DETERMINANTS OF MATERNAL MORTALITY AND MORBIDITY IN KENYA

BY

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DECLARATION

This thesis is my original work and has not been presented elsewhere for the award of a degree in any other University.

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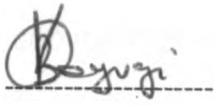
Signature: 

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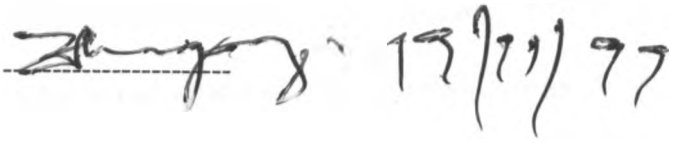
Signature: 

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DEDICATION

This thesis is dedicated to my father, the late Mzee Kiage "Ongujo" who selflessly sacrificed to sell his hard earned livestock to finance my education.

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ABSTRACT

The study attempts to examine the demographic, socio-economic and social determinants of maternal mortality and morbidity in Kenya using hospital based information of the Kenya Maternal Mortality Survey of 1994. In an attempt to determine the crucial factors that influence maternal mortality and morbidity in Kenya, the study analyzed 66,080 cases drawn from 19 district and provincial hospitals covered by the survey. The hospital information was collected using pre-designed forms of three types. The first form was used to extract information from files of each woman admitted to the pregnancy ward. The basic information included age, parity, marital status, educational level attained, ante-natal and postnatal clinic attendance, medical history on the survival status of the patient at the time of discharge, and the cause of death if applicable. The second form was used to collect a summary information from the maternity and gynaecology wards on the number of admissions, the number of deliveries by method and the number of maternal deaths. Lastly, the third form was a designed questionnaire administered to hospital personnel pertaining to major maternal mortality causes, ante-natal and postnatal services as well as referrals from traditional birth attendants admitted to the hospitals. The hospital-based maternal mortality statistics suffered selectivity bias in reflecting national level of maternal mortality, particularly in areas where women did not routinely give birth in the hospitals.

The data obtained was analyzed by the use of descriptive statistical methods involving the performance of percentages, frequencies, cross tabulation and logistic regression through SPSS / PC+ computer program.

The primary finding of the study indicated that mothers age, parity, educational level attained, ante-natal and postnatal clinic attendance and province of residence were significant determinants of maternal mortality and morbidity in Kenya. The results further revealed that maternal deaths was highest among women of older reproductive ages (40+ years) and those of parity 7+. With regard to maternal level of education on maternal mortality, there was a noted decrease in maternal deaths with an increase in level of education attained with a secondary + level of education exhibiting the lowest maternal mortality incidence. Lastly the wide disparities in maternal mortality across the provinces with Nyanza and Coast Provinces experiencing higher maternal mortality incidence Eastern, Rift-Valley and Central Provinces.

Based on these findings, a number of relevant recommendations to policy makers and areas of further research are suggested. In order to reduce maternal mortality, an intensive campaign has to be carried out by the government through the Ministry of Education to promote women education especially to higher levels (secondary +), expand provision of primary health care particularly the coverage of ante-natal and postnatal services to women equitably across all provinces. Further studies should be done to find out why some provinces exhibit higher maternal mortality than others and to establish whether the regional disparities across the provinces noted by hospital data also exist in the household / community based survey. Lastly, research should be done to assess the impact of HIV/AIDS prevalence on maternal mortality and morbidity given the close association between the AIDS pandemic and reproductive health.

CHAPTER ONE

INTRODUCTION

1.1 - General Introduction

The World Health Organization estimates that at least 585,000 women die each year as a result of complications of pregnancy or child birth (Rinehart and Kols,1992). The majority of these deaths occur in the developing world, estimated at 1,025 deaths per 100,000 live births in some African countries (Boerma,1987). The increasing maternal mortality and morbidity rates in the world where tremendous achievements in medicine has been realised continue to be a major worry for African governments (Rosenfield and Maine,1985). As African women try to fight for equal rights, maternal deaths still remain a big problem in a continent where high fertility and mortality rates reign supreme.

In 1987, the Kenya Government hosted the launch of the International Safe Motherhood Initiative and endorsed the Plan of Action to reduce maternal mortality and morbidity. The Safe Motherhood Initiative focused international attention on the problem of maternal mortality. A decade after the launching of Safe Motherhood Initiative, it has become increasingly clear that strategies to save mother's lives have been less successful than the child survival programme (Maine and McNamara 1987, Royston and Armstrong, 1989). The complexity of the issues and the broad range of factors that have been taken into account have made interventions with specific target, difficult to design. The provision of adequate health services to prevent maternal mortality and morbidity is constrained by lack of infrastructure, equipment and trained medical personnel that hampers development in general, and thus adverse maternal outcomes are inextricably tied

to difficult economic conditions that characterise many parts of the developing world, Kenya included (Obermeyer, 1993:354-365).

The Kenya Maternal Mortality Baseline Survey (1994) indicated that regional maternal mortality differentials characterise Kenya's provinces as do the disparities in fertility and in infant and child mortality. Thus, the high maternal mortality in Coast, Nyanza and parts of Western Kenya contrasts sharply with exceptionally low rates in Central and parts of Eastern Provinces attest to this fact. According to this report (KMMBS, 1994), Kwale, South Nyanza (Homa-Bay, Migori) and Busia districts reflect a less stage in the demographic transition and have much poorer maternal health regimes hence they deserve special attention.

1.2 - PROBLEM STATEMENT

A maternal death is defined as the death of a woman while pregnant or within 42 days (6 weeks) of a termination of a pregnancy, irrespective of the duration and site of pregnancy, from any cause related to or aggravated by pregnancy or its management but not from accidental or incidental cause (WHO, 1993). Maternal mortality has long been a neglected topic of research and as recently as 1985, maternal mortality in developing countries was referred to as "a neglected tragedy" (Rosenfield and Maine,1985). In Kenya, the precise number of these silent and neglected tragedies that occur to women in their prime life (15-49 years) cannot be determined and the estimates are alarming. Over 4,300 die of maternal deaths and over half-a-million women encounter obstetric complications yearly (Ministry of Health, 1997). At this rate, a great many Kenyans are affected by these tragedies through the loss or disablement of a wife, a daughter, sister -

indeed a mother.

Although the national estimate for maternal mortality ratio of 365 deaths per 100,000 live births (KMMBS, 1994) appears low by comparison with the figures from other sub-saharan countries, the same report indicates that regional maternal mortality differentials characterize Kenya's provinces from the highest maternal mortality ratio of 2221.7 per 100,000 births in Kwale to the lowest ratio of 18.8 per 100,000 births for Nyeri district. South Nyanza (the current Migori, Homa-Bay, Suba and Rachuonyo) districts are ranked second, with maternal mortality ratio of 1072.9 per 100,000 births (KMMBS, 1994:42). Thus South Nyanza (Homa-Bay, Suba, Rachuonyo and Migori) districts reflect a less stage in the demographic transition because of their much poorer health regimes and hence deserves special attention (KMMBS, 1994).

Maternal mortality rate in Kenya as in any other part of Africa is exceedingly high. In Kenya the family formation patterns are influenced by cultural and social values which place a high premium on fertility. Marriage is universal and early marriage is almost the rule. Girls are often married by the time of menarche (15 years). Pregnancy and childbirth often occur within two years of marriage. Polygamy is widely practised and acceptable among many Kenyans. Fecundity and high parity (7+) are regarded as great attributes and blessings. The high rates of childhood mortality in Kenya over 97 per 1000 births, (NCPD, 1993) cause parents to overinsure against the anticipated child losses. As a consequence, the early marriage for women in Kenya is followed by three decades of unregulated succession of pregnancies, childbirth and lactation. But each pregnancy entails a risk of injury to the life or health of the mother. It is against this background that

the study seeks to investigate the socio-economic, demographic and social determinants of maternal mortality and morbidity in Kenya.

1.3 - OBJECTIVES

1.3.1 - General Objective:

The main objective of this study is to establish the determinants of maternal mortality and morbidity in Kenya.

The specific objectives of the study are:

1) To determine socio-economic correlates of maternal morbidity and mortality differentials in Kenya.
2) To establish the socio-demographic determinants of maternal morbidity and mortality rates in Kenya.
3) To identify demographic factors underlying the maternal morbidity and mortality in Kenya.

