rural community, it should not be surprising that so many children suffer from diarrhoea.The occurrence of gastroenteritis cause deaths was as below:-

TABLE 4.9 DEATHS CAUSED BY GASTROENTERITIS.

NO. OF CASES				TOTAL	% OF TOTAL DEATHS
UNDER 1		<>5			
M	F	M	F		
35	31	23	13	102	7.8

Source: Field data

TABLE 4.10

OCCURRENCE AND DISTRIBUTION OF DEATHS AS A RESULT OF GASTROENTERITIS.

ZONE	NO OF CASES	% OF TOTAL
NORTH IMENTI	45	44.2
TIGANIA	23	22.5
THARAKA	34	33.3
TOTAL	102	100.00

Source: Field data 1989.

From the Table 4.10. it is evident that 64.7% of all deaths that occurred as result of gastroenteritis were in the children under 1 year. This may be attributed to the fact that this is the age bracket when babies begin to crawl and when likelihood of infection is highest.

As earlier noted, breastfeeding has a role to play in diverting infection, however many mothers who are engaged in either full time

employment are not able to breastfeed for long. This fact may explain the high incidence of diarrhoea in North Imenti where many women are engaged in some form of employment particularly casual labour whereby the children are left under the care of other children and are weaned early. In Tharaka, the unavailability of clean water, as this is a semi-arid zone may contribute to the large percentage. The two issues may not apply to Tigania where women breastfeed longest and in many instances are not engaged in any form of employment.

Deaths as a result of gastroenteritis gave a cause specific death rate of 77 per 1000 deaths, calculated as below:-

$$D_{1(0-5)} = 102$$

$$P_{(0-5)} = 1306$$

$$= \frac{102}{1306} * 1000$$

$$= 77/1000 \text{ deaths}$$

4.1.7 **MALNUTRITION.**

Malnutrition means wrong or faulty nutrition. The fault may be too little or even too much food. However, the commonest form of malnutrition in this study is a shortage of proteins and/or energy giving foods. Diseases associated with this deficiency were recorded in the clinic and death certificates as protein-calorie-malnutrition (PCM) or protein-Energy-malnutrition (PEM) meant that they were suffering from kwashiakor (a protein deficiency) marasmus (general malnutrition) and were often underweight. The

major clinical syndromes resulted from differences in the protein and energy intake and their relative importance. In underweight children, both the protein and the energy were lower than in normal children. In marasmus, the intake of nutrients was much lower than required. It may be considered as balances starvation. In kwashiakor cases the energy intake was about normal but the protein intake was much lower. In the cases of marasmus/kwashiakor, both energy and protein intake were much lower, the lack of protein being the most serious.

How then are these related to morbidity and mortality?

Lack of these main nutrients in the food results in growth failure while the protein deficiency has a further effect on the immune system of the body. The defense mechanism does not work properly in infections. If the protein concentration in the blood becomes very low, hypo-protein anaemia (oedema) results due to the decreased colloid osmotic pressure. As a result, metabolic process runs at a slow rate. Glucose and temperature regulation are not properly controlled. Chronic malnutrition disturbs the bowel and leads to malabsorption. The activities of intestinal enzymes are reduced and thus may cause severe diarrhoea due to intolerance of sugar. (Anon, 1968)

As a result of PCM, children are underweight and develop less than well nourished children. They are at a higher risk of picking

infections. These infections are more serious than in well nourished children and more easily cause death.

Malnutrition therefore in itself is not a direct cause of death but children suffering from kwashiakor are prone to several opportunistic diseases particularly those related to intestinal infections. A large number of the death records indicated that the immediate cause of death (see Appendix 2) was malnutrition and the other symptoms followed, indicating that other diseases that have been symptoms were actually opportunistic. Deaths as a result of the immediate cause being malnutrition accounted for 6.6 % of all deaths during the study period, giving a cause specific death rate of 66/1000.

$$D_{i(0-5)} = 86$$

$$P_{(0-5)} = 1306$$

$$= \frac{86}{1306} * 1000$$

$$= 66/1000 \text{ deaths}$$

The occurrence and distribution of these deaths was as below;-

TABLE 4.11 DEATHS AS A RESULT OF MALNUTRITION.

NO. OF CASES				TOTAL	% OF TOTAL
UNDER 1		<>5			
MALE	FEMALE	MALE	FEMALE		
29	16	17	24	86	6.6

Source: Field data

TABLE 4.12

DISTRIBUTION AND OCCURRENCE OF DEATHS AS A RESULT OF MALNUTRITION.

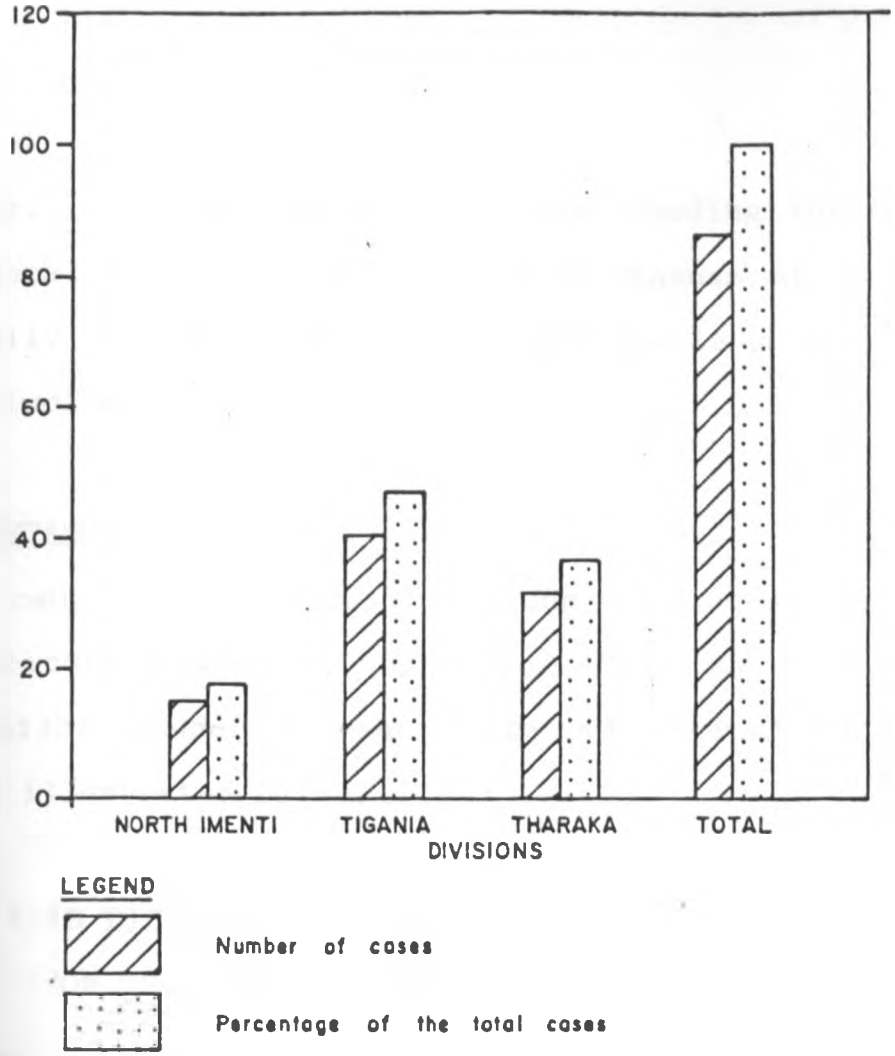
ZONE	NO. OF CASES	% OF THE TOTAL
NORTH IMENTI	15	17.4
TIGANIA	40	46.5
THARAKA	31	36.1
TOTAL	86	100.00

Source: Field data

The occurrence of malnutrition in Meru District is a paradox in that almost every part of the district produces some sort of protein. Even the arid and semi-arid Tharaka division, grows groundnuts, pigeon peas and cowpeas in plenty while in Tigania there is blackbeans and in North Imenti there is plenty of beans. Other than the plant proteins, animal protein especially milk is almost readily available too. 92% of all respondents stated that they had either a cow or goat producing milk while all the respondents stated that they produced at least one of the pulses that is either beans, cowpeas, pigeon peas or black beans.

The only explanation that may be offered for the occurrence of protein malnutrition is ignorance. Beans are seen as an inferior sort of food while eating of potatoes is prestigious. This prejudice is carried on feeding children and the result is

FIG. 4.8 DISTRIBUTION AND OCCURENCE OF DEATHS AS A RESULT OF MALNUTRITION



malnutrition. Other mothers continue feeding their children on traditional diet, porridge and green bananas after weaning them especially in Tigania while in Tharaka yam is used as a staple for all including weaning babies.

4.1.8 TETANUS.

Deaths caused by tetanus infections accounted for 1.0% of all deaths recorded in the study period. Majority of the deaths were those children under one year of age and particularly the neonates. This is illustrated below:-

TABLE 4.13 DISTRIBUTION AND OCCURRENCE OF MORTALITY AS A RESULT OF TETANUS INFECTIONS.

ZONE	NO. OF CASES				TOTAL
	UNDER 1		<>5		
	M	F	M	F	
NORTH IMENTI	1	-	-	-	1
TIGANIA	4		1	-	9
THARAKA	2	1	-	1	4
TOTAL	7	5	1		14

Source: Compiled from field data.

Deaths by tetanus gave a cause specific death rate as computed below:-

$$D_{1(0-5)} = 14$$

$$P_{(0-5)} = 1306$$

$$= \frac{14}{1306} * 1,000$$

$$= 11/1000 \text{ deaths}$$

Tetanus infection of the newborn acquired during or after delivery has a very high mortality. The tetanus bacteria gain entrance to the newborn's body through the stump of an umbilical cord which has been cut by unsterile instrument or treated in an unclean manner. Tetanus bacteria can only grow in anaerobic conditions and these are often present in unclean crusted umbilicus.

It is important to note that children who survive neonatal tetanus do not develop immunity against tetanus infection. The parts of entry of tetanus bacteria in older children are commonly wounds or punctures of limbs through injuries, burns, unsterile vaccination or injections. The symptoms of these infections are similar to those of newborns which are inability to open mouth and painful muscle spasms without loss of consciousness.

The interviewed women who had lost a child reported that the symptoms were similar to those of fever. 34% of all the births in the survey had taken place at home under the attendance of a traditional midwife who may have used unsterile knives for cutting the umbilical cord and therefore causing the infection. Another cause of the infection is the smearing of the umbilicus stump with ashes or dung.

Tetanus infection of the newborn also known as tetanus neo-nartum is caused by infection of the umbilical stump. Tetanus typically develops during the first or second week of life and is fatal in almost 70-90% of all the cases (Foster, 1984) though medical may reduce it to lower than 40%. Seven factors have been identified as thought to affect the risk of neonatal tetanus infection and these are environmental exposure to tetanus organisms, sex of the child,

place of delivery, type of birth attendant, cord care practice, immunization status of the mother and socio-economic status (WHO, 1983)

Using the above seven clauses, the tetanus mortality risk in the study area can be expressed as below.:-

Environmental exposure to tetanus organisms.

The three environmental zones used for the survey show distinct variation in the exposure to the tetanus organism. The occurrence of tetanus caused deaths in Tigania was highest followed by Tharaka. This can be attributed to the fact that in Tigania, it is still very common to find domestic animals particularly goats, sheep, calves and domestic fowls sharing sleeping quarters with people. The mixture of animal dung and urine is a ready culture for tetanus organisms breeding and therefore infection is very likely.

Place of delivery.

Delivery at home carry a high risk of neonatal tetanus, though delivery does not guarantee protection. This is so because hospital deliveries particularly in the ever crowded government hospitals are usually 2-3 days and infection may occur after discharge. In Tigania where 61% of all births occurred at home had the highest incidences of tetanus infection. Despite having 63% of all births occurring at home, Tharaka had 50% less than Tigania, while only 8% of all births in North Imenti took place in the home.

Type of attendant.

Chen, P. (1976) in his studies in Malaysia shows that infants delivered by untrained attendants, family members or traditional

birth attendants (TBAs) had a high rate of neonatal tetanus. Although this is not very clearly evident from the study, it is likely that the births occurring at home had a high risk of tetanus infection. This is more so particularly due to the fact that those mothers who delivered at home did not attend prenatal clinics and were therefore not trained in hygienic delivery.

TABLE 4.14

ANTE-NATAL ATTENDANCE AND PLACE OF DELIVERY.

ZONE	SURVEYED		ATTENDED		NO DELIVERED AT HOME	
	NO.	%AGE	NO.	% AGE	NO.	%AGE
NORTH IMENTI	54		50	92.6	5	9.3
TIGANIA	34		24	70.6	21	61.8
THARAKA	12		4	33.3	10	83.3

Source: compiled from field data

Cord care practices.

Three aspects of umbilical cord care influences the risk of neonatal tetanus, the instrument used to cut the cord, the process of tying or not tying and the materials applied to the untreated umbilical stump. Although the research did not get actual statistics on the cord care practices, the interviews with the midwives revealed that they had special tools for birth attendance which were used for nothing else but that. This varied from one to the other. There were those who used razor blades new or cleaned and those who used special blades called "kirunya"

Immunization status of the mother.