1.4 - JUSTIFICATION OF THE STUDY

A woman in Kenya has 1 in 43 chance of dying of pregnancy-related causes during her reproductive life. About 194,000 experience life-threatening conditions and over half-a-million women suffer complications related not to a disease - but a natural event - pregnancy (M.O.H, 1997). The death of such a mother seriously affects the survival of her children and particularly the index child. In a high fertility population such as Kenya, the number of children orphaned by maternal death is indeed high. For some of these, their mother would have been the head of the household and death leaves them destitute. Beyond the immediate loss of life, maternal mortality also exerts a devastating effect on the family. Frequently,

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infant and maternal deaths occur simultaneously. Prevention of maternal deaths can, in many cases, also save the life of a child perhaps several children (Beverly and Sullivan, 1987). The fate of surviving children is not documented, but the likelihood that they will receive optimal care and health protection is probably diminished. Emphasis on maternal mortality prevention thus complements the growing concern about infant and childhood mortality (KMMBS, 1994).

Since adequate information on the determinants of maternal mortality and morbidity are still lacking in developing countries, the study intends to fill the gap left by the earlier survey (KMMBS, 1994) which was a baseline survey to assess mainly the magnitude and pattern of maternal mortality in Kenya. A comprehensive knowledge on the explanations of determinants of maternal mortality and morbidity will be essential for planning successful maternal and child health programmes in the country.

1.5 - Background Information

1.5.1 - Geography

Kenya covers an area of 582,000 sq kilometres. It borders Ethiopia in the north, Sudan in the northwest, Uganda on the west, Tanzania in the south and Somalia in the east. It has 400 kilometres of Indian Ocean Shoreline. Lying between 3 degrees north and 5 degrees south latitude and between 34 and 41 degrees east longitude , it is entirely within the equatorial zone. The country is almost bisected by the equator.

The country falls into two distinct regions, i.e. lowland and highland (upland) Kenya. This distinction affects the climate patterns of human settlement and

agricultural activities. Kenya has an unusually diversified physical environment:- savannah, tropical, equatorial volcanic and tectonic. Approximately 80% of Kenya's land is arid and semi-arid and only 20% is arable. A large part of the arid and semi-arid zones have been set aside for wildlife conservation.

Kenya is divided into 8 provinces, which are subdivided into districts. In all there are about 68 districts, 26 of which were recently delineated.

1.5.2 - Demographic Situation

Population distribution in Kenya is influenced by factors among them the physical, historical, pattern of economic development and policies pertaining to land settlement. The average population density was approximately 37 persons in 1989. With only 17.5% of Kenya's land suitable for cultivation, population density vary considerably. Population densities for areas with large proportions of arable land such as Western, Central and Nyanza provinces reached 230 persons per square kilometre while in the dry North Eastern Province the average density was only 3 persons per sq. kilometre in 1989.

On the basis of census statistics, Kenya's population increased from 5.4 million in 1948 to 15.3 million in 1979 and to 21.4 million in 1989 (CBS,1994) and was estimated at 27.5 million by mid-1995 assuming moderate decline in fertility and mortality rates that take into account the AIDS pandemic. A time series analysis of census results indicate that Kenya's natural rate of increase accelerated from 2.5% in 1948 to 3.0%, 3.3%, 3.8% in 1962, 1969 and 1979 respectively. The analysis also indicates that the country's rate of population growth declined from 3.8% in 1979 to 3.3% in 1989 and was estimated at 3.0% in mid 1995.

While the acceleration in the growth rate during the 1948-1985 period was due to a combination of factors namely - high fertility levels and low contraceptive use, the decrease in mortality was attributed to improvements in the health and socio-economic status; the decline in growth rate during the 1990-1995 period was mainly due to fertility decline.

The crude birth rate increased from 50 per thousand in 1948 to 52 per thousand in 1979. The high fertility rates in Kenya in the past four decades are now on the rapid decline. The Total Fertility Rate (TFR) was 7.7 children per woman in 1984. This declined to 6.7 in 1989, 5.4 in 1993 and declined to 4.7 in 1998 (NCPD,1998). The reported drop in fertility rate has been observed throughout the country although differentials still exists among Kenyan women associated with the area of residence and level of education. Although the explanation for the past onset of demographic transition towards lower fertility is complex and requires a detailed analysis, the factors which have contributed to the decline in fertility in Kenya have been mainly the increased use of contraception and increased age at marriage and women's educational status.

Levels of mortality in Kenya have declined steadily during the four decades prior to 1989. Crude death rate decreased from 17 per thousand in 1948 to 14 and 12 per thousand in 1979 and 1989 respectively. Infant mortality declined from 184 deaths per 1,000 live births in 1948 to 104 in 1979 and to 62 deaths in 1989. Life expectancy at birth has also increased from 39 years in 1948 to 54 years in 1979 and to 60 years in 1989. It has declined to 58 years by 1990-1995 period mainly due to the impact of the HIV/AIDS pandemic. The 1995 estimate of maternal mortality rate of 365 deaths per 100,000 births is also relatively high when

compared with rates of the developed countries 27 per 100,000 (WHO & UNCF 1996).

The sustained combination of high and increasing fertility as well as declining mortality in the past four decades has resulted in the current youthful population structure. Almost 50% of the population in the country was below 15 years of age by mid 1995. Considering that only 4% of the population is above 64 years of age, the total dependency ratio had risen to about 117 economically dependent persons for every 100 who were economically active by mid-1995.

1.5.3 - Health Services in Kenya

There are approximately 3,500 health facilities in Kenya, including 2,150 dispensaries, 631 health centres and 191 hospitals. The Ministry of Health administers over 50% of these institutions, and the Ministry of Local Government over 3%, the remainder are operated by private, mission and NGO sectors.

There is a modest concentration of health facilities in urban areas, but significant difference exists between districts. The Ministry of Health's recurrent budgetary expenditure on health was US$ 4.5 per capita in 1991/1992. The share of the government recurrent expenditure devoted to health has declined from 9.5% in 1980/1981 to 7.6% in 1996 / 1997. The government provides 72% of the finance for the combined recurrent and development budget representing about 25% of the total and 4 / 5ths of this provided by the donor community.

The government is the largest employer with an estimated 8,000 employees in the health sector, engaging more than 75% of nurses, clinical officers, laboratory and radiology staff. Almost 60% of doctors and dentists are in private sector

,whilst the NGO/ Mission Sector only employs 10% of the doctors. 56% of all health personnel are urban based, with 84% of all doctors in urban areas. There are major health personnel deficits at health centres and dispensaries, with less than 60% of the latter having a doctor or clinical officer; there is a serious shortage of clinical officers. Almost 25% of the health personnel are found in Nairobi and there are major regional differences in key health personnel; for example, Nyanza province has seven clinical officers per 100,000 residents while North Eastern has 15 (Ministry of Health, 1997).

1.6 - SCOPE AND LIMITATION

The study used secondary data from the hospital records. The data are those collected by the Population Studies and Research Institute during the Kenya Maternal Mortality Baseline Survey of 1994. The survey covered rural clusters within the current National Sample Survey and Evaluation Programme (NASSEP III) of the Central Bureau of Statistics except seven arid / semi arid districts where the sample frame has not been established. The districts not covered were: Isiolo, Marsabit, Garissa, Mandera, Wajir, Turkana, and Samburu. Lamu and Tana River in Coast Province were not covered due to inaccessibility. In all, the frame comprises of 1048 rural clusters with an average of 100 households per cluster. Clusters were selected by systematic random sampling and the selection of households within selected clusters was systematic with equal selection probabilities.

In the survey, the districts were covered as two separate strata:

i) Ten core districts-namely Busia, Kisumu, South Nyanza, Nyamira, Baringo,

Nyeri, Embu, Kitui, Kwale and Taita Taveta.

ii) Other remaining districts. The unit of enumeration was household. About 1,000 households were sampled in the case of the ten core districts and about 8,000 households in all the other remaining districts. The total sample size was about 18,000 households in 503 clusters.

The target population were adults in the age group 15-50 years for all the districts covered. The study expected to interview a total of 39,000 respondents (adults in sampled households aged 15-50 years, excluding siblings). However due to non-response, non-operational clusters, vacant or demolished dwellings and absent or family away households, only 24,000 respondents were interviewed from about 12,000 households.

In the sample frame, the core districts have either 24 or 36 rural cluster. All operational clusters were covered giving a total of 10,599 households. A target of 9,000 respondents in the remaining districts were supposed to be covered based on the 1989 census figures. However due to field logistics, coverage of clusters in the remaining districts was reduced by half.

One major limitation of the secondary data is that the researcher has no control of the data quality and has to use it the way it is. In this case, the data may have some non sampling errors arising out of mistakes made in carrying out the field survey such as failure to locate and interview the correct sample selecties, errors in the way questions were asked and misinterpretation of questions on the part of the interviewer and the respondent, plus other entries and data processing errors.

The data to be used in this study is limiting in another sense that it was collected with different objectives in mind and not of the present study and therefore may not have captured adequate relevant information for this study. This therefore will demand that certain manipulations are made to make it as reliable and appropriate as possible.

The study will limit itself to the determinants of maternal mortality and morbidity in Kenya and not the levels of maternal mortality. The study will limit itself to data collected by KMMBS, 1994: Only the hospital based data will be used. The hospital data will not be a representative of the municipalities or the districts as some deliveries occur in homes and health centres and will only be used as a study unit of the subject maternal mortality and morbidity due to their accessibility and centralised information.

The data used in the study may be biased in reflecting national level statistics or differentials since most health institutions nor do all pregnant mothers attend ante-natal clinics. On the other hand hospital cases may lead to over estimates of exact levels or major determinants of maternal mortality causes. In essence, it is difficult to ascertain the exact base population actually at risk from this source only.

Nevertheless, over ninety percent of information and researches on maternal mortality have been based on hospital data since health service statistics are generally accessible and provide useful information about the immediate cause of death. The findings of this study will give prospects for more detailed future studies in specific regions of Kenya where maternal mortality may be of concern.

CHAPTER TWO

LITERATURE REVIEW

2.1 - A Preview of Maternal Mortality in The World

Complications of pregnancy and childbirth are the leading causes of premature death among women in developing countries (World Bank, 1993). Estimates of maternal mortality issued in 1996 indicate that around 585,000 women die each year of pregnancy-related causes, 99 per cent of them in the developing countries (WHO & UNCF, 1996). The gap in maternal mortality ratio between more developed and less developed regions is wide: in 1990, there were more than 480 maternal deaths per 100,000 live births in the developing regions compared to 27 per 100,000 live births in the more developed regions. In parts of Africa, ratios can be as high as 1,000 maternal deaths per 100,000. The range of the maternal mortality ratio is wide from 2,000 maternal deaths per 100,000 births in Mali to 2 in Ireland. Maternal mortality ratio is nearly 40 times greater in developing compared to developed countries. In 1987, the International Safe motherhood Initiative was launched to address this problem. Unfortunately, the progress has been slow, partly because of lack of concerns on how best to reduce maternal deaths government and other parties who are involved in the Safe Motherhood Programmes.

At the global level, new attention is focusing on the health problems of women though most studies on medical impact of child bearing patterns have been carried out in the more developed countries of North America and Europe. However, demographers, physicians and public health workers have had a long standing interest on maternal mortality and morbidity as an indicator of the success

of maternal health programmes and as an explanation of sex differentials in mortality (Buchanan, 1975, Burns, 1942, El-Badry, 1969, Gladstone, 1937).

The causes of maternal deaths are similar around the world. Globally, 80 per cent of such deaths have direct causes, that is to say, obstetric complications of the pregnant state (pregnancy, labour, and the puerperium), arising from interventions, omissions, incorrect treatment or a chain of events resulting from any of these. The single most direct cause of death accounting for a quarter of all maternal deaths is obstetric haemorrhage, generally occurring during post-partum. Puerperal infections, often a consequence of poor hygiene during delivery or untreated tract infections (including those that are sexually transmitted) account for some 15 per cent of maternal mortality. Hypertensive disorders of pregnancy, particularly eclampsia (convulsions) result in some 13 per cent of maternal deaths. About 7 per cent of maternal deaths occur as a result of prolonged obstructed labour. Other direct causes of maternal deaths include ectopic and molar pregnancies, embolisms and consequences of interventions such as anaesthesia. About 20 per cent of maternal deaths have direct causes, that is to say, they are as a result of existing disease aggravated by the physiological effects of pregnancy. Of the direct causes of death, anaemia is among the most significant (WHO & UNCF, 1996).

It is also well documented that factors such as maternal age, parity and birth intervals have a significant impact on maternal health (Buchanan, 1975, Yerushalmy, 1970). Hence to achieve an irreducible minimum maternal mortality, the frequency of timing of childbearing must be regulated (Omran, 1971b). Some demographers also acknowledge the fact that the influence of maternal age and

parity are also mediated by socio-economic, cultural practices and beliefs, genetic predispositions health and nutritional status, environmental conditions, differentials risks by age and parity (Nortman, 1974; Adetoro, 1987; Ozumba, 1988; Ogunniyi and Faleyimu 1988).

2.2 - Maternal Mortality and Morbidity in Developed Countries

Regarding age, Nortman (1974) found that parental age as a factor in pregnancy outcome for specified causes by race in United States. She found that obstetrical complications, that is, toxaemia, haemorrhage and sepsis (infection) rose with age among both whites and blacks.

Berry (1977) in his study on the influence of age and parity on maternal mortality in the U.S. between 1919-1969 found that the demographic variables had some influence on maternal mortality rates even during an era of rapid overall decline and concluded that the frequency and timing of births must be regulated if maternal mortality had to be reduced to low levels. She further observed that the age and parity distributions in the U.S for the same period of study (1919-1969) were more favourable to low maternal mortality than the childbearing patterns prevailing in many less developed countries and concluded that the broader the age ranges and more high parity births certainly contribute to the high rates of maternal mortality now prevailing in parts of Africa, Asia and Latin America. On the relationship between the maternal age and pregnancy outcome, she established that the risk of mortality or morbidity to mother or child is minimal when the mother is neither too young nor too old and when the child is of moderate birth order, but not exceeding four. Women who become pregnant before or after their prime

reproductive years therefore take an added health risk for themselves and their infants. United States study from 1974 revealed that the incidence of deaths associated with pregnancy and childbirth among American women climbs steeply after the mother pass age 30, rising from a low of 10 maternal deaths per 100,000 births among women in their early 20s, and 86 deaths per 100,000 births among women over 45 years (Berry, 1977).

2.3 - Maternal Mortality and Morbidity in Developing Countries

In the developing countries, Maternal risk also increases dramatically with age. Perkin (1969) in a study of 18,000 deliveries at women's hospital in Bangkok, Thailand in 1964 found the expected J-shaped relationship of age in complicated deliveries. From 13.3% among women aged 15-19, the rate dropped to 11.2% at ages 20-24 and rose to 23.4% and 21.3% among women aged 40-44 and 45+ respectively. Also in Thailand in 1971, maternal death rates rose from 54 per 100,000 births among women in their 20s to a grim 474 per 100,000 births among women in their 40s. Although many female deaths occur in childhood, the life expectancy of females at age 15 is still shorter than that of males with the excess deaths due solely to pregnancy-related causes (Fauveau et al 1989). The main medical causes of these deaths (Septic abortion, haemorrhage, eclampsia, obstructed labour and infection) have been documented in several studies; the majority occur in the postpartum period (Alanddin 1986, Chen et al 1974 and Fauveau et al 1988).

Bangladesh has one of the highest maternal mortality ratios in the world, about 600 deaths per 100,000 live births (UNICEF, 1993). It is one of the few

countries where life expectancy at birth for females is shorter than males (UNICEF, 1993). At Maltab, Thana in Bangladesh between 1968-1970, Koenig observed that maternal death rates rose from 380 to 810 per 100,000 deliveries for women in their twenties and those in forties respectively. Another study by Koenig (1988) for the period 1976-1985 found a U-shaped curve with death rates reaching 743 per 100,000 live birth for age group 15-19 which dropped to 426 per 100,00 deliveries for women in their 20's and then rose again to 791 for women in their 40's.

Coyaji (1989) points out that backstreet performed abortions claims approximately 200,000 women's lives annually. Moreover clandestine abortions are increasing among adolescent school girls because of the repressive legislation against contraception. This would be reduced if family planning were available to the victims. Rosenfield and Maine (1985) pointed out that abortion is presently prevalent in most less developed countries where it is illegal.