Two doses of tetanus toxoid administered at least one month apart and at least one month prior to delivery are nearly 100% effective in preventing neo-natal tetanus. Thus, lack of tetanus immunization of the mother is a significant risk factor for neo-natal tetanus in the infant. This immunization is usually given during the ante-natal clinic and as was found in the survey, few mothers complete their ante-natal clinics and therefore did not receive their anti-tetanus dosage.

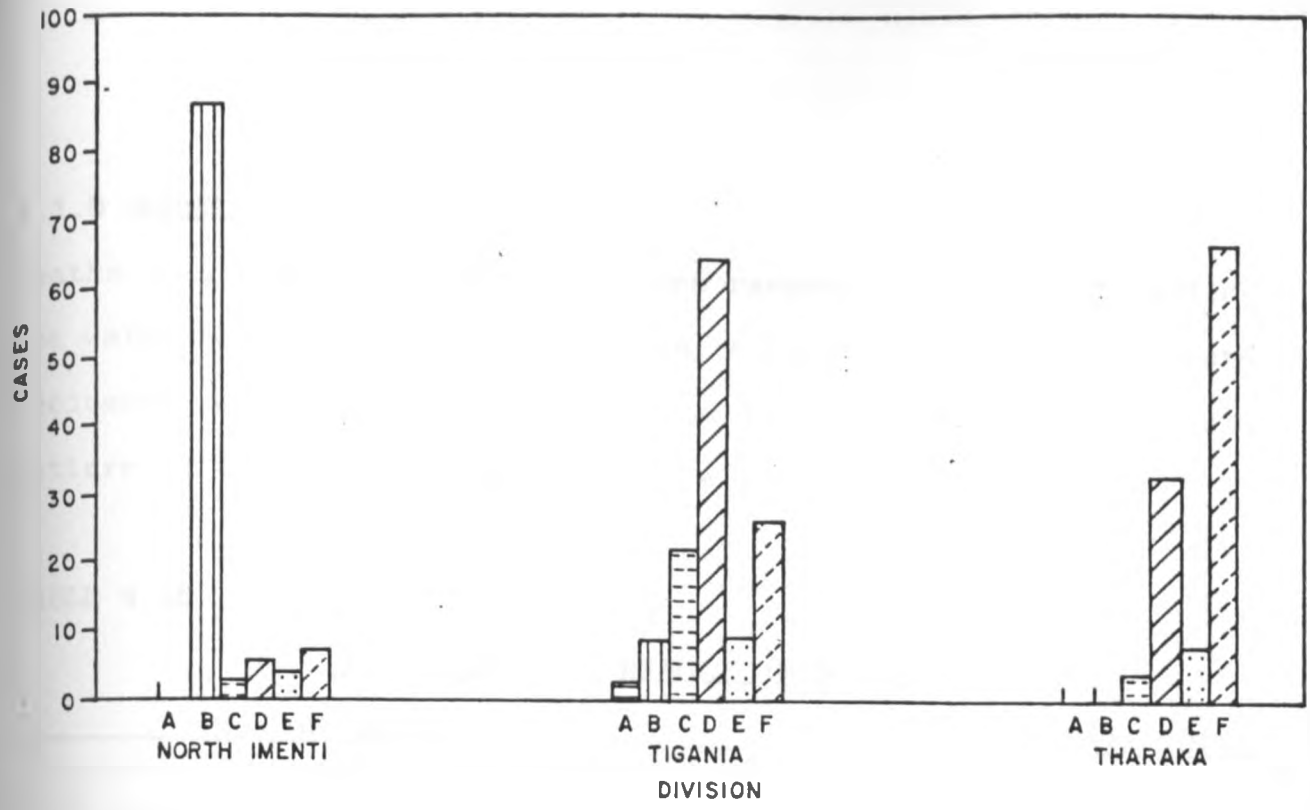
TABLE 4.15

ANTE-NATAL ATTENDANCE.

ZONE	NO. IN THE SURVEY		COMPLETED		PARTIALLY		DID NOT	
	NO	%AGE	NO.	%AGE	NO	%AGE	NO.	%AGE
NORTH IMENTI	54		47	87.0	3	5.6	4	7.4
TIGANIA	34		3	8.8	22	64.7	9	26.5
THARAKA	12		-	-	4	33.3	8	66.7

Source: compiled from field data.

FIG. 4.9 ANTE – NATAL ATTENDANCE



LEGEND

A — Number that completed

B — Percentage that completed

C — Number that partially completed

D — Percentage that partially completed

E — Number that did not attend

F — Percentage that did not attend

4.1.8 BURNS.

Deaths as a result of sustained burns ranged from burns, paraffin, hot water scalds, fire and hot foods. A large number of these were accidents and therefore difficult to prevent. However a certain pattern of occurrences was noticeable.

TABLE 4.15

MORTALITY AS A RESULT OF BURNS.

NO. OF CASES				TOTAL	% OF TOTAL
>1		<>5			
MALE	FEMALE	MALE	FEMALE		
7	2	7	10	26	1.9

Mortality by burns gave a cause specific death of 0.006 computed as below:

$$D_{1(0-5)} = 26$$

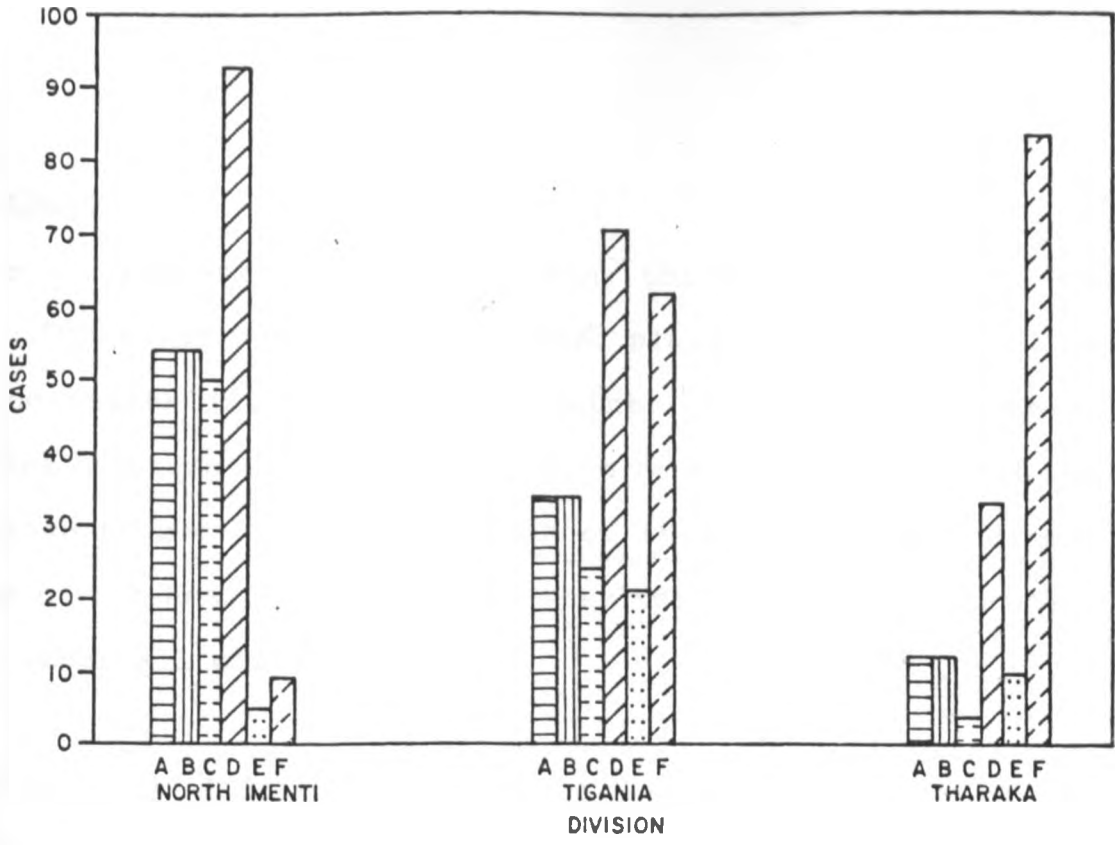
$$P_{(0-5)} = 1306$$

$$= \frac{26}{1306} * 1{,}000$$

$$= 20/1000 \text{ deaths}$$

The occurrence of 7 males versus 2 females under the age of 2 may be attributed to the adventurous nature of the male while the almost equal number of these under 5 may be as a result of lack of proper parental care. This is more so considering the fact that by the time the children are 2 years old, the mother already has another. Since the youngest gets the most attention, the toddler is in many instances neglected and therefore prone to accidents.

FIG. 4.10 ANTE – NATAL ATTENDANCE AND PLACE OF DELIVERY



LEGEND

A Number in the survey

B Percentage of surveyed

C Number in attendance

D Percentage in attendance

E Number delivered at home

F Percentage delivered at home.

4.2 CONCLUSION.

A child's environment is all of the many things that surround him everyday. These include where he sleeps, plays, eats, the water he drinks and bathes in, the air he breathes, the latrine he uses, the clothes he wears , the other children he plays with and all the other things around him. Because each of these items has a direct influence on his health, it is vital that their quality be the best possible under all circumstances.

Exposure to many different infections is a normal part of the childhood. These range all the way from mild cold or infection to a life threatening case of measles or Tuberculosis.

An hypothesis by Amon (1968) that the high case fatality ratios are due to virulent strains of disease particularly measles in developing countries can not be conclusively entertained in this study. Instead, the quality of health care in and outside the home was an explanatory factor. Another factor may be the occurrence of measles and other pathological infections is often complicated by many secondary infections whose presence greatly increases the risk of death. Among the most serious complications observed in this study has been diarrhoea and broncho-pneumonia.

In testing the hypothesis that Ho; there is no significant association between the levels of malnutrition and the incidences of pathological diseases; the statistics used are the number of children who suffered malnutrition and those who suffered other pathological diseases. These were cross-tabulated and the hypoth

association between the occurence of malnutrition and the incidence of pathological diseases. Malnutrition accounted for 76% of pathological diseases occurrences. Using the X^2 index. the calculated X^2 was 30.99 with 12 degrees of freedom while the critical X^2 was 13.5 at 0.999 significant level;. Since the calculated X^2 is greater than the tabulated X^2 , the Ho; is rejected and the alternative that; there is a significant association between the levels of malnutrition and the incidence of pathological diseases.

Severity of the disease is also intensified by the nutritional status. The presence of malnutrition greatly increased the case of fatality of measles from the hospital records observed.

This chapter can therefore conclude that immuno-competence in children is seriously impaired when the children are malnourished. Therefore, although nutrition does not reduce the incidence of infection well rounded children have decreased severity of infections.

CHAPTER FIVE

MORTALITY DIFFERENTIALS IN THE STUDY AREA.

5.0 INTRODUCTION

This chapter seeks to examine the inherent mortality differentials in the study area. The differentials will be based on four variables namely socio-economic, demographic, ecological and medical. The socio-economic variables include such sub-variables as education attainment of the mother whether primary, secondary, vocational or none at all. Marital status of the mother will be examined whether single, married, divorced/widowed/separated. Religious affiliation will also be considered.

Whereas there are several demographic factors that influence the levels of mortality, this study will take into account only the parity of the dead child, the birth interval, (this will be the interval between the dead child and one before and the one after), sex of the dead child and age of the mother at the time of death and finally the total population density of the study area.

Ecologically, such factors as the average of rainfall totals in the study and the agricultural productivity in terms of cash crops and food crop production both will be considered in tonnage.

Medical aspects such as the number of medical personnel that is doctors, nurses, clinical officers, the availability and accessibility of medical facilities namely hospitals, dispensaries and health centres will be assessed.

All these variables, demographic, ecological, socio-economic and medical factors all have certain influences on levels of mortality. This chapter will seek an explanation as to existing relationships, negative or positive between the above variables and childhood mortality.

It is also in this chapter that the hypotheses will be tested.

5.1 INFANT AND CHILDHOOD MORTALITY LEVELS

Before embarking on the inherent infant and childhood mortality differentials in the district, it is essential to work out the childhood and infant mortality levels in the three study zones namely N..Imenti, Tigania and Tharaka for high potential, middle potential and low potential zones, respectively. The methodology used in this instance is the Brass method (1968). This method uses census data, using the information of children surviving from children ever born to women aged 15-19, 20-24, 25-29, 30-34, 35-39, 40-44 and 45-49. To get the conventional measures of mortality, the method converts the proportions surviving and proportion dead among children ever born (CEB) to women in different age groups. Given constant fertility and mortality, it is possible to estimate the proportion ever born who survive to age 1,2,3,4,10,15, ... 35, from the proportion ever born to mothers in different child bearing age groups.

The values of q(x) for q(1) and q(10) are usually unreliable and neglected due to unreliability of figures and memory relapse by

women whose responses are not representative of current mortality expenses. It is for this reason that this study will use q(o) as a measure of childhood mortality in the 3 study zones.