In Africa, very few population based maternal mortality rates have been published, yet maternal mortality is reported to be about 100 times higher in developing than developed countries. As Mati (1974) observes, there is plenty of data lying in the Ministries of Health, hospitals and schools of medicine in the form of annual reports, maternal records and student dissertations.

Nevertheless, during the last two decades, Africa has began to address the problems related to reproductive health as some of these problems which have taken a serious turn, threatening Africa's future (Mtimavalye, 1982). In the past 10 years, a number of organisations have participated in the launch of Safe Motherhood Initiative by supporting both research on the determinants of maternal

mortality and interventions to reduce levels of maternal mortality.

Other studies on maternal mortality in Africa are for specific hospitals and cannot be considered representative for whole countries or communities in which the hospitals are situated as a very small proportion of African women give birth in hospitals. Such hospital based studies include the works of Bullough (1977) using data from central region of Malawi; Okiosor (1979) using data from Lagos University Teaching Hospital Nigeria 1976-1977; Makokha (1980) using data from Kenyatta National Hospital, Kenya 1972-1977; Mtimavalye (1982) using data from Muhimbili Medical Centre-Tanzania 1974-1977; Obunga (1988) using data from Pumwani Maternity Hospital and Kenyatta National Hospital, 1977-1986 and Mutura (1990) using data from Nakuru General Hospital and Menengai Nursing and Maternity Home-Kenya. The maternal mortality rates they came up with varied between 10 times to 40 times those of Finland in 1973 which was estimated at about 0.11 per 1,000 deliveries (Mtimavalye, 1982).

Mtimavalye acknowledges the fact that most of the number of maternal deaths are basically preventable wholly or to a large extent. Such preventable causes include postpartum haemorrhage (the leading maternal killer in the above listed studies), ruptured uterus, puerperal sepsis, obstructed labour, anaemia of pregnancy and postabortal sepsis. This is where the knowledge of how demographic, socio-economic and environmental forces influence the maternal deaths and morbidity would help in their prevention.

In Nigeria, several studies (Adetoro 1987, Chukwudebelu and Ozumba 1988, Faleyimu and Ogunniyi 1988) have shown that maternal mortality is more common among women in the lower socio-economic class when indices such as education,

income level and type of housing are used. Harrison (1982) in his study of Zaria showed that education was a strong determinant of maternal mortality in Nigeria. He found out that among a group of pregnant women who had at least secondary education, maternal mortality was as low as that in more developed parts of the world. Studies have also demonstrated increased risk of maternal mortality among young mothers, grandmultiparous women, unmarried mothers, due in part to their lower socio-economic status (Hartfield and Woodland 1980; Oransaye et al 1982; Chukudebelu and Ozumba 1988).

The beneficial effects of improved socio-economic status on maternal mortality are not direct, but are mediated by the interplay of such factors as improved health and reproductive behaviour, improved health status, and improved access to health services, as well as by various unknown mechanisms (Harrison, 1985; Loudon 1986; Thaddeus and Maine 1990). In Nigeria, for example, delay in seeking medical care usually by women in the lower socio-economic class, has consistently been cited by hospital-based investigations, as the most important intermediate risk factor in maternal mortality.

A reproductive maternal study in Lusaka, Zambia 1982-1983 by Chisale M. and others (1986) found that women aged 35 years and older or who had four previous pregnancies had a higher risk of dying than other women especially by haemorrhage. The chief risk factors included not using an effective method of contraception, using unsafe means to terminate unintended pregnancies, lack of prenatal care, refusing blood transfusion (for religious reasons) and inadequate treatment of hypertensive disease of pregnancy. They also found that medical management problems appeared to occur more frequently during night time medical

shift.

In East Africa, the pattern is much the same; there are no community based maternal mortality and morbidity national surveys except the Kenya Maternal Mortality Baseline Survey (1994). However, the works of Mtimavalye and Armon (1982) Tanzania, Mati (1974), Makhoka (1980), Ngoka (1987), Aggarwal (1980), Obunga (1988) and Mutura (1990) in Kenya and Ndugwa (1982) in Uganda have tried to give an insight into the problem even though only at institutional levels. All these studies single out inadequate health facilities as the basic problem. Being physicians, except for Obunga and Mutura, they are more concerned with the immediate medical complications that lead to high maternal mortalities and morbidities in the region.

2.4 - Maternal Mortality and Morbidity in Kenya

2.4.1 - Incidence of Maternal Mortality in Kenya

Kenya like any other sub-Saharan country have very limited data on maternal mortality. Most studies have been based on heath service statistics particularly health institutions based in capital city, Nairobi. From the hospital information, incidence rates have often produced divergent information.

Studies from Kenyatta National Hospital, a referral institution, have indicated that maternal mortality ratio ranged from 224-480 deaths per 100,000 live births in the period 1972 to 1979 (Makokha, 1980; Aggarwal,1980). Ewbank et al, 1986 using information based on the hospital in patient admission due to pregnancy in 23 hospitals in Kenya estimated maternal maternity ratio of about 240 deaths per 100,000 live births which they consider as under estimate, but suggest

that the true ratio could be closer to 400 deaths per 100,000 live births.

Although hospital data provide useful information about underlying causes, they do not provide reliable national statistics as most deliveries occur at home. For example recent data from the Kenya Demographic and Heath survey (KDHS), 1993 showed that sixty percent of births in rural areas are delivered at home and only about forty percent of the deliveries are assisted by trained personnel. Therefore, hospital data may under estimate the level of maternal mortality. On the other hand, deaths that occur in hospitals are usually desperate and complicated cases making the hospital data to overestimate the true levels. It is for this reason that makes community based surveys provide adequate information about true levels of maternal mortality in developing countries like, Kenya.

Community based surveys have also provided some information on few regions rather than at entire national level. A longitudinal study in central Kenya in 1979 indicated maternal mortality ratio of about 90 per 100,000 live births (Voorhove et al, 1984) and study based in Kwale using networking method estimate levels in that region to be about 600-700 per 100,000 live births (Boerma and Mati, 1987).

A more recent study at national level indicates that the level could be between 300-400 per 100,000 live births (KMMBS, 1994). However, there exist significant regional differences with regions at the Coast and Western Kenya near lake Victoria having ratios of over 1,000 per 100,000 live births to a fairly low levels of under 100 per 100,000 live births in the central parts of Kenya. With levels of about 400 deaths per 100,000 live births, and at current levels of fertility rate of about 5.4 live births per woman translates into a lifetime risk of about 1 in

46 (MOH,1997).

From the various sources of data, it appears that the exact levels of maternal mortality is not yet well established. The health service records though have provided useful information on immediate causes, have mostly been based on data from Nairobi and may not reflect the situation in the rural areas. More significantly, the situation where data was obtained are mainly those that serve low socio-economic status women. Secondly, in the absence of vital registration or community based surveys, no trends can be established. But from the available sources, it can be inferred that the levels are considerably high; in addition there may be indications that these levels may be increasing (WHO, 1993) a fact still difficult to ascertain.

2.4.2 - Causes of Maternal Mortality in Kenya

From the available studies, it has been documented that haemorrhage, puerperal sepsis, ruptured uterus, and obstructed labour are the major causes of maternal deaths (Boerma,1987; Makokha, 1980; Ewbank et al, 1986). Ewbank et al (1986) particularly noted that excluding abortion related deaths, 28% of deaths were due to puerperal sepsis, while 19% were due to post partum haemorrhage, a fact which indicates that most deaths may be occurring during puerperium.

From medical point of view, it is now widely accepted that 63 to 80 per cent of all direct maternal deaths and 58-98% of all maternal deaths could be avoided with proper health facilities, early diagnosis and proper utilization of health care facilities (WHO, 1986; Mhango et al. 1986, Makokha, 1980).

It is clearly evident that maternal mortality rates are high in Kenya which give

clear indication that childbearing in Kenya may be risky "business" thus increasing the overall mortality burden of women. However, research also indicates that majority of these deaths could be avoided since major causes of deaths are preventable more so through availability and proper utilization of health facilities. Whereas these facts are acknowledged, does the problem of maternal mortality lie solely on using advanced obstetrical care? To answer this question needs an examination of predisposing factors of maternal mortality and morbidity. Since it is acknowledged that for the effective intervention to be possible , there need to be an understanding of medical, socio-economic and cultural causes of maternal morbidity and mortality.

In Kenya, Malone (1980) observes that it would be reasonable to assume that the quality of ante-natal care provided in hospitals and health centres does influence not only maternal but also perinatal morbidity and mortality. Makokha (1980) in his study of maternal deaths at Kenyatta National Hospital between 1972-1977, analyzed his findings in relation to actual (medical) causes, annual distribution, age, parity, marital status, antenatal care, complications of pregnancy, labour and puerperium and their management, mode and place of delivery (for the referred cases) and the type of attendant (doctor, midwife, nurse, clinical officer or traditional-again for referred cases). Makokha's findings concerning the relationships between age and parity of the mother and risk of dying contradicts the hypothesis that the risk of maternal deaths increases with age and parity. He analyzed 99 deaths, with more than 50 dead mothers aged between 15-25 years, half of them being 15-20 years old and 27% being 26-35 years of age. Only 3% were aged 36 years and over, the maximum age recorded being 40 years. As for

parity, he found that 57% of the 99 deaths were mothers of low parity with 1-3 children. Nearly half of them were young women pregnant for the first time. But he acknowledges that majority of deaths were related to abortions especially for those found to be single (39.4%) among the 99 cases. Thus he used the other said factors to explain the causes of such deaths. Makokha's work, therefore, went along way in documenting some of the non medical factors that operate on women to cause maternal mortalities.

Ngoka (1987) also did a retrospective study of maternal deaths at Pumwani Hospital for the period 1975-1984 and found an incidence of maternal mortality of 67.2 per 100,000 births. Of the 223,111 births during the 10 year period at the hospital, there were 150 maternal deaths. He analyzed these deaths in relation to age, parity, gestation at the time of death and records of antenatal care. From his analysis he found that high maternal age is a very important predisposing factor in maternal mortality and that deaths occurred mostly among the primigravida (those pregnant for the first time / her first child) and grand-multiparas (those who had been pregnant before / has several children). Like Makokha, he also acknowledges the contribution of social, personal, health care and administrative factors to increased maternal mortalities in Kenyan Hospitals.

On abortion, the works of Ngoka (1985), Muraya (1986), Aggarwal and Mati (1982) deserves to be mentioned. At Kenyatta National Hospital, abortions contributed a lot of maternal health problems. It was found that teenage pregnancies accounted for 11.1% of the total pregnancies (Ngoka and Mati, 1980). In another study at the same institution, 28% of all abortions were found to occur in teenage mothers and 43% of all procured abortions were in teenagers (Aggarwal

and Mati, 1982). These studies, therefore, recognise that teenage pregnancy has become a common and important obstetric problem not only in Nairobi but for the whole country as shown in the KMMBS (1994) and that it threatens the health of both the mother and child.

Although only limited research has been conducted in developing countries on abortion, in the last few years, hospital data that do exist for Africa indicate that the problem of unsafe abortion has not diminished. For example, Kenyatta hospital in Nairobi, which reported 2,000 and 3,000 admissions a year for abortion complications in the late 1970s and early 1980s (Rogo,1990) is now treating 30-60 cases a day. these numbers translates to over 10,000 admissions a year for complications of abortions or five-fold increase over the past ten years or so (Jacobson, 1990).

Aggarwal and Mati (1982) noted the fact that maternal mortality is high in abortion cases. Their retrospective study of abortion cases at Kenyatta National Hospital from January to June 1978 found 3 abortion deaths per 1000 abortion admissions.

Apart from immediate complications and risks, physicians also warn of the fact that abortion patients later suffer from pelvic inflammatory disease leading to tubal leakage, secondary infertility, ectopic pregnancy, miscarriage and premature deliveries due to lacerated cervix. All these later give rise to high rates of maternal mortality and illnesses. Most literature on the problem of abortion therefore recommend country wide health education programmes with particular emphasis on sex education in schools and family planning; making population aware of contraceptive measures and making these services easily available. Such measures

could go along way in reducing not only morbidity and mortality from septic induced abortion, but also the general maternal mortality and morbidity levels among women of reproductive ages.

A study at Kenyatta National Hospital and Pumwani Maternity Hospital found maternal mortality ratios to be 2.0 per 100,000 and 0.7 per 100,000 respectively (Obunga, 1988). Both rates are higher than that of the developed world.

Maternal mortality exhibits a classic U-shaped relationship with maternal age. Mortality rates are higher among women aged 15-24 years, reach a minimum for ages 24-34, and then rises further reaching a peak at age 35 and above. The high deaths to young mothers could be attributed to low age at marriage, low age at first birth and abortion (Mutura, 1990). Mutura also found out the relationship between maternal mortality and parity to be curvilinear. Regarding the fertility factors, only primigravida and multiparous women were found to have higher mortality risks and this accounted for 41.1% of all maternal deaths. The maternal mortality ratio is subsequently lower among the parities 3 through 6.

Most complications which can lead to maternal death include haemorrhage, obstructed labour and uterine rupture, infections and abortions. Indirect causes are related to anaemia, diabetes, heart diseases and malaria (Mutura,1990). This is consistent with Obunga's 1988 study which found the major causes of maternal deaths at Kenyatta National Hospital and Pumwani Maternity Hospital to be puerperal sepsis, postpartum haemorrhage, eclampsia, toxaemia and ruptured uterus.

According to the KMMBS (1994), 332 maternal deaths per 100,000 live

births occurred in hospitals from which the data was collected, 14% of them in Coast Province, followed closely by Nyanza Province (11%). It was also found that nearly one-third of all the maternal deaths occurred during pregnancy, compared with 16% during child birth. The major causes of death were known by most respondents but current condition of the mother (20% of the maternal deaths), haemorrhage (18%) and puerperal complication (15%). Another curious feature is rampant abortion; of the 8,737 cases reported by hospitals, Nakuru General Hospital reported 14.9% of all cases and 14% were in Coast General Hospital.

Most maternal deaths occurred among women aged 15-29 years and among those with parities of 0-4 children. Estimates from the survey data gave a total maternal mortality of 530 per 10,000 births with Nyanza accounting for 23.6%, Western 23% and Eastern 21%. About 46.4% of the deaths occurred in hospitals and were positively correlated with distance from health delivery points.

According to the KMMBS (1994), traditional socio-cultural status of women have disadvantaged them and deprive women equal education opportunity, and source of wealth which directly and indirectly impacts negatively on their health status and life expectation, for example, in reaching health centres, in utilizing properly, in deciding where to seek medical services, in communicating with doctors etc. Socio-cultural beliefs and practices have imposed many food taboos and food avoidances as well food cultures on staple food which in fact promote malnutrition, poor diet to the expecting mothers and their children. This was found to be widely practised in Embu, Kwale and South Nyanza Districts for examples, the avoidances of milk and eggs.

The negative socio-cultural practices are still having an impact in the light of

social change taking place. There is large school drop out as a result of poverty, and this has enabled polygyny as a form of marriage to flourish. In this system of marriage, it was found to contain many practices which indirectly endanger the health of expecting mothers and their children.

In conclusion, maternal mortality rate shows a far greater disparity between developed and developing countries than even infant mortality which is most often taken as the measure of comparative advantage. Maternal mortality in the developing countries is not a chance event. It is the endpoint of a process that begins at birth and develops over a woman's entire reproductive lifetime. As with most other processes, it has its origins in many intertwined factors, starting with the social status and the position of women, greatly affected by the economic resources and infrastructure of the country, and immediately dependent on the accessibility and availability of skills, materials and facilities for family planning and maternity care.

CHAPTER THREE

CONCEPTUAL FRAMEWORK, DATA SOURCES AND METHODOLOGY

3.1 - Conceptual Framework

From the available literature, it is clear that the number of possible combinations of all the variables which have an effect on pregnancy outcome are vast. Any factor that is thought to influence maternal mortality, or rather reduce maternal mortality, must operate through the following events; reduce the likelihood that a woman will become pregnant, reduce the likelihood that a woman will experience some complication of pregnancy or childbirth, or improve the outcomes for women with complications. These include a set of socio-economic and cultural factors which act through a diverse range of other variables to influence pregnancy outcome.

3.1.1 - McCarthy and Maine (1992) Analytical Framework

The development of this framework was carried out by reviewing the widely accepted frameworks that have been developed for fertility and child survival, and reviewing the existing literature on maternal mortality, including the results of research studies and accounts of intervention programmes. In this framework, any factor that is thought to influence maternal mortality and reduce maternal mortality, must operate through these events. These efforts must either:

Reduce the likelihood that a woman will become pregnant;

(ii) Reduce the likelihood that a pregnant woman will experience serious complications of pregnancy of childbirth; or

(iii) Improve the outcomes of women with complications.