The data required for this objective are:-

1. Children ever born (CEB) classified by five year age group of mothers.
2. The number of children dead (CD) classified by five year age group of mothers.
3. The total number of women aged 15-49 (FPOP) classified by 5 year age groups.

WORK OUT

STEP ONE

The average parity per woman P(i)

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

Where CEB denotes the number of children ever born by women in the age group (i); and $FPOP_{(i)}$ is the total number of women of that age group (i).

STEP TWO

The proportion of children dead in each age group of the mother D_i

$$D_{(i)} = \frac{CD_{(i)}}{CEB_{(i)}}$$

Where $CD_{(i)}$ is the number of children dead reported by women in age group (i) while $CEB_{(i)}$ is the children ever born in the same age group.

STEP THREE

$K_{(i)}$ multiplier obtained in the relation.

$$K_{(i)} = a_{(i)} + b_{(i)} [P_{(i)}/P_{(2)} + C_{(i)} [P_{(2)}/P_{(3)}]$$

$a_{(i)}$, $b_{(i)}$, $C_{(i)}$ are constants estimated by regression analysis of a large number of model cases. The differences for this study are derived from West Model life table given in Appendix 5.

STEP FOUR

The probability of dying by age (x)

$$q_{(x)} = D_{(i)} \cdot K_{(i)}$$

Where

X = 1,2,3,5,10,20 and

(i) = age groups 1,2,3,4,5,6, and 7 for 15-19, 20-24, 25-29, 30-34, 35-39, 40-45 and 45-49 respectively.

The mortality level was then calculated per 1000 deaths and the following were the results for each of the study zones.

TABLE 5.1

NORTH IMENTI

AGE GR.	FPOP	CEB	NO.DEAD	$D(_1)$	$P(_1)$	$K(_1)$	$[K(_1).D(i_{))}$	MORTALITY LEVEL
15-19	14225	12840	565	.044	.902	2.016	.089	89/1000
20-24	10560	9872	644	.065	.935	1.218	.082	82/1000
25-29	8711	8200	454	.055	.941	1.175	.065	65/1000
30-34	6698	6403	191	.029	.956	1.406	.042	42/1000
35-39	5141	4936	144	.029	.960	1.473	.043	43/1000
40-44	4549	4342	182	.042	.954	1.479	.049	49/1000
45-49	3661	3494	265	.076	.954	1.459	.052	52/1000

TABLE 5.2

THARAKA

AGE GR.	FPOP	CEB	NO.DEAD	$D(_1)$	$P(_1)$	$K(_1)$	$[K(_1).D(i_{))}$	MORTALITY LEVEL
15-19	3238	2224	298	.134	.687	.708	.0948	95/1000
20-24	2404	2948	1042	.353	1.226	.218	.077	77/1000
25-29	1983	1896	397	.209	.956	.330	.069	69/1000
30-34	1525	1458	287	.196	.956	.229	.045	45/1000
35-39	1171	1124	399	.392	.959	.130	.051	51/1000
40-44	1036	984	102	.104	.949	.550	.057	57/1000
45-49	834	796	105	.188	.954	.329	.062	62/1000

TABLE 5.3

TIGANIA

AGE GR.	FPOP	CEB	NO.DEAD	$D(_i)$	$P(_i)$	$K(_i)$	$[K(_i).D(i)]$	MORTALITY LEVEL
15-19	9235	8336	934	.112	.902	1.201	.0134	34/1000
20-24	6856	6409	1204	.187	.935	.655	.0123	23/1000
25-29	5655	5407	459	.085	.956	1.186	.0101	101/1000
30-34	4348	4157	295	.071	.956	1.388	.0098	98/1000
35-39	3338	3205	195	.061	.960	1.485	.0089	89/1000
40-44	2953	2819	171	.061	.954	1.490	.0091	91/1000
45-49	2377	2268	149	.066	.954	1.471	.0097	97/1000

The picture depicted here is that, there are distinct mortality level differentials in the study area with North Imenti having the lowest levels of infant and childhood mortality; an average of 60/100 deaths, Tharaka with 65/1000 deaths and Tigania had the highest with 104/1000 deaths. As earlier stated, certain hypotheses would be subjected to non-statistical tests and therefore the Ho: There are no significant differences in the levels of infant and childhood mortality in the study region; is rejected on the basis of the findings of Brass method of estimating infant mortality. These mortality differentials are a reflection of socio-economic status of the study zones. North Imenti is definitely more well endowed than the other zones with medical facilities both private and public. Other than being a high

potential area, in which agricultural production is highest. North Imenti enjoys good communication network (see chapter two) of all weather murram roads and tarmac roads as well. The district headquarters is also located in the division, therefore provision of social amenities such as schools, piped water and medical facilities are closely monitored.

Whereareas Tharaka is a semi-arid zone with low agricultural productivity, the zone is sparsely populated and the few social amenities available are probably adequate. Despite having no hospital in the division, the health centres and dispensaries serve the population well. Unlike Tigania where there are more health facilities but the population/health facility ratio is much more higher standing at 26,262 persons per facility, compared to 9,415 for Tharaka and 6,188 persons per facility in North Imenti (see Table 5.16). Looking at the above statistics, Tigania has to seek alternative medical services to meet its inhabitants needs and therefore the frequent indication of visits to traditional medicine men and herbalists. 55% of the mortality occurrences in Tigania took place at home. This could have been that the child did not receive any conventional medical treatment and probably died in the care of traditional healers.

Another possible explanation to the high mortality rates in Tigania can be attributed to the people´s attitudes towards cash crop production. Miraa is a crop that fetches thousands of shillings

every day, yet this money is not invested in any profitable manner. There is very little overflow effect in the form of provision of social amenities such as health facilities, schools and provision of piped water. Whereas money earned from cash crops would be utilized to secure better nutrition, clothing, shelter or medical care for the family members, the case is not so in Tigania where the family earnings are not reflected in their social status or standards of living.

The mortality differentials in the study are not a reflection of the agricultural potential of the different study zones but there are other contributing factors occurring at individual and family levels, for instance among the educated and illiterate, married, single and so on. These and other issues form the basis of the following discussion.

5.2 SOCIO-ECONOMIC VARIABLES

5.2.1. EDUCATION LEVEL OF THE MOTHER

The importance of maternal education in relation to infant and childhood mortality is an indirect link through health, child care and general nutrition. This ranges from change from unhealthy traditional diets to better nutritional foods and supplements, more hygienic baby care such as boiling of milk and also includes better preparation of foods and utensils.

Education also depending on its level is an avenue out of poverty where family income earning is improved.

To assess the mortality differentials occurring in relation to the education level of the mother, this study divided the levels into primary, secondary, university and vocational. Relationships, correlations and the hypothesis concerning the education level of mother and occurrence of infant and/or childhood mortality was tested.

From the survey's sample of women who experienced mortality, 49% had received some primary education, 12% had some secondary schooling, 8% had some post secondary, college, technical or vocational while 31% had no education at all. The variables which were correlated with the education level of mother in as far as occurrence of infant or childhood mortality were mother occupation, children ever born, cause of death of the child, parity of the dead child, birth interval of the dead child, the one before and one after, place of death, length of breastfeeding, immunization history, crop production and problems faced in trying to get medical attention for themselves and the children.

The rationale behind this is that this study is using data of women who have already experienced an infant or childhood mortality and therefore the differentials are obtained in the numbers of deaths per category of education level.

Secondly, maternal education has been found to have a bearing on the likelihood of an infant mortality occurring (Bern, 1976-78), such that evidence of a relationship between women's roles and the mortality of their children is much difficult to obtain. This is because while educational levels remain constant, once women attain maturity employment, marital status and so on may change, the current status may bear little relationship to the situation at the time when the death occurred or when the child's health began to deteriorate. Such that other variables linked to educational level may be attributed to the occurrence of mortality and not education per se. It is for this reason that this study opted to carry out a multiple regression analysis with education level as the independent and other variables as the dependent.

From the 49 women who had some primary schooling, 44% were unemployed living as housewives/farmers entirely dependent on their husbands and shambas for upkeep, 8.2% were involved in some form of business, 14.3% were casual labourers and 8.2% were formerly employed while 24% were unemployed and did not have any sort of gainful engagement and depended entirely on their spouses. On the other hand women who had no education at all were 74% as housewives/farmers, 3% had some sort of gainful employment while 19% had no gainful occupation.

Using the contingency coefficient statistical test (c), it was found out that the relationship between education level and mothers occupation was 0.85. This gave a very strong positive relationship between the two variables.

The other phenomena that were found to have been influenced by mothers education were children ever born, immunization and food crops, cash crop production and birth intervals. Using the contingency coefficient it was found out that it had a value of 0.4, 0.3, 0.03, 0.1, 0.3 and 0.5 respectively. All these gave a positive and comparatively strong relationships.

Taking these factors into account and how they are influenced by levels of education it can be stated that infant and childhood mortality is highest among women with low levels of education namely primary and no education at all. Women with the lowest or no education at all also had low paying (casual) jobs or depended on small scale farming or on their husbands for their livelihood. In other words they lowly supplemented the family earnings. Of the 49 women who had received primary education, 59% had more than 5 children, while 56% of those who had no education at all had more than 7 children. The average number of children ever born per woman was 6.3 and there was little discrepancy between those women who had received any form of formal education and those who hadn't.

The other aspect positively correlated with mother's education was immunization. With a contingency coefficient value of 0.3. This is not a very strong relationship, but is indicated that mothers education did influence immunization history. A tabular illustration of cause of death by 3 immunizable diseases and level of mothers education is as below:-

TABLE 5.4 IMMUNIZATION VERSUS MOTHER'S EDUCATION.

EDUCATION LEVEL		PRIMARY		SECONDARY		POST SECONDARY		NONE AT ALL	
CAUSE OF DEATH	TOTAL DEAD	I	NI	I	NI	I	NI	I	NI
Meningitis	9	2	3	0	0	0	1	2	1
Measles	14	0	3	2	1	2	0	3	3
Tetanus	2	0	1	0	0	0	0	0	1
TOTAL I	25	2	7	2	1	2	1	5	5

NB: I - Immunized NI- Not Immunized

This indicates that 40% of the children who died from immunizable diseases were born to women who had received no education at all while 36% were born to women who had some primary education and 24% were born to mothers who had either some secondary schooling, some post secondary, technical or vocational training.

Food and cash crops production had a relatively weak correlation with a value of 0.03 and o.1 respectively. This is an indication that food and cash crops production at the family level was really not influenced by the education level of the mother but the implications of this will be discussed later.

On the other hand birth intervals between the dead child and the one of a lower and higher parities showed a distinctly strong correlation of 0.3 and 0.5 respectively. A birth interval of less than 2 years was characteristic between the dead child and the one after. Variations with mothers education was even more distinct with mothers who had no education having shorter birth intervals between the dead child and the one born between dead child and the one before was also comparatively short, a higher percentage were first order births.

The link here is that increasingly educated mothers have fewer children ever born, have more children immunized and bigger birth intervals than uneducated mothers and those with primary education. Consequently more infant and childhood mortality occurrences was found among mothers who had no education at all or had some primary schooling than among those women who had some secondary schooling and post secondary schooling.

TABLE 5.5

BIRTH INTERVALS VERSUS EDUCATION LEVEL OF THE MOTHER

BIRTH INTERVAL 1.	MOTHERS EDUCATION LEVEL			
	PRIMARY	SECONDARY	POST SECONDARY	NONE
1 YEAR	15	4	3	8
2-3 YEARS	7	4	3	6
OVER 4	2	3	1	0
NONE	22	5	4	

Source: Compiled from field data, 1989.

TABLE 5.6

BIRTH INTERVAL 2.	MOTHERS EDUCATION LEVEL			
	PRIMARY	SECONDARY	POST SECONDARY	NONE
1 YEAR	10	5	2	13
2-3 YEARS	21	5	3	13
OVER 4	2	2	6	8
NONE	2	1	1	2

Source: Compiled from field data, 1989.

The high occurrence of infant and childhood mortality in instances where there was no interval (none) was an indication that either the occurrence was a first parity birth (as in table 5.2) or a last parity birth (as in table 5.3). Occurrence of parity 1 deaths was highest among women who had some primary schooling and lowest among those women who had some post secondary schooling or training. This may be attributed to school girl pregnancies who were too young for child birth and whose children die either due to birth disorders or complications. The high number of women with primary schooling who have a birth interval of 2-3 years may be explained by the fact that they were single when the infant death occurred and waited awhile before having another baby.

The above discussed factors were found to be positively correlated to the education level of the mother in as far as infant and childhood mortality is concerned. They are therefore explanatory factors in the testing of null hypothesis;

H_o: There is no significant relationship between mothers education and the occurrence of infant and childhood mortality.

H_1:

The critical X^2 value in this hypothesis was 13.5 with 12 degrees of freedom at 0.999 significant level. The calculated value of X^2 was 32.909 at 12 df. The H_o: was therefore rejected and the alternative H_1: accepted stating that; There is a significant relationship between mothers education and the occurrence of infant and childhood mortality.

In an attempt to explain the ways in which mother's education influences occurrence of infant and childhood mortality, the following aspects will be addressed; total number of children ever born, birth intervals, food and cash crop production at the family level and immunization procedures.