Using the same approach as Davis and Blake, 1956, Bongaarts 1978; Mosley and Chen, 1984 that specify the biological and behavioral mechanisms through which socio-economic and cultural factors operate to produce a birth and the survival of a child at age five, this framework has taken a more systematic approach to the understanding of the determinants of maternal mortality. The framework can also be applied to the chronic morbidity that results from pregnancy or child birth. In this framework, "maternal morbidity" encompasses only long-term serious morbidity that are severe and long-standing. The term 'disability' is also used to refer to the chronic severe morbidity that results from either pregnancy or childbirth and refer to the maternal death as the ultimate outcome of the framework.

Figure 1 - Conceptual Model

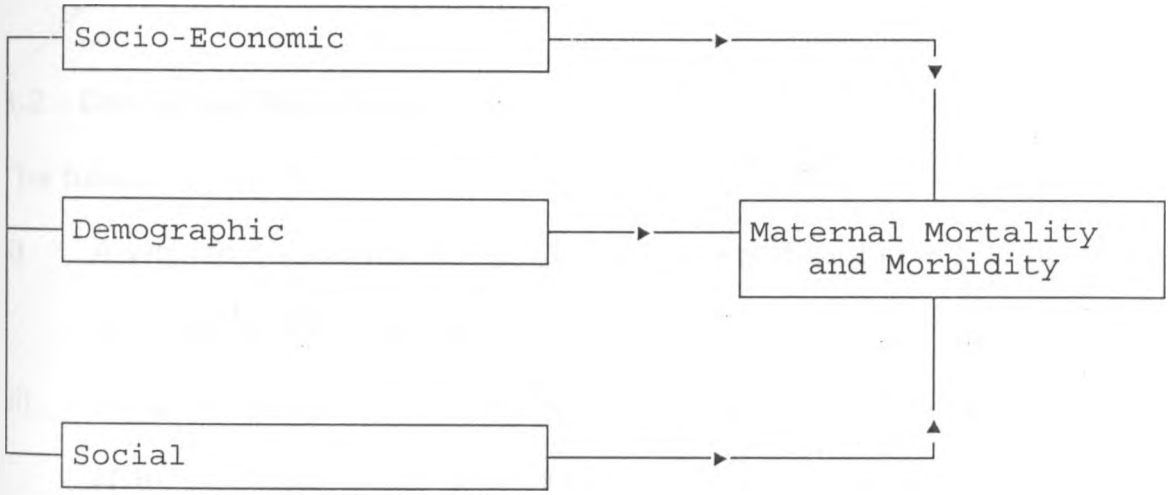
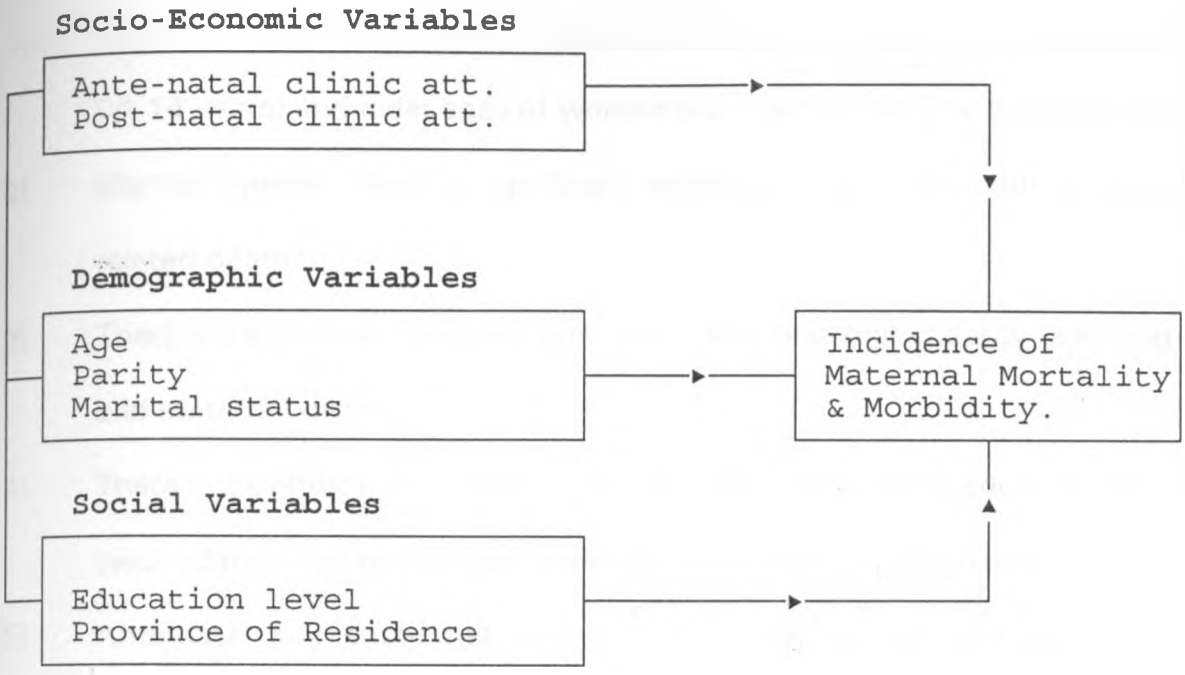


Figure 2 - Operational Model



Source: A modified McCarthy and Maine Framework (1992) for analyzing the Determinants of Maternal Mortality and Morbidity.

3.2 - Conceptual Hypotheses

The following hypotheses will be examined in the study:

(i) A woman's socio-economic status has a significant effect on her chances of surviving a pregnancy.

(ii) A woman's reproductive/demographic status has a significant effect on her chances of surviving a pregnancy.

(iii) A woman's social status has a significant effect on her chances of surviving pregnancy.

3.3 - Operational Hypotheses

1) There is a significant positive relationship between women of younger ages (< 14 years) and older ages of women (40+ years) and maternal mortality.

2) Married women have a significant negative relationship with pregnancy related deaths.

3) There is a significant positive relationship between higher parity (5+) status and maternal death.

4) There is a significant negative relationship between higher educational level (secondary+) of women and chances of surviving a pregnancy.

5) Ante-natal and post-natal care attendance by women during and after pregnancy are significantly negatively associated with lower pregnancy deaths.

6) There exists regional differentials in maternal mortality and morbidity incidence in Kenya.

7) There is a significant positive relationship between lower parity (zero) status and maternal mortality.

3.4 - Operational Definitions

3.4.1 - Death : The final outcomes in the framework is maternal death. This variable will be measured as binary variable: whether the woman died or not.

3.4.2 - Distant Determinants

3.4.3 - Socio-economic Factors

It is well known that the risk of dying is strongly influenced by ones position in society. In most circumstances and for most diseases, including maternal mortality, the poor and the disadvantaged are more likely to die than the more affluent people. Differentials in maternal mortality by socio-economic status exist among countries. However, socio-economic status is a complex concept at community level.

For women, their status in the family and in the community can be related to their level of education, their occupation, their level of personal income or wealth, and their autonomy (e.g. their ability to travel on their own or make independent decisions to use health facilities).

These factors will be analyzed at the macro and micro levels. At the macro level, the economic level of the whole country will be considered. For example, the study will consider whether the country has the resources to have a well-spread and easily accessible network of ante-natal and post-natal clinics, maternity homes, trained midwives and health care centres. The macro level variable will also consider the general educational level of women in the country which in turn affects the level of understanding of mothers and would-be-mothers, their ability to make use of the said health and / or maternity services and facilities to their advantage.

At the micro-level the economic level of the household / family can also greatly influence the health of the mother. It can determine whether a pregnant woman has sufficient/adequate food during and after pregnancy. It will also

determine the availability of easily accessible transport and emergencies. Where public health care systems are weak, the family's economic situation would afford private health care services from private medical practioners or even private hospitals.

The social well-being of a family also determines its level of hygienic and general eating habits. The social variables considered in this study are: their educational status and regional / province of residence.

i) **Education:** Education will be measured by the level reached by the woman e.g. none, primary, or secondary+.

ii) **Region / Province of Residence:** The place of residence will be used to refer to the victims residence (province) at the time of death. It will be categorized according to the Kenya six provinces: i.e. Central, Coast, Eastern, Western, Nyanza, and Rift-Valley.

3.5 - Demographic Factors

These factors affect the health of the mother to the extent of exposing her to the risk of ill-health or death. They include age, marital status and parity.

i) **Age:** The reproductive lifespan of women ranges from 15-49, ages 20-35 are considered to be the safest ages to have children. But, the absolute extent of risks to hazards of pregnancy is also determined by the social and environmental conditions of the women involved. It is also known that certain complications of childbirth rise with age while others are experienced when the would be mother is either too young i.e below 20 years of age or too old i.e 40+ years. Age shall therefore be considered as the risk of

morbidity or mortality to the mother.

Age as used in this study will be measured in the following categories: 10-14, 15-19, 20-24, 25-29, 30-34, 35-39, 40-49. Age, though being an important demographic variable, has numerous problems including age misstatement, heaping, shifting and some are indicated as "A" for adults and "minor" for children.

ii) **Parity:** Parity is measured as the number of children one has including the present live birth or pregnancy which has the same risk exposure to the mother. Parity is not a continuous variable. It is widely recognised that higher maternal mortality is related to higher parity. The parity will be measured in terms of the following categories: 0, 1-2, 3-4, 5-6, and 7+.

iii) **Marital Status:** This will be measured in terms of the following categories: single, married, and other forms of marriage (divorced, separated or widowed). The variable will be measured as a dummy variable.

3.6 - Socio-Economic Factors

Such factors include late referrals of patients to hospital for specialist attention by the doctors / institutions. Socio-economic factors that will be studied here are:

i) **Ante-natal Clinic Attendance:**

The variable is a binary. Reference will be made as to whether one has ever attended clinic or not but the number of attendance may be difficult to obtain.

ii) **Postnatal clinic Attendance:**

This variable is also a binary variable. It will be measured in terms of whether the mother attended postnatal clinic or not.

3.7 - DATA SOURCES

3.7.1 - Primary Data Source

The study will use the hospital based data of the Kenya Maternal Mortality Based Survey of 1994 as its main data source. The survey was conducted between January - December 1993. The sampling frame included all women admitted to the 19 district and provincial hospitals covered by the survey. The sample designs and other features of the survey can be obtained from the KMMBS report. Health service statistics and hospital records are generally accurate and provide useful information about the immediate cause of death to those who utilise these services.

3.7.2 - Other Sources of Data on Maternal Mortality

Currently, two other sources of data on maternal mortality are used: vital registration and community based surveys. These two sources vary greatly in their suitability for studying different aspects of maternal mortality. Vital registration may provide adequate information on both levels and causes of maternal deaths as well as trends but this source is incomplete in Kenya. Where it exists only the urban population is covered and the rural population missed because of non reporting of such deaths.

Community based sample surveys may be prospective or retrospective. In Kenya, there has been a number of household surveys covering most parts of the country and only one (KMMBS,1994) did collect data relating to maternal mortality and morbidity. Some information was also collected by the Demographic Health Survey (NCPD,1993) but it was too limited. Part of the difficulty could be due to large samples required to obtain heath information about maternal deaths and morbidity, and the emphasis on infant/child mortality. However, this source is poor in determining specific cause of death. Methods used to obtain estimates on maternal mortality from community based health surveys include: sibling survivorship (including sisterhood method), orphanhood and widowhood methods and lastly "networking" (Ministry of Health, 1997).

The data was primarily be extracted from the Kenya Maternal Mortality Baseline Survey (KMMBS,1994). Only the hospital data was used for the analysis.

3.7.3 - Hospital Data

The hospital information was collected using pre-designed forms of three types. The first form was used to extract information from files of each woman in-patient admitted to the pregnancy ward. The basic information include age, parity, marital status, education, attendance of antenatal and postnatal clinic, medical history on survival status of the patient at the time of discharge and the cause of death if applicable.

The second form was used to collect summary information from the maternity and gynaecology ward for each month for the period Jan-Dec 1993. The information collected was on the number of maternity admissions, the number of

deliveries by method, for example, normal (svd), forcep, vacuums, caesarian section etc; the number of still and live birth and the number of maternal death. This form was used to collect information from the gynaecology ward for the period Jan-Dec 1993 on the number of admissions due to abortion and the number of abortion related deaths, deaths due to ectopic pregnancy and deaths during the puerperium.

The third form was a designed questionnaire administered to hospital personnel on matters pertaining to major maternal mortality causes, ante-natal and post-natal services as well as referral system from traditional birth attendants (TBAs).

3.8 - METHODS OF DATA ANALYSIS

3.8.1 - Descriptive Statistics

The study will use descriptive statistics to summarize the data, for example, the use of frequency tables and also make extensive use of percentages, to illustrate some of the relationship between demographic variables (parity, age etc) and maternal mortality and morbidity.

3.8.2 - Cross Tabulations

This method will be used to determine the relationship among variables. This will be done for two or more variables. To determine the significance of association between maternal mortality and all other key independent variables like age, parity, marital status, education, ante-natal care attendance among other variables, as determined by the Chi-square statistic. Chi- square is used to test if the observed

series of values differ significantly (statistically) from what was expected.

Chi-square will be used to find out whether the relationship exists among the socio-economic factors and the demographic processes mentioned above.

In computing X^2, the following steps will be followed:

i) The null hypothesis (H_o) will be stated.

ii) Levels of significance at which the hypothesis is to be tested will be specified.

iii) The degree of freedom will be worked out (R-1)(C-1).

iv) The null hypothesis (H_o) will be rejected only when the calculated value of X^2 is equal to or more than the tabulated value of X^2 at the specified level of significance using the stated degrees of freedom.

This is principally used for testing the Null-Hypothesis, and hence calls for other methods of data analysis to test the strength of association among variables.

3.8.3 - Logistic Regression

The study utilizes logistic regression to examine the determinants of maternal mortality and morbidity. Detailed description of the method is provided in the sub-sections that follow:

Logistic regression has been used to determine the probability of an event occurring in this case (maternal death and morbidity) given certain conditions (i.e.the independent variables). Logistic regression model is the same as that of any model-building technique such as linear or multiple regression. The idea is to find the best fitting model to describe the relationship between the outcome (dependent or response variable) and a set of independent variables , often called covariates.

The difference between logistic regression model from linear regression model is that the outcome variable (dependent) in logistic regression is binary or dichotomous.

Basically logit analysis is a probability regression model which expresses the dichotomous variable, Y_i as non-linear function of the explanatory variable X_i and can be interpreted as the probability that the mother will die or survive given the variable in the model.

Two primary reasons for choosing logistic model are:

i) From a mathematical point of view, it is extremely flexible and easily used function; and

ii) It lends itself to a biologically meaningful interpretation (Hosmer and Lemeshow, 1989).

a) Simple Logistic Regression Model

The specific form of the logistic model is as follows:

$$\pi(x) = \frac{e^{\beta 0 + \beta 1 x}}{1 + e^{\beta 0 + \beta 1 x}}$$

Where $\pi(x)$ = Probability of an event occurring
e = The base of the natural logarithms
approximately 2.718
β = Coefficients estimated
x = Independent variable

A transformation of $\pi(x)$ that is central in the study of logistic regression is the logit transformation. This defined in terms of $\pi(x)$, as follows:

$$g(x) = \ln \left[\frac{\pi(x)}{1 - \pi(x)}\right] = \beta 0 + \beta 1 x$$

This transformation is important because it has many of the desirable properties of linear regression. The logit, g(x) is linear in its parameters, may be continuous, and may range from $-\infty$ to $+\infty$ depending on the range of x.

b) Multiple Logistic Regression Model

This deals with a logistic model of more than one independent variable ie. the "multivariate case".

If we have a collection of p independent variables denoted by x = (x1, x2 - --xP), then the conditional probability that the outcome is present if denoted by P (Y = 1/x) = $\pi(x)$. Then the logit of the multiple regression model is given by they equation:

$$g(x) + \beta 0 + \beta 1 x1 + \beta 2 x2 + \text{---------} \beta p Xp$$

in which case:

$$\pi(x) = e^{g(x)}/1 + e^{g(x)}$$

In this situation the method of choice is to use a collection of design variable or dummy variables.