Education of a mother plays a major role both in increasing skills and knowledge as well as the ability to deal with new ideas and in providing a means for the incorporation of useful foreign cultural elements. The link in increased education and reduced incidence of infant and childhood mortality is that, the more educated mother was in a better position to make decisions concerning her child. One of the aspects involved is the fact that the mother is less likely to attribute her child's illness to certain taboos and therefore seek medical attention earlier. For instance, the common

misconception that a child should not be taken to hospital when suffering from measles until the disease has reached "maturity". The six months break between the DPT III and measles vaccine (see Appendix 4) is also too long for an illiterate mother to keep dates in her head. It is very likely that she will forget to take the child for immunization even if she intended to. This may be an attributing factor to the higher incidence of measles deaths among the none educated women.

Another aspect on the link between increased maternal education and reduced incidence of infant and childhood mortality is effective use of available medical services vis a vis traditional remedies. This factor includes such aspects as immunization. Whereas a child would be taken to a doctor only when sick, an educated mother is more likely to understand and take preventive measures against diseases than an illiterate mother. The common issue and belief that hospital is only for the sick does not arise in this case and therefore their attitudes influence the health of children and all family members. The educated mother is also more likely to attend ante-natal and post-natal clinic reducing the risk of tetanus and child birth complications which may result in childhood mortality.

The study found out that food production was equitably distributed throughout the study area. With pulses such as beans , peas , black eye, pigeon peas grown widely, while maize was grown in every

family holding. Food therefore was not a problem as long as the climate was favourable and production was good. The disparity appears in the nutrition components of the food intake where educated women may flout taboos concerning the consumption of certain foods during pregnancy. For instance among the Tigania and Tharaka, it is a taboo for a grown up woman to eat chicken and eggs as these are thought to be boys food. The knowledge of nutrition food intakes vis a vis full a stomach is likely to surface among uneducated women due to ignorance while educated woman may know of nutritional values and ignore certain taboos.

Increased maternal education reduces the risk of infant and childhood mortality by changing the patterns of child bearing, whereby educated mothers were found to have bigger spaces between births and even fewer children ever born. The later came out distinctively where the average number of children among women with secondary schooling or more was 5.2 compared to 6.3 for all women in the survey.

For all birth intervals, 30% of all deaths occurred in instances where the birth interval between the dead child and the one before was less than one year, 20% in instances where the interval was 2-3 years, 6% where the interval was more than 3 years and 44 % where the dead infant or child was a first born. By education levels, the highest incidence was among women who had a primary schooling, who accounted 46% of all deaths. For the birth interval

of the dead child and the one after, 33% occurred in fertility histories where the interval was less than one year, 43% where the interval was 2-3 years and 18% where the interval was less than 4 years and only 6% where the infant or child was the last born. Educationwise, 35% of the death occurred among women who had some primary education, 36% among those who had no education at all, 13% among woman who had some secondary schooling and 12% among women with post secondary education or training.

Use of modern contraceptives is one method of effecting birth spaces. Yet its use among illiterate women who had only primary schooling accounted for a mere 5%, 39% among women who had some secondary and 42% among women who had some post secondary schooling or training. Even if generally, the contraceptives use was low, the encouraging number of educated women is an indication that birth spacing and control which all influence infant and childhood mortality can be effected through education of women as the more educated they are, the more likely they are to use contraceptives.

TABLE 5.7 CONTRACEPTIVE USE VERSUS MOTHER'S EDUCATION.

	MOTHER'S EDUCATION LEVEL			
	PRIMARY	SECONDARY	POST SECONDARY	NONE
PERCENTAGE USING	5	39	42	5
PERCENTAGE OF SAMPLE	49	12	8	31

Source: compiled from the field data, 1989.

Increased education entails increased job opportunity whereby the woman is put in a better position married or otherwise. A woman in gainful employment can supplement and increase total family earning and resources therefore affecting the occurrence of diseases and possible mortality. This is because those who have a regular income are able to subsidize family earnings and are in a better position to fend for their families and divert the threat of infections and parasitic diseases.

Education also affects perception of culture as far as health, and medical care are concerned. Apart from supplementing available food resources, an educated woman may have healthier children because she has information on the optimal allocation of health resources and thus is able to procure health care at lower costs. This is because education acts as a proxy for such resources as clothing, shelter, medical care, sanitary facilities and water

supplies. All these being factors that determine the survival of children. Shelter has an effect on mortality in that children not well protected from the elements of the environment particularly cold and exposure or if they do not have much space, mortality is likely to occur.

5.2.2 MARITAL STATUS.

The socio-economic variable "marital status" at the time of the infant or childhood death. was subdivided into ; single, married, divorced or separated and widowed. Where the response was married, the interviewee was requested to state whether it was monogamous or polygamous of union.

Of the surveyed number of women who had experienced an infant or childhood mortality, 29% indicated that they were single, 56% were married, 10% were widowed and 5% were divorced or separated. Using these categories, several variables were cross tabulated to look for relationships between marital status and the occurrence of infant and/or childhood mortality and later a multiple regression analysis was carried out to test the null hypothesis;

H_0: There is no significant relationship between marital status and the occurrence of infant and childhood mortality in the study area.

H_1:

Using the cross tabulation statistical method, a c value of 0.6 got for the relation between marital status and parity. It was found out that of the 29 single women whose children had died, 74% were first parity births, 3% were second and third while 6.9% were parity 5 and over births. Among the married women, 32% were first parity births, 7% were parity 2 births, 14% were between parity 3 and 5 birth and 46% were parity 5 and over births. Among the widowed, 12% were first parity and 3-5 parity births and 37% were parity 2 births and over parity 5 births. For the separated and divorced women 20% were first and second parity births and 60% were third to fifth parity births.

Another aspect considered was the total number of children ever born. the single women had an average of 1.5 and the married an average of seven. the widowed 4 and the separated an average of 4. Among the married women, those in monogamous type of marriages had higher occurrences of infant and childhood mortality than the polygamous marriages and they also had a higher number of children ever born. The former had an average of 6.7 and the later 5.1. The c value in this case was 0.6 relatively strong relationship with married women having the highest number of CEB.

An interesting observation from the data collected was in the causes of death. 68% of all deaths among the single women were as a result of measles, prematurity, birth disorders or malaria, while only 15% of deaths among the married women were from the above

causes. 20% among the widowed and none among the divorced or separated women.

Of all the women who attended prenatal. only 17% were single, 68% were married, 6% were divorced or separated and 9% were widowed. 72% of all the single women did not attend antenatal clinic neither did 38% of all the married women. 68% of the separated or divorced women and therefore did not receive an anti tetanus vaccine. The contingency co-efficient value in this instance was 0.3 indicating a positive relation between marital status and attendance of prenatal and ante natal clinics. The relationship here indicated that the married women attended more than the others with the single women attending least. The same trend was followed in immunization where 65% of all immunizations were of children born to married women, 21% to single women and 9% were divorced or separated while 7% were widowed. 17% of the immunization history of children born to single women was indicated as N\A (not applicable). This is explained by the fact that the babies may have been born alive but died within hours or days of delivery due to prematurity or birth disorders.

In using the X^2 to test the null hypothesis: H_o: it was found out that the critical X^2 value at 0.999 significant level at 28 degrees of freedom was 26.2 while the calculated value of X^2 was 56.892. The null hypothesis was therefore rejected and the alternative

H_0: There is a significant relationship between the occurrence of infant and childhood mortality and marital status.

Taking all the above discussed variables into account, it can be stated that infant and childhood mortality in the study areas is highest among the married women, the commonest killer diseases among the single women are non-immunisable diseases, while birth order 1 has the highest occurrences of infant and childhood mortality among the single women and birth order 3-5 have the highest occurrences among the married women. Most of the single women did not attend prenatal or antenatal clinics nor did they take their children for immunization.

The single mother have low occurrences of infant and childhood deaths because they have fewer numbers of children mostly just one who received all the maternal attention. Fending for one child is not usually a problem even in instances where the single mother is not in any formal sort of employment. Using the correlation coefficient between marital status and education level, it was found out to have a c value of 0.7, a very strong relationship. 70% of all single women had at least some form of education with 30% having attained post secondary training. This implies that the single mothers have a better income than the married women. On the other hand, only 22.7% had any form of food crop or cash crop production of their own and were either surviving on their labour earnings or were living with their parents. This indicates that

the single mother had no control of the food or cash crop production whose sale may have supplemented her child's diet.

Most single mothers also did not attend prenatal or antenatal clinics neither did they take their children for immunization. This may be attributed to the fact that in the communities in the study area, particularly Tigania and Tharaka, single parenthood is not condoned and a single mother is bound to be withdrawn and unlikely to be found in public places with her child.

An explanation to the occurrence of large numbers of infant and childhood mortality among the married women may be attributed to the large family size where attention is diverted from a growing child. It is not surprising therefore that although the attendances of ante-natal and immunization procedures among the married women was impressive, many of the children did not complete their immunization schedules. 72% of all the children who died among the married women died from the non-immunisable diseases, which may have been as a result of exposure. These are mainly pneumonia , burns, gastroenteritis and also malnutrition. Available food has to be shared among many mouths and supplements are more likely to be inadequate among married women than among the single women who have fewer children. The high incidences of mortality occurrences among married women may be as a result of misreporting, where due to the stigma attached to divorce and separation, such women prefer to report their marital status as being married.

Among the people in the study area, culture dictates that children belong to the father. This explain the low number of children ever born among the separated and divorced women who once they leave the matrimonial home are under no obligation to take the children with them. They therefore report the children with them as the only children ever born to them.

In the polygamous marriages, the occurrence of deaths was lower than the monogamous marriages and this may be attributed to the lower fertility among polygamous unions and the familiar competition among co-wives. Despite having a husband, many women in polygamous unions have to fend for their own children, and the competition among the co-wives as to who produces more food than the other keeps the family well fed.
Married women with large families are therefore more at risk of contributing to infant and childhood mortality than single, separated, divorced or widowed ones.

5.3 DEMOGRAPHIC VARIABLES

5.3.1 BIRTH ORDER

This term refers to the birth order of the dead child. In trying to find the relationship between birth order and the occurrence of infant and/or childhood mortality, several variables were considered and these include the cause of death, birth intervals and immunization history. Using the cross-tabulation statistical method, birth order versus the above variables yield values of 0.4,

0.7, 0.4 and 0.3 respectively.

46% of the surveyed cases were parity 1, 31% were birth order 2, 13% were between birth order 3 and 5 and 10% were of over birth order 5. Taking this into account and the X^2 statistics the null hypothesis; H_0: There is no significant relationship between birth order and the occurrence of infant and childhood; H_1: The following was evident. The calculated value of X^2 was 20.6 at 21 df and the tabulated X^2 at 0.999 significant level was 46.797. The null hypothesis was therefore, rejected and the alternative H_1 accepted that there is a significant relationship between birth order and the occurrence of infant and childhood mortality.

The death of infants and children in the birth order 1 category was highest among single mothers where 74% of all deaths were of birth order 1 while 32% of the birth order 1 deaths were from married women and 12% first birth order were from widowed women. Birth order 2 deaths were highest among the married women who had 37% of all birth order 2 deaths followed by widowed women who had 32% of all second birth order deaths and while only 2% of all second birth order deaths were from separated and divorced women. Over birth order 5 deaths were highest among married women who had 46% of all deaths, single women had 6.9% of all over birth order 5 deaths while divorced women had 60% of all over birth order 5 deaths. This gives the impression that the highest occurrence of 1st birth order infant and childhood mortality was among the single women

while the over birth order 5 deaths were highest among the divorced and separated women.

In the cause of death versus birth order, 20% of all birth order 1 deaths were caused by pneumonia, malaria, diarrhoea and birth disorders (non-immunizable diseases), and 56% were from immunizable diseases and 24% from other causes. Birth order 2 deaths were mainly caused by non-immunizable diseases accounting for 51% of Birth order 2 deaths and 38% deaths were as a result of immunizable diseases. In the over 5 birth order, 80% of the deaths were as a result of non-immunizable diseases and 20% were as a result of the other causes.

Immunization history indicated that 63% of all cases in birth order 1 had not completed their immunization procedures or weight monitoring. 21% had completed and 2.3% were not applicable indicating that they had died immediately after birth.

In the relationship between birth order and the occurrence of infant and childhood mortality this study found out that there exists a significant relationship whereby the highest number of deaths was the birth order one bracket followed by birth order 2 while higher birth orders (over 5) did not have high occurrences. An explanation to this may be found in the fact that most of the 1st birth order deaths occurred among single mothers who are in many instances very young women who have had no previous experience

in child rearing. It is noticeable that most children in this category died from immunizable diseases, which could have been prevented but the parents did not have them immunized. What more with 63% of 1st birth order death not having completed their immunization procedures is an indication that new motherhood is root to infant and childhood mortality. Realization of the importance of immunization after the birth order one death may have shocked the women into realization of the importance of immunization which they had earlier ignored. This is evidenced by the fact that only 38% of all deaths in birth order 2 were as a result of immunizable diseases.

Widows have more deaths in the higher birth order (over 5) than order 1 and 2. This can be attributed to economies. The dead may have been children born just before the husband died. In an environment where the men are the breadwinners, responsibilities of fending for the family may overwhelm the woman and cause her inability to take proper care of the children healthwise. The difficulties that the widowed woman may confront are reflected in the occurrences of infant and childhood mortality. Birth order can, therefore, be said to have a significant relationship with the occurrence of infant and childhood mortality with birth order 1 having the highest births and over birth order 5 having relatively low deaths in contrast to what Caldwell (1979) states.

5.3.2 BIRTH INTERVALS

In considering the health of children, one of the most important factors is the length of time between their births. This aspect referred to as birth intervals was divided into the birth interval between the dead child and the one before and the one after. The two factors were used in testing the null hypothesis that:

H_0: There is no significant relationship between birth intervals and the occurrence of infant and childhood mortality.

H_1:

Using the X^2 statistics, the calculated value was 37.697 with 15 df while the critical value of X^2 was 13.1 at 99.9% significant level. The null hypothesis H_0 was therefore rejected and the alternative H_1 that there is a significant relationship between the birth intervals and the occurrence of infant and childhood mortality.

According to the World Fertility Survey Statistics, birth spacing is especially important since children born after a short birth interval are twice likely to die in infancy than a child born after a two year interval. The health. not only of the short interval newborn is jeopardized, but also that of older siblings and the mother.

The link between birth intervals and child mortality can be inferred from length of breastfeeding period and immunization history. Using the birth interval between the dead child and the one after and the breastfeeding period an explanation is given as to the relationship between birth intervals and the occurrence of infant and childhood mortality. The relationship between birth interval and length of breastfeeding was found to have a value of 0.4 given a positive relationship. The frequencies indicated that 52% of the respondents had an interval of less than 18 months while a cumulative 98% had less than 4 years interval. With a breastfeeding period of less than 1 year, taking into account that 9 months of the 18 months between births the mother was pregnant, it is not surprising that so many children died.

The role of breastfeeding cannot be under estimated. A mother who gives birth to children close together is unable to maintain good health in either herself or her children. An important part of providing children with good start in life and adequate nutrition after birth is in the form of breast milk.

In considering the health of children one of the most important factors is the length of time between their births. A short birth interval of one year means a mother is nearly always pregnant and will give birth to many children. The main burden of raising children usually falls on the mother. She must be prepared both physically and mentally in order to be able to provide her children

with a good start in life. Because each pregnancy used a considerable amount of minerals and the other nutrients from the mother's body, she needs not only a good diet but also adequate time in between pregnancies to regain the nutrients. If she does not have this opportunity, the next baby may suffer from less than adequate nutrition from the mother while developing in the uterus. It is no wonder that this results in an increase in the neo-natal and infant mortality rates among children born after a short birth interval. As the birth interval lengthens, chances of survival increase.

The mother's own health also suffers for short birth intervals. She is frequently more tired and unable to work hard and care for the children. This means they must take care of themselves or be looked after by older siblings or relatives. A weakened condition for more susceptible to infection and other diseases.

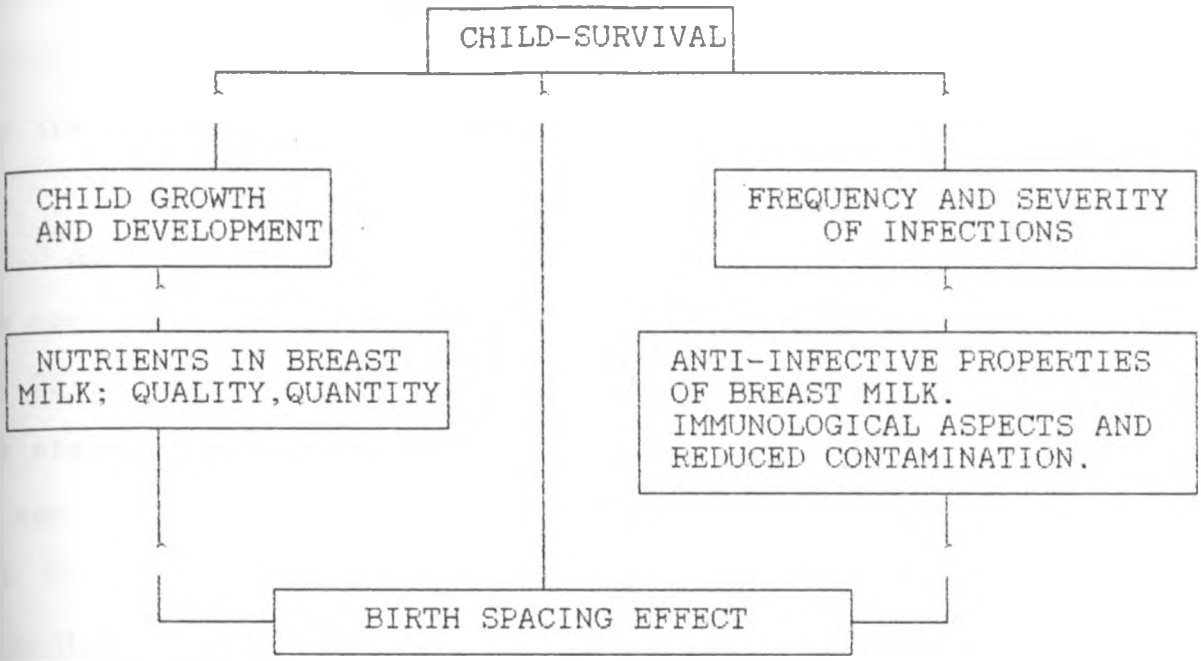
Children who survive the short birth interval also suffer without the chance to develop their full physical and mental potential. During pregnancy and for the first 1-2 years after birth, the child's brain and neurological systems as well as other parts of the body are growing rapidly. If he does not have adequate nutrition, this development may be permanently damaged so that he can never be as strong, bright or healthy as he should be. (Ebrahim, 1978)

When the children are born close together, it is normally not the youngest child who will suffer but the older baby who must be weaned from the breast because a new one has come. This often results in malnutrition for the older child, because the available food is not sufficient for him to grow. In a subsistence farming, where the family lives off the farm food with little or no supplement, it is true that the larger the family, the less food there is for each child to eat.

Whereas breast milk alone is sufficient for most infants until 4-6 months of age, additional foods to supplement the breast milk are vital. For healthy transition to more solid foods, child's diet ought to have all the basic nutrients necessary for normal growth. This is because during weaning, the child is at high risk of infection particularly diarrhoeal diseases and of malnutrition.

Long birth intervals ensure that a baby is put on the breast as long as possible. Breastfeeding can contribute to child survival thus extending the period of post-partum ovulation, through abstinence and by lengthening intervals between births, giving a cyclical survival opportunity.

FIGURE 5.1 THE ROLE OF BREASTFEEDING IN CHILD-SURVIVAL



Modified from Mosley, W.H. et al 1984.

Other than provision of food for the baby during weaning, another baby health care aspect bound to be affected by the birth intervals is immunization. As earlier stated, children who are born close together do not get as much attention as they would otherwise get. Of the 52 children born with a birth interval of 18 months or less, 38 had not received any immunization compared to 24 who had a birth interval of more than 3 years. Only 18 of the children born within a one year interval had completed their immunization history.

The implication of these statistics is that, other factors not withstanding, children born with a short birth interval did not receive immunization may be because, the younger child received more attention and the immunization requirements of the older one

was ignored especially if he was growing well. Opportunistic immunizable diseases may have pounced on an otherwise healthy looking child who may not have received the relevant immunization and therefore the occurrence of a death.

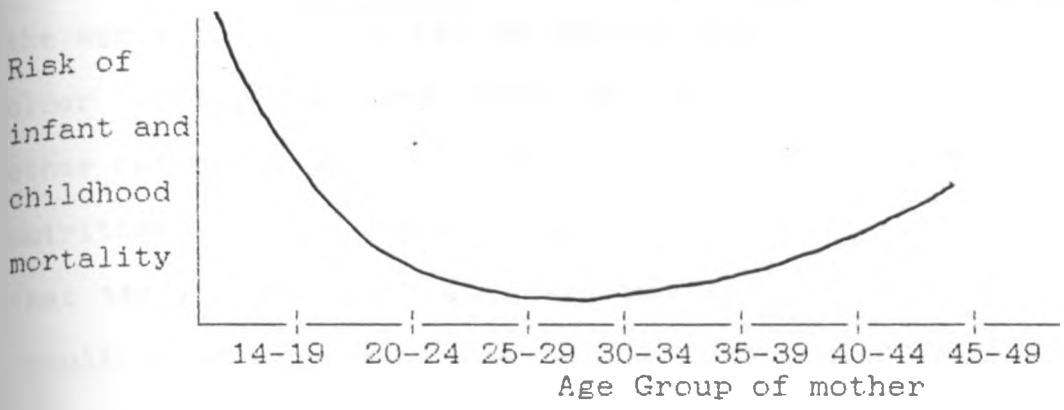
5.3.3 AGE OF MOTHER

The age of mother variable was also divided into cohorts 14-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-50. The frequency table gave the statistics that of all the surveyed cases 21% were of the 14-19 age group, 29% of the 20-23, 17% 25-29, 10% 30-34, 11% 35-39, 9 % 40-44 and 3% of the 45-49 age group. This indicated that cumulatively 50% of all infant and childhood deaths occurred with the 14-24 age bracket while only 12% occurred in the older women of child bearing ages that is 40-49.

In testing the null hypotheses H_o: There is no significant relationship between mother's age at the time of death and the occurrence of infant and childhood mortality, a calculated X^2 value of 27.3 with 35 df at 99.9% significant level, the critical X^2 was 73.402. Using the above statistics the null hypothesis H_o, was rejected and the alternative was accepted.

It is a biological fact that the babies born to very young mothers especially those under 18 and those over 35 years of age are at a greater risk of dying than those born to mothers in the upper lower ages of the fertility curve. See curve below:

FIGURE 5.2 INFANT AND CHILDHOOD MORTALITY RISK CURVE.



In ages below 18, the mothers' bodies are still underdeveloped and prone to injury. It is not surprising therefore that 50% of the premature births death occurred with the 14-19 age group while 37.5% occurred within the 20-24 age group and only 13% in the other older age groups.

The occurrence of the common killer diseases was highest in the 14-19 age group with 42% of all occurrences and 33% in the 20-24 age group both accounting for 75% of all deaths compared to 13%. 6%, 3% and 2% in all the other age groups.

Apart from the biological malformation of the young mothers' bodies, these young mothers have little knowledge of baby care such that many do not receive complete immunization procedure. Immunizable diseases while preventable therefore easily take toll.

Although the study area is relatively productive producing all sorts of nutritious foods, nutrition intake among children born in the age groups 14-24 may be substandard due to ignorance. While older mothers may feed their children well from experience with other children, younger mothers while not having the knowledge of nutritious foods, may also have an added strike against them in that their economic status are unstable or undeveloped. As a result, food supplements may not be forthcoming especially if they have to rely on sale of their farm produce to procure food supplements.

5.3.4 POPULATION DENSITY

Using the CBS, 1979 population projections for 1989 when the survey was carried out, the following statistics was carried out, the following statistics were got for the study area.

TABLE 5.8 POPULATION DENSITY.

DIVISION	AREA KM^2	POPULATION NOs.	DENSITY PERSONS/KM^2
THARAKA	1496	75,316	50.3
N. IMENTI	4691	160,887	330.9
TIGANIA	652	210,697	323
MERU	6590	1,243,619	188.7

Source: CBS 1979 Census projection for 1989.

Using the survey data (from questionnaires) and computations of the levels of mortality levels in each study zone and the study area in general, the following statistics were got:

TABLE 5.9 CALCULATED MORTALITY LEVELS.

DIVISION	MORTALITY OCCURRENCE %AGE OF SURVEY SAMPLE	MORTALITY RATE
THARAKA	12	65/1000
N. IMENTI	54	60/1000
TIGANIA	34	104/1000
MERU	100	

Source: Researcher 1990

Using a simple regression analysis to find a relationship between the pop densities and the occurrence of mortality and consequent testing of hypothesis the following was the calculated results.

TABLE 5.10 REGRESSION TABLE.

DIVISION	R	R^2	% ACCOUNTED FOR
THARAKA	0.99	0.9801	9.8
N. IMENTI	0.18	0.0324	3.2
TIGANIA	0.23	0.529	5.3
MERU	0.12	0.0144	1.44

Source: SPSS tables - Researcher 1989

TABLE 5.11 "T" TABLE.

DIVISION	T CALCULATED	T TABULATED	DF	SIG. LEVEL
THARAKA	4.203	4.025	11	99.9%
N. IMENTI	3.967	3.307	53	99.9%
TIGANIA	3.901	3.385	33	99.9%
MERU	2.920	3.160	99	99.9%

Source: SPSS statistical tables. Researcher 1989

Using the above statistics, it is evident that the relationship between population densities and the occurrence of infant and childhood mortality is very weak. Population density accounts for 9.8%, 3.2%, 5.3% of the occurrences of mortality for each of the study zones and a mere 1.44% of the whole study region. In testing the hypothesis, the calculated `t´ value 2.920 is less than the observed `t´: 3.160 at 99 degrees of freedom 0.999 significant level; the null hypothesis is accepted that there is no significant relationship between the population densities and occurrence of mortality. This implies that if population densities account for only 1.44% of the occurrences then there are multi other variables that play a greater role.

Tharaka division has a population density of 50.3 persons/Km^2 is evidently the lowest but it is also not as habitable as the others. Crop production is restrained by the harsh climate and therefore the need for large expanses of land to support a small population. Therefore any mortality occurring is not so much due to the density of the population but other factors.

North Imenti and Tigania are areas that are relatively well endowed and therefore despite the high population densities, the health and mortality of children is not affected by the population densities per se but as is evident in chapter 2 provision of socila amenities and infrastructural facilities is very inadequate. Tigania and North Imenti have an average of 35 % and 55% respectively of all water, medical care, sanitation housing and communications in the district

The small percentage accounted for by population densities can be attributed to social development aspects such as provision of clean drinking water. However, in an endeavor to supply piped water to the community, high population densities may be a hindrance in that supply will be limited to a few homes or the supply may dry out in certain connections.

What these statistics imply in essence is that there are apparent differentials occurring in the study area that can be attributed to the population density per se.

5.4 ECOLOGICAL

5.4.1. Rainfall

Reference is made to chapter 2.

The relevance of rainfall distribution amounts in this study of infant and childhood mortality is twofold. One. the varied amounts in the study area calls for analysis of the possible effects these may have on the occurrence and distribution of diseases. Using the data on average rainfall amounts received in the study area and the occurrence of deaths, a simple level regression analysis was carried out using the SPSS package. The value of `r´ was 0.106, $r^2$ = 0.1124 with 1 df at 99.9% significant level. The calculated F value was 3.39792 at the same levels. The tabulated value of F was 5.83. · The tabulated `t´ is greater than the calculated F so we do not reject the null hypothesis H_o: There is no significant relationship between rainfall and the occurrence of mortality. This is emphasized further by the fact that only 1.26 of the occurrence of mortality is accounted for by the rainfall totals.

Secondly, the seasonal patterns of rainfall may have an effect on occurrence of diseases especially where certain diseases such as malaria and pneumonia are bound to be prevalent after the rains. In Tharaka where the temperatures are on the average 26°C, the environment becomes very ideal for mosquito breeding and the prevalence of malaria infection is highest when rain-falls. It is also during these rain seasons when the incidence of diarrhoea is prevalent due to stagnation of water and poor sanitation.

In the wetter zones particularly N. Imenti and certain parts of Tigania the rainy season brings with it extreme cold. Pneumonia and upper respiratory tract infection usually accompany the spell when the children are more exposed. As the children are more exposed. As the children hurdle together for warmth in smokey kitchens (usually because the wood is wet) respiratory diseases are transferred from one child to another. This study was carried out after an outbreak of meningitis soon after the 1988 long rains March to May followed by the cold spell of June-July. It is no wonder that the disease spread fast taking a very high toll. Had it occurred during a drier period, the mortality as a result of meningitis would have been less.

Rainfall affected food and cash crop production. This, therefore, can be used as an indicator of the nutrition intake of the population. The unreliability of farms in Tharaka and to a lesser extent in Tigania can be attributed to the frequent drought and consequent shortage of food in the areas. Rainfall may be used as a proxy in explaining the occurrence of malnutrition either as a symptom or as a contributing factor to the cause of diseases in the study area.

5.4.2 AGRICULTURE PRODUCTION

Agricultural production was divided into main cash crop production and main food crop production in terms of tonnage and hectarage. Using the 1989 Ministry of Agriculture Annual Report for Meru, the following tables were used for crisis tabulation with the occurrence of infant and childhood mortality to look for relationships and test the null hypothesis H_o: There is no significant relationship between the study area, agricultural production and the occurrence of infant and childhood mortality.

The tables are as below:

TABLE 5.12

CASH CROP PRODUCTION

Cash Crop	Ha	Tonnage
Coffee	36,052	16,136,169
Tea	7,437	31,661,857
Cotton	15,000	2,594,895
Pyrethrum	1,189	91,234
Miraa	4,993	4,065
Tobacco	680	868
Sunflower	18,000	9,000
Barley	1,820	6,624
Wheat	8,700	217
Potatoes	10,139	12,304,675

Source: Ministry of Agriculture 1989

TABLE 5.13

FOOD CROP PRODUCTION

Food Crop	Ha	Tonnage
Maize	53,815	163,952
Beans	43,826	31,544.75
Millet	23,133	31,544.75
Bananas	14,500	49,000
Pigeons Peas	6,788	5,980.28
French Beans	120	630

Source: Ministry of Agriculture 1989

The X^2 value obtained 51.4 with 42 df at 99.9% significant level. The calculated value of X^2 was 73.402. The null hypothesis H_o; is therefore rejected because the calculated X^2 is greater than the critical X^2 indicating that there is a significant relationship between the agricultural production and the occurrence of infant and childhood mortality in the study area.

FOOD CROPS

The link between mortality and food crop production is twofold. One, the type and quantity of food a child eats is one of the biggest factors influencing his health. If this nutrition is inadequate, he is much more susceptible to other diseases and each attack of a disease will be more severe than usual. For instance a malnourished child has a 400 times grater risk of dying from measles than a well nourished child Assad (1983). The probability of dying therefore depends on how well the child is nourished and the availability of food and food supplements. The respondents produced at least one pulse indicating that, other factors held constant, protein supply to the family diet was ascertained. All

the respondents who had any family land grew at least one type of carbohydrates either maize or potatoes or yams. The vitamin component of nutrition can be easily obtained from green vegetables, peas, beans, pumpkins which would be in plentiful supply but may be utilized not due to availability but out of ignorance. Secondly, the survey indicated that 2% of the respondents did not engage in any form of food production and therefore had to rely on market sales. With abundant food production, then the residents of the study area are assured of good food supply and those who have to buy can get it in enough quantities and at lower prices.

Any differentials in food intake cannot be attributed to production but other factors. Consequently the direct cause of malnutrition on the child is not getting enough food for his body requirements but a more important thing to find out why. This could be because the mother has to sell most of it so as to procure other provisions or due to ignorance, for instance where a mother may sell eggs to buy bread for her family because eating bread is considered prestigious.

CASH CROPS

The cash crops produced in the study area varied from those of the international market such as coffee and tea grown mostly in Tigania and to a lesser extent North Imenti, cotton, tobacco which is mainly for the Kenyan market grown in Tharaka to miraa grown only

in Tigania.

Like food crops, cash crops are well distributed in the study area although there are differentials occurring due to value.

Cash crop production influence on infant and childhood mortality is threefold. First at the family level, cash crop production helps raise the family's standards of living by increasing the family income. Among other things the family is in a position to supplement the food intake especially if the family does not produce a certain nutrient particularly proteins or vitamins.

The biggest problems indicated as facing the respondents in an attempt to procure health care for themselves and their families was lack of drugs in the available health facilities accounting to 33% of all responses and lack of money for transport and buying of drugs accounting for 23% of all responses. With an extra income from cash crops, these are usually overcome and the family is put in a better position to get health care.

Perhaps the biggest differentials occur in the overflow effect of cash crops in the rich potato producing areas of North Imenti and the Miraa producing areas of North Imenti, there is more "floating" cash than in Tharaka and this may be the reason behind the better provision of social amenities as the people have more money to contribute to fund raising and community development particularly

health centers and water provision. This may be supported by the fact that of those who stated that the health facilities were too far. 60% were from Tharaka, 16% from Tigania and 18% from North Imenti.

5.5 MEDICAL

The availability and accessibility of health services and personnel was worked out in terms of numbers in the study zones and accessibility in terms of distance to the health facility from the respondents residence. The medical facilities in the study area were as below:-

TABLE 5.14

HOSPITAL BEDS/POPULATION IN THE STUDY AREA.

AREA	POPULATION	HOSPITALS	HOSPITALS BEDS AND COTS NO. OF BEDS/COTS	NO. OF PERSONS/BED
N. IMENTI	160,881	1	270	593
C. IMENTI	136,376	1	287	475
S. IMENTI	155,109	-	-	-
NITHI	213,149	2	435	490
TIMAU	35,037	-	-	-
TIGANIA	210,097		1	210
IGEMBE	136,030	1	78	1,744
THARAKA	15,316	-	-	-
	1,243,619	6	1,533	4,302

Source: compiled from field observation, 1989.

TABLE 5.15

RURAL HEALTH FACILITIES/POPULATION IN THE STUDY AREA.

AREA	POP	NO. OF RURAL HEALTH HEALTH FACILITIES				POP HEALTH/ FACILITY
		HC	NH	D	TOTAL	
N.IMENTI	160,881	1	3	22	26	6,188
C.IMENTI	136,376	1	1	20	22	6,198
S.IMENTI	155,109	1	1	16	18	8,617
NITHI	213,149	-	1	12	13	16,396
TIMAU	35,037	1	-	5	6	5,840
TIGANIA	210,097	1	-	7	8	26,262
IGEMBE	136,030	1	-	11	12	11,336
THARAKA	75,316	2	-	6	8	9,415
	1,243,619	8	6	99	113	11,005

Source: compiled from field data.

TABLE 5.16

MEDICAL PERSONNEL

AREA	POP	NO. F PERSONNEL						POP/PERSONNEL TOTAL	
		DOCTORS		C.O.s		NURSES			
		NO	POP/DOC	NO	POP/CO	NO.	POP/ UR		
N.IMENTI	160,881	26	6,188	44	3,656	267	602	337	447
C.IMENTI	136,376	10	13,638	8	17,047	93	1,466	111	1,228
S.IMENTI	155,109	1	155,109	3	51,703	42	3,693	49	3,165
NITHI	213,149	15	14,210	39	5,465	115	1,853	169	1,261
TIMAU	35,037	-		6	5,840	23	1,523	29	1,208
TIGANIA	210,097	5	42,019	7	30,014	71	2,959	83	2,531
IGEMBE	136,030	3	45,343	19	7,159	39	3,487	61	2,230
THARAKA	75,316	-		3	25,105	19	3,964	23	3,274
	1,243,619	60	20,727	129	9,640	669	1,859	802	1,551

Source: compiled from field data 1989.

Using the number of persons per hospital beds and cost, the number of person per health facilities and the number of persons per type of medical personnel, a multiple linear regression analysis was carried out using the above variables as dependent and the occurrence of mortality as the independent. This yielded an r value of 0.129, R^2 value of 0.016 for the number of hospital beds and cots an r value of 0.539, r^2 value of 0.29 for the number of health facilities and an r value of 0.60, r^2 value of 0.36 for the health personnel. This indicates that 1.6%, 29% and 36% of occurrences of infant and childhood mortality were accounted for by the available number of hospital beds, number of health facilities and medical personnel respectively. A combined statistics' value for all the three variables gave an r value of 0.51, r^2 value of 0.26, F statistic of 3.699 with 32 df at 99.9% significant level; the critical value of F was 3.385. The calculated value of F was higher than the critical `F' so the null hypothesis H_o; was rejected and the alternative H_1; accepted that there is a significant relationship between medical variables and the occurrence of infant and childhood mortality.

Health care provision in the study is relatively poor with 1 bed for every 4302 people, 1 health facility for every 11,005 persons and 1 health personnel for every 1,551 people and 1 doctor for every 20,727 people. The importance of health facilities is more important in prevention than curative measure. However, with such ratios as indicated above, it is obvious that the people are

discouraged from attending the health centres. It is an indication that the health facilities are poorly manned with the staff obviously overworked.

Many of the deaths that occurred in the study region are from preventable diseases or curable condition. This can be attributed to that and the mothers getting little or no medical care before, during or after birth. The health facilities in the study are capable of effectively providing immunization procedures, but this is not so because of lack of personnel. It is quite common to find a dispensary being manned by subordinate untrained staff while storage of immunization is almost non-existent.

Community education by health personnel particularly public health nurses is vital in promoting health. This includes on such aspects as immunization hygiene, nutrition and general health care of the children. This way such preventable diseases such as the immunizable ones diarrhoea and malnutrition deficiencies can be prevented.

Accessibility of the health facilities measured in distance from the respondents resident indicated a relatively weak relationship of a contingency co-efficient value of 0.3. The respondents gave the least distance travelled to a health facility as below:

TABLE 5.17 DISTANCE TO HEALTH FACILITIES.

	TO HOSPITAL (KM)					TO A DISPENSARY (KM)			
	1-5	6-10	11-19	>20	T	1-3	4-10	>10	T
RESPONDENTS %	14	13	25	47	100	23	38	39	100

Source: Compiled by researcher 1989

This indicates that 73% of all respondents had to travel more than 10 Km to get to a hospital while 39% had to travel at least the same distance to get to a dispensary. The distance to a health facility was a great hindrance to most respondents who sought medical attention with 50% indicating that among other things they were too far.

With this kind of response and the unavailability of drugs, lack of adequate personnel and equipment, it is not surprising that immunization, antenatal and post natal attendance numbers are that low. It is obvious that this being a rural community alternate means of cure are sought. Herbal medicine-men are preferred to the western practitioners who are bound to charge higher professional fees.

It is a common notion in the study area that hospitals are for the sick. As long as an individual is in good health there is no need for medical attention and therefore immunizations are boycotted and seen as irrelevant.

Therefore, other than lack of adequate health facilities and personnel ignorance due to lack of community health education has a contributing factor to the occurrence of infant and childhood mortality.

CHAPTER SIX.

CONCLUSIONS OF THE FINDINGS AND RECOMMENDATIONS.

6.0 INTRODUCTION.

This study draws its conclusions from the findings of the study based on computations of the mortality levels, the prevalent of the common childhood killer diseases, the inherent differentials based on socio-economic, demographic, ecological and medical variables.

6.1 CONCLUSIONS.

Infant and childhood mortality levels were highest in Tigania division which is a medium potential zone with a level of 104/1000 compared to North Imenti's 60/1000 and Tharaka's 65/1000. This study concludes that the high occurrences of mortality in the zone is attributable to the high population numbers and the low social economic development of the zone particularly availability and accessibility of medical services, availability of clean drinking water and generally the low education levels of the women. Ecological potential therefore is not inversely proportional to occurrence of mortality and if this was the case, Tharaka would have had the highest mortality levels.

When the common childhood killer diseases were subdivided into immunisable and non-immunisable diseases, this study found out that the highest percentage of mortality occurred as a result of the non-immunisable diseases especially pneumonia, malaria and diarrhoea. This can be attributed to a break through in the

immunization of children carried out by the Ministry of Health through the mobile outreach clinics conducted by KEPI. Although many respondents did not complete their children,s immunization procedures, the children did not die as much from immunisable diseases. This study therefore concludes that lack of basic hygiene and health care procedures are the root of infant and childhood mortality. The diseases caused by unhygienic preparation of foods, unnutritious food and improper dietary habits lead to diarrhoeal diseases, a common killer. Improper sanitation and home care leads to breeding grounds for mosquitoes which cause the killer disease malaria. All these diseases are not the root cause of deaths, their presence renders curative less effective and worsens the conditions.

In the socio-economic variables, primary schooled and non-schooled mothers had the highest occurrences of mortality, while married women contributed the highest numbers in the marital status category. Lack of proper health care procedures, limited resources to supplement food and medical services were found to be the contributing factors to these findings.

Parity 1 and 2 had the highest occurrences of mortality with decreasing incidence upto over parity 5 when the occurrences increase. This was particularly evident among the single mothers for parity 1 and 2 and married women for over parity 5 cases. The highest occurrences of mortality in the birth interval category was

for the children who were born with less than 18 months interval between them. Breastfeeding periods were therefore shorter and the mother's attention was diverted to the youngest addition to the family. Immunization procedures stopped almost immediately the mother became pregnant and more attention was paid to the youngest child.

Age 14-24, which is the class 1 and 2 in the fertility history chart contributed highest numbers in the occurrence of mortality with decreasing occurrences with age. Physiological and biological factors such as immature bodies and mental unpreparedness for motherhood resulted in high incidence of mortality. Premature births and birth disorders were also highest in this age bracket.

Total population densities, food and cashcrop production did not show much variation but medical availability and accessibility may have attributed to high incidence of mortality where the services were not within easy reach of the respondents for curative and preventive services. Medical and health personnel were also scarce such that community education was not effective for proper child care, sanitation, health and general hygiene.

Many of the health problems encountered in mothers and children in the study area are preventable either by means of health education or regular supervision, yet it is these illness that take a heavy tool of young lives so much that about 1/4 to a 1/3 of the babies

do not reach the age of 5 (Ebrahim G.J 1972).

One of the problems facing infant and childhood mortality management in Meru district is the minimal resources devoted to primary health care to deal efficiently with the most pressing health and medical problems of the children. There is a failure of policy analyst to device an integrated and cost effective approach to the alleviation of the inherent common health problems.

Economic development is obviously the major requirement for the ultimate achievement of a fully satisfactory, nutritional and health status (Barnum, 1984). Development is however a slow process but it is possible that the use of direct health and environmental intervention can bring about a substantial improvement in health status. These could be in nutrition programs the improvement of water quality, the provision of preventable and curative clinical services to an entire population. Resource constraints, however are headed by lack of funds such that it is common to hear the phrase "------ will be done when the funds are available". Other than these financial constraints, limited administrative skills, skilled personnel all limit provision of services. With scarce money and manpower and facilities, interventions must be chosen carefully for them to be effective. It is for this reason that this study makes the following recommendations.

6.2 RECOMMENDATIONS.

6.2.1 RECOMMENDATIONS FOR POLICY MAKERS AND IMPLEMENTERS.

By all requirements, the biggest need in the study area is for health education. Unhygienic ways of living are main factors in maintaining diseases in the community. Such unhygienic habits may be in relation to food, disposal of human waste, housing or even in the form of wrong concepts about diseases. For instance, the near epidermic of meningitis in Tigania which had been attributed to witch craft. When individual standards of hygiene in a rural community is poor, every opportunity to promote health education should be exploited. In this respect, it is important to remember that public talks as well as home visits should be integrated in public education.

Public education should be with an aim of producing a change in people's behavior. This is particularly so on nutrition, child rearing practices, environmental sanitation and personal hygiene. While health is easy with educated people, it is quite difficult in the rural areas where the dietary patterns have been established after along period and attempts to change are bound to meet alot of resistance. It is a common belief among the Meru that children brought up on bananas and yams are the strongest and healthiest, yet these are only starches and a growing child needs proteins and vitamins.

Large families are increasingly becoming a burden to parents, yet many rural ones state that they need many children to help in the farm and others to bring in money and support the family. Community educators need to remind such parents that a baby and even children take a long time to be workers and for many years he must be fend for by both the parents and the community before he can make any contribution.

Another misconception that needs to be corrected is the fear by the parents that will not have anyone to look after them in old age. It needs to be stressed that fewer children spaced further apart will be better fed, easier to clothe and educate so as to prepare them for future controls when in society building.

The following statement by President Nyerere of Tanzania carries alot of weight in this dimension;

> "Giving birth is something in which mankind and animals are equal but rearing the young and especially educating them for many years is something which is a unique gift and responsibility of men. It is for this reason that it is important for human beings to put emphasis on caring for children and this ability to look after them properly rather than thinking only about the numbers of children and the ability to give birth. For it often happens that men's ability to give birth is greater than the ability to bring up the children in a proper manner."

A family does not necessarily have to plan on having fewer children, a longer birth interval usually results to smaller families who will be stronger and brighter with better chances of survival and success in life.

All parents are interested in having healthier and bright children with a good start in life but the concept of children spacing and the approach of health and community workers has been wrong. Many trainers approach it with concept of family planning and the rural community takes this as implying having no children and thus reject it. The various effects of short birth intervals should be explained simply and carefully, to both parents with the various methods by which they can prolong their birth intervals being clearly presented.

The decision on the number of children and spacing rests mainly with the father in the study areas and he should not be alienated when such discussions are being held.

The health of mothers and children is closely related to the general health of the community and public health measures that will bring about an improvement in general health will be able to produce improved maternal and child health, better sanitation and water supply for example and control of such communicable diseases as meningitis.

From the above discussion, it is apparent that the health needs of the mother and child need to be given priority in the national health programmes and a suitable service should be evolved to look after them. Children's health should encompass preventive aspects of paediatrics, obstetrics, nutrition, health education and child development all adapted to the needs and the resources of the community and moulded to the local cultures and traditions.

There are several ways that the medical and community health personnel can assist the rural population in a bid to control child and infant mortality by better nutrition. These include active participation in village committees, community development plans, district and regional nutrition and MCH committees and co-operation with village leaders and particularly the women groups.

In disseminating the message, socio-political organizations such as KANU-MYWO, church organizations, women groups should all be used as a forum.

These local committees should be able to assist and monitor nutrition education in schools as well as promoting better environmental sanitation (safe water, use of latrines good housing and vector control).

Agricultural programmes designed to improve food production, more and better crops, animal keeping, food storage, processing,

distribution and marketing should be streamlined and promoted further.

Breastfeeding and proper lactation is one of the most important aspects of infant and childhood care in developing countries... (Ebrahim, 1972). Babies who are not breastfed have a poor chance of survival in such a situation. This study was carried out in a rural situation where most rural homes do not have the facilities for coping with hygienic methods of bottle feeding and the principles of sterilization are poorly understood. Bottle feeding in these conditions invariably results in gastroenteritis. To make the matters worse, the expense of artificial feeding is beyond the budget of most households so that the baby is offered diluted milk and suffers undernutrition. To counter this, the mothers should be encouraged to attend prenatal and ante-natal clinics where they are advised on the importance of breastfeeding.

Community development workers should be boosted so that they reach the most rural and inaccessible areas to counter the growing belief especially among young mothers that bottle feeding is fashionable.

While not underplaying the role of big hospitals, their services are limited to namely the population around them and internal cases. They therefore do not meet the frequent daily needs of the general population in the district due to distant and lack of personnel. Although there are six such hospitals in the study

area, their location leaves alot to be desired in that only 2 are government maintained, supposedly offering "free" services while the rest are mission where services are charged. The location of these facilities is centralized urban or semiurban areas which does not present a cost effective use of resources. It would be more effective if smaller scale curative facilities especially for the outpatients care offering low technological therapies such as oral rehydration for diarrhoea cases can be administered at the level of health clinics and dispensaries which are more less distributed throughout the district.

The study appreciates the fact that there is shortage of trained/professional nurses and community workers for health extension services. However, health workers with low levels of education even as low as standard eight or women group leaders should be used for promotional programmes at the village community level where they would visit households and track the health status of children and women, encouraging consistent breastfeeding throughout infancy and convey information about available health services particularly immunization. Many rural folks in the study area particularly in Tharaka and Tigania suffer from ignorance.

Finally, this study calls for greater commitment in the fight against childhood mortality particularly to the three sectors of the community. These areas are the central government. the health services and the general public. The central government should

allocate resources and therefore a bigger budget to the Ministry of Health for the prevention of diseases among the rural poor who are the majority of the citizens.

Secondly, the health services, Ministry of Health should be more committed to the public censuring provision of immunization and basic curative services and education to all rural populations and lastly, the general public should be more responsible for their own health and seek aid elsewhere other than relying on the government meager resources. The notion that the government is responsible for public health, as much as is true ought not to be used as alibi by the public for their own contribution to the provision of health care for themselves.

6.2.2 RECOMMENDATIONS FOR FURTHER RESEARCH.

This study considered a limited number of socio-economic, demographic, ecological and medical variables. There is a great need for the same research to be carried further so as to establish the contribution of other factors such as the education level of father, the sex differentials in the cases occurring and the other environmental factors that were not considered in this study.
When and if data is available, a statistical research should be carried out whereby levels of infant and childhood mortality are worked out and these used to discuss differentials other than using absolute number of occurrences. Although this can only be done where details such as mother's education level, marital status,

total fertility and so on are entered in hospital records and death certificates.

This study established that certain diseases such as measles and meningitis occurred seasonally. A seasonality pattern study of the leading diseases of infant and childhood mortality should be carried out.

Malnutrition has a role to play not only in the actual cause of death but also in the severity of diseases. Study on caloric and nutrient value of food intakes and their relation to certain diseases should be carried out.

Another area of further research could be a cultural approach to infant and childhood mortality. This could cover the mortality differentials in the different ethnic groups namely; the Wachuka, Waimenti, Watigania and the Watharaka. This will take into account different dietary patterns and approaches to treatment of various ailments.

All these would go along way in bridging the loopholes in the study of infant and childhood mortality in the area.

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APPENDIX 1.

QUESTIONNAIRE FOR WOMEN WHO HAVE EXPERIENCED AN INFANT OR/AND A CHILD MORTALITY:

ALL THE INFORMATION GIVEN IN THIS QUESTIONNAIRE WILL BE TREATED WITH STRICT CONFIDENCE AND WILL ONLY BE USED FOR THE PURPOSE OF THE STUDY ON MORTALITY IN MERU DISTRICT:

QUESTIONNAIRE NO:- ----------

DIVISION ----------

ECOLOGICAL ZONE ----------

I MATERNAL DATA:

1. Name of the respondent ----------

2. Age ----------

3. Marital status

01. single	¦	¦
02. married	¦	¦
03. widowed	¦	¦
04. separated/divorced	¦	¦

4. What education level did you attain?

01. primary	¦	¦
02. secondary	¦	¦
03. post secondary training	¦	¦
vocational/technical	¦	¦
04. None at all	¦	¦

5. What is your occupation?

01.	housewife/farmer	¦ ¦
02.	Casual labourer	¦ ¦
03.	businesswoman	¦ ¦
04.	Teacher/clerk/nurse (any formal employment)	¦ ¦
05.	None	¦ ¦

6. What is your spouse's occupation? ----------

II DEMOGRAPHIC DATA:

7. How many children have you ever born alive?

01.	1	¦ ¦
02.	2-4	¦ ¦
03.	5-7	¦ ¦
04.	8 or more	¦ ¦

8. What are their ages? 1st ----- 2nd ----- 3rd ----

4th---- 5th----6th -------- 7th ---- 8th -------

9. Of these, how many have died? ----------

10. What was the cause of death? (as per death certificate)

01.	pneumonia	¦ ¦
02.	measles	¦ ¦
03.	meningitis	¦ ¦
04.	malaria	¦ ¦

05. burns | |

06. prematurity | |

07. birth disorders | |

08. diarrhoea | |

09. tetanus | |

10. any other (specify) ----------

11. How old was the dead child?

01. 0-1 | |

02. 1>5 | |

12. What was the sex of the dead child?

01. female | |

02. male | |

13. What parity (born) was it?

01. order 1 | |

02. order 2 | |

03. order 3-5 | |

04. order 5 and over | |

14. How old were you when the death occurred?

01. 14-19 | |

02. 20-24 | |

03. 25-29 | |

04. 30-34 | |

05. 35-39 | |

06. 40-44 | |

07. 45-49 | |

15. Where did the death occur?

01. Hospital | |

02. Home | |

03. Other (specify) | |

16. Was the child ill?

01. Yes | |

02. No | |

17. For how long?

01. 1-7 days | |

02. 2-4 weeks | |

03. 1-2 months | |

04. more than 2 months | |

05. N/A | |

18. For how long had you breastfed the child?

01. 0-6 months | |

02. 6-12 months | |

03. 1-2 years | |

04. N/A | |

19. Did you attend pre-natal and ante-natal clinics?

01. YES | |

02. NO | |

20. Was the child immunized?

01. Yes | |

02. No | |

21. Against 01.TB | |

02. measles | |

03. polio | |

04. whooping cough | |

05. tetanus | |

06. diphtheria | |

07. N/A | |

22. How far is the nearest Dispensary?

01. >1 - 2km | |

02. 3-4 km | |

03. 5-10km | |

04. more than 10 km | |

23. Hospital?

01. >1-3 km | |

02. 4-5 km | |

03. 6-10km | |

04. 10-20km | |

05. more than 20 km | |

24. How large is your farm holding? ----------.

25. What crops do you grow?

foodcrops:		Cashcrops:	
1. beans	¦ ¦	1. tea	¦ ¦
2. maize	¦ ¦	2. cotton	¦ ¦
3. peas	¦ ¦	3. coffee	¦ ¦
4. potatoes	¦ ¦	4. tobacco	¦ ¦
5. bananas	¦ ¦	5. groundnuts	¦ ¦

6. Any other ----------

(You may tick more than one)

26. What are some of the problems that you encounter when seeking medical care for your children?

01. Lack of money for transport and drugs. ¦ ¦
02. No medicines in the hospitals ¦ ¦
03. Far away facilities ¦ ¦
04. No doctors/ nurses in facility ¦ ¦
05. Lack of attention by medical personnel ¦ ¦

27. Have you ever been on any family planning method?

01. Yes ¦ ¦
02. No ¦ ¦

28. When ----------?

29. Which one?

01. Pill	¦	¦
02. IUCD	¦	¦
03. Diaphragm	¦	¦
04. Permanent (TL)	¦	¦
05. Natural	¦	¦
06. None at all	¦	¦

THANK YOU VERY MUCH FOR GIVING THIS VITAL INFORMATION.

MUKAMI M. RIMBERIA

UNIVERSITY OF NAIROBI

NOV 1989.

APPENDIX 2

DUPLICATE

REGISTER OF DEATH

FORM A2

(For use by Medical Practitioners and in Hospitals)

District: Registrar's Serial No.:

1. Full Name of Deceased	Baptismal or given Name(s)	Middle or Tribal Name	Son or daughter of	Surname or Tribal Name of Father
2. Date of Death	Date of Month:	Month:	Year:	3. Sex of Deceased Male .. .. 1 ☐ Female .. .. 2 ☐
4. Age of Deceased	Years (If under one year state in months_____ or days_____)			5. Occupation of Deceased
6. Exact Place of Death Code	No. of house and street or road, if any	Name of Town, if any, or Village/Sub-location and location		If in Institution—name of hospital or medical centre
7. Normal Residence of Deceased Code	If Deceased not normally resident at above place, state District in which he lived.			

8. TO BE COMPLETED BY MEDICAL PRACTITIONER:

Interval between Onset and Death

A. *Cause of Death*—Enter one cause per line:

Code

I. IMMEDIATE CAUSE (A)_____

DUE TO (B)_____

DUE TO (C)_____

II. OTHER SIGNIFICANT CONDITIONS_____

B. *Certificate*

I certify that—

Delete as appropriate.

(*a*) I attended the deceased, or

(*b*) I examined the body after death, or

(*c*) I conducted a post mortem examination of the body and that the above information is correct to the best of my knowledge.

Signature_____ Title_____ Date_____

NAME IN BLOCK LETTERS_____

9. Signature of Local Registrar_____ Date record received_____

TO OBTAIN A DISPOSAL PERMIT (BURIAL OR CREMATION) THIS CERTIFICATE IN DUPLICATE (TWO FORMS) MUST BE TAKEN TO THE OFFICE OF THE REGISTRAR OF DEATHS AT:—

On week-days (during office hours); *or*

On Sundays and Public Holidays and after office hours on week-days.

IMPORTANT.—A record must be made for *each death*. Use a typewriter or ball-point pen or other pen with black or dark blue ink. *This is a permanent legal record.* Be sure the carbon copy is legible.

GPK

APPENDIX 3

ORIGINAL

FORM A3

ALL ENTRIES EXCEPT SIGNATURES TO BE MADE IN BLOCK CAPITALS
(*See* note on left-hand margin)

REGISTER OF DEATH

(For use by next-of-kin where no medical certificate of cause of death issued)

District: Registrar's Serial No.

1. Full Name of Deceased	Baptismal or given Name(s)	Middle or Tribal Name	Son or daughter of	Surname or Tribal Name of Father

2. Date of Death	Date of Month:	Month:	Year:	3. Sex of Deceased
				Tick appropriate sex Male .. .. .. 1 ☐ Female .. .. .. 2 ☐

4. Age of Deceased		5. Occupation of Deceased
	_____years. If under one year state_____ months. If under one month state_____days.	

6. Exact Place of Death	No. of house and street or road, if any	Name or Town, if any, or Village/Sub-location and location	If in Institution—name of hospital or medical centre

Code	7. Normal Residence of Deceased	If Deceased not normally resident at above place, state district in which he lived.

8. CERTIFICATE TO BE GIVEN BY RELATIVE OR OTHER INFORMANT WHERE NO MEDICAL CERTIFICATE GIVEN.

A. Apparent Cause of Death (Place tick in box against description which most nearly describes condition before death):

1. Natural Causes:

☐ Bellyache, with diarrhoea	☐ Sudden death (stroke)	☐ Fever with headache & stiff neck	☐ Other known cause, specify
☐ Bellyache, without diarrhoea	☐ Difficulty or pain in passing urine	☐ Other fever	condition:_____
☐ Cough with short illness (less than 1 month)	☐ Yellow skin or yellow eyes	☐ Convulsions with lock-jaw (tetanus)	_____
☐ Cough with long illness (more than 1 month)	☐ Smallpox		_____
☐ Shortness of breath & swelling of legs	☐ Measles	☐ Woman dying in childbirth	_____

I am satisfied after inquiry that the above-mentioned death is not one to which sections 386 or 387 of the Criminal Procedure Act (Cap. 75) apply. An external examination of the body has/has not been made by a medical practitioner.

_____
Deputy Registrar Magistrate/Police Officer

2. Unnatural Causes:

(A disposal certificate in these cases can ONLY be given by the police when satisfied that the provisions of Cap. 75 have been observed).

☐ Accident	☐ Killed by another person	☐ Cause unknown
☐ Attack by animal or snake	☐ Suicide	

3. Certificate

I certify that I am (state relationship to deceased or capacity in which information given)_____

_____and that the above information is correct to the best of my knowledge.

*Signature*_____ Date _____

(If illiterate, witness to mark of informant to sign)

9. *Signature of Local Registrar*_____ *Date record received*_____

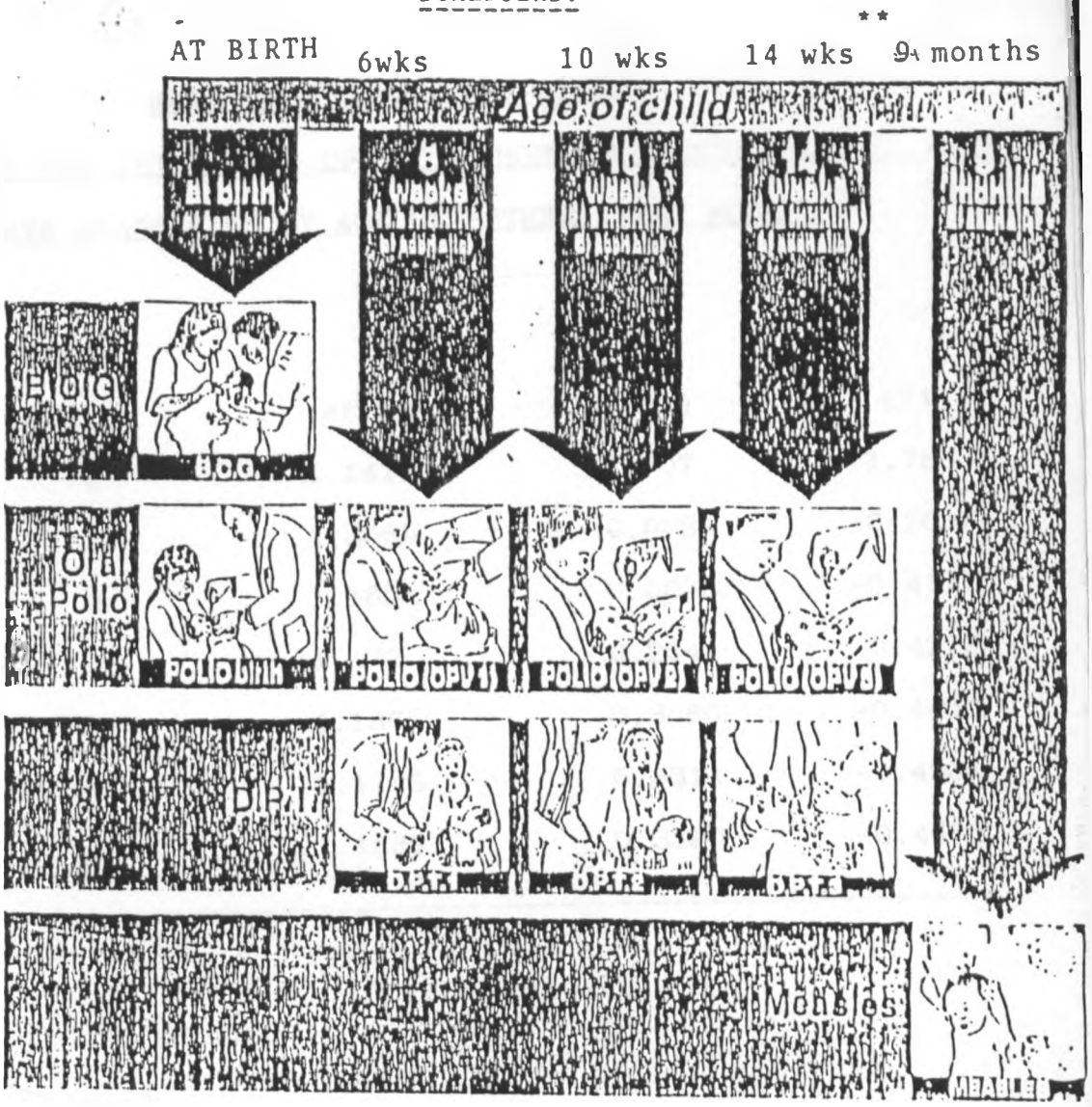
GPK

IMPORTANT.—A record must be made for each death. Use a typewriter or ball-point pen or other pen with black or dark blue ink. This is a permanent legal record. Be sure that the carbon copy is legible.

APPENDIX 4

KENYA EXPANDED PROGRAMME ON IMMUNISATION (KEPI)

SCHEDULES.



All *Primary Vaccinations should be completed before the first year of life*

** : Note the six month time period between D.P.T 3 and measles schedules.

APPENDIX 5

BRASS TABLE OF MULTIPLIERS.

CO-EFFICIENT FOR ESTIMATION OF CHILD MORTALITY MULTIPLIERS, WITH DATA CLASSIFIED BY AGE OF MOTHER; WEST MODEL.

AGE GROUP.	INDEX.	a(i)	b(i)	c(i)
15-19	1	1.1415	-2.707	1.7663
20-24	2	1.2563	-0.5381	-0.2637
25-29	3	1.1851	0.0633	-0.4177
30-34	4	1.172	0.2341	-0.4272
35-39	5	1.1865	0.3080	-0.4452
40-44	6	1.1746	0.3314	-0.4537
45-49	7	1.1639	0.3190	-0.4435

Source: Manual X, UN (1983).