In general if a variable has k possible values, then k - 1 dummy variable will be needed. For example, suppose the jth independent variable, x; has kj levels, then kj - 1 dummy variables can be denoted as Bju, U = 1, 2, -------- kju - 1. Thus the logit for a model with p variables and jth variable being discrete would be:

$$g(x) = \beta 0 + \beta 1x1 + \text{----------} + \Sigma Bju\ Dju + \beta pxp$$

Interpretation of the coefficients of the Logistic Regression Model.

In Logistic regression the estimated coefficients for the independent variables represent the shape or the rate of change of a function of the dependent variable. Thus, interpretation involves two issues. Determining the functional relationship between the dependent variable and the independent variable, and appropriately defining the unit of change for the independent variable.

The first step is to determine what function of the dependent variable yields a linear function of the independent variables. This is called the link function (McCullagh and Nelder, 1983).

In the case of linear regression model it is the identity function since the dependent variable is linear in the parameters, i.e. it is the function y = y. In logistic regression model the link function is the logit transformation:

$$g(x) = \ln \{\pi(x)/[1-\pi(x)]\} = \beta 0 + \beta 1x.$$

For a linear regression model the shape coefficient, $\beta 1$, is equal to the difference between the value of the dependent variable at x + 1 and the value of the dependent variable at x, for any value of x. For example, let $y(x) = \beta 0 + \beta 1x$

from which it follows' that $\beta = y(x+1) - y(x)$. In this case the resulting coefficient expresses the resulting change in the independent variable. Such as, if in a regression weight on the height of adolescent male children, we may then conclude that change in 1 inch in height is associated with a change of 5 pounds in weight.

In the logistic regression model $\beta 1 = g(x + 1) - g(x)$. That is the slope coefficient represents the change in the logit for a change of one unit in the independent variable x.

Logit analysis is like multivariate regression method for estimating relative risk. The logit coefficients are the natural logarithms of the relative odds by which determinants of mortality are different from the risk of dying. An odd is the frequency of being in one category to the frequency of not being in that category and is interpreted as the chance that an individual randomly selected will be observed to fall into that category and is interpreted as the chance that an individual randomly selected will be observed to fall into the category of interest. The odds ratio here is the marginal odds applying to the total frequencies while holding the effect of the other variables constant.

The logistic model can be re-written in terms of the odds of an event occurring. The odds of an event occurring are defined as the ration of the probability that it will occur to the probability that it will not. It is easier to think of odds, rather than log odds, and the logistic equation can be written in terms of odds as:

$$\frac{\text{Prob (event)}}{\text{Prob (no event)}} = e\beta_0 + \beta 1x1 \text{ ---------- } \beta pxp$$

The e raised to the power of β_1 is the factor by which the odds change when the ith independent variable increases by one unit. If β_1 is positive this factor will be greater than 1, which means that the odds are increased; if β_1 is negative the factor equals to 1, which leaves the odds unchanged.

The parameters in the logit model may be interpreted as ordinary regression coefficient. Positive values indicate that the independent variables or their interactions raise the log odds of the dependent variables, while negative coefficients show lower log odds (Pindyck and Rubinfield, 1976).

One major assumption of logit regression analysis concerns the independence of the individual explanatory variable, i.e. the absence of multicollinearity. The presence of multicollinearity affects the regression coefficients by raising the standard error of the estimates (Blalock, 1968; Asher, 1976). To solve this problem is to use the probit or logit technique which will guarantee that the estimated conditional probabilities be between zero and one (Gurajati, D. 1978).

The need for use of logit regression is prompted by a number of factors. First, some of the mortality determinants in the model are related to general public health condition that affect mortality risk of most females subjected to the influences. Logit analysis is appropriate for the factors because it is multivariate method of estimating relative risk. The logit coefficients are the natural logs of the relative odds by which the determinants of mortality are different from the risk of dying.

c) **Limitations of Logistic Regression Analysis**

1) The statistical list used in the selection of the model depends and is affective by sample size i.e is only effective if large samples is used.

2) Requires categorization. In so doing, important information unique to particular categories is usually lost and conclusions drawn about the relationships may be inconsistent with those in the underlying population.

3) The approach assumes that all the observed frequencies for cells of the Across - Classification are greater than zero, or otherwise estimation is impossible.

CHAPTER FOUR

REGIONAL MATERNAL MORTALITY DIFFERENTIALS

4.1 - Introduction

This chapter gives the frequency description and cross tabulation results. These are important as they give a quick look of some of the significant factors associated with maternal mortality and morbidity differentials in Kenya.

The information was extracted from hospital based questionnaires which sought to know the following information from each individual in-patients confined to the hospital due to pregnancy:

1) Age of the mother
2) Parity
3) Marital Status (single, married, widowed, divorced or separated)
4) Level of education (none, primary, secondary and above)
5) Ante-natal clinic attendance by the patient
6) Post-natal clinic attendance by those of parity 2+
7) What was the diagnosis
8) Did the woman die?
9) Time of death (before child birth, during child death, or within 6 weeks after child birth).
10) For those who died what was the cause of death? and
11) Medical / Health information of the patient.

4.2 - Distribution of Maternal Deaths

An analysis of maternal mortality is not complete without looking at the underlying factors which influence this type of mortality in a community be they medical or non-medical factors. An effective intervention strategy can only be developed with a good understanding of these factors.

Table 4.1 is the frequency distribution table that shows the general characteristic of women as derived from the KMMBS (1994) Hospital Data (questionnaires) which carried information on demographic (age, parity, and marital status) and social factors (education and province of residence). In this table, percentages of selected socio-demographic variables are presented.

The table shows how death rates were computed as case fatality ratios based on women admissions rather than live births hence they can be interpreted as maternal death rates rather than ratios, expressed per 1,000 admissions. When the rates were computed according to marital status, the single women had higher death rates than those who were married and those who were either widowed, separated or divorced exhibiting the lowest death rate of 0.96 per 1,000 admissions.

Death rate by age exhibits the expected / typical U-shaped curve indicating greater risks at very young ages of 7.46 deaths per 1,000 admissions at 10-14 ages and older reproductive ages (40+ years) of 19.2 deaths per 1,000 admissions.

Death rates computed based on parity status of women shows that women of parity 1-2 were the least affected with maternal mortality rate of 2.3 per 1,000 admissions. Greater rates were also observed among higher parity (7+) women of

11.42 deaths per 1,000 admissions. However, it should be noted that age is confounding here since women of higher parity are also likely to be older. Older women aged 40+ had the greatest risk with a rate of 19.2 per 1,000 admissions.

The table also indicated that most of the women admitted did not state their level of education (70.4%). However, 16.4% had primary level of education. This group of women also recorded the highest death rate of 5.63 per 1,000 admissions. Those who had a secondary level of education and above were the least affected with maternal mortality rate of 2.58 per 1,000 admissions.

On deaths by province of residence, Nyanza recorded the highest maternal mortality rate of 11.6 per 1,000 admissions followed by Coast with mortality rate of 7.23 per 1,000 admissions whereas Eastern Province had the least maternal mortality rate of 0.95 per 1,000 admissions.

The table below shows the distribution of women admitted by various background characteristics including those who died.

Table 4.1: Distribution of Maternal Deaths per 1,000 women admitted by various Background Characteristics:

BACKGROUND CHARACTERISTICS 1	TOTAL ADMISSIONS 2	PERCENTAGE 3	NUMBER OF DEATHS 4	CASE FATALITY RATIO PER 1000 ((4/2)X1000) 5
AGE GROUP.				
10-14	134	0.2	1	7.46
15-19	14197	21.5	49	3.45
20-24	26612	40.3	58	2.19
25-29	14228	21.5	55	3.86
30-34	6288	9.5	29	4.61
35-39	2362	3.6	14	5.92
40+	625	0.9	12	19.2
NOT STATED	1634	2.5	15	
TOTAL	66080	100.0	234	3.54
PARITY				
0	16421	24.9	41	2.5
1-2	30009	45.4	69	2.3
3-4	12242	18.5	46	3.76
5-6	5032	7.6	29	5.73
7+	2189	3.3	25	11.42
NOT STATED	187	0.3	24	
TOTAL	66080	100.0	234	3.54
MARITAL STATUS				
SINGLE	10412	15.8	38	3.65
MARRIED	54407	82.3	171	3.14
OTHERS	1033	1.6	1	0.96
NOT STATED	288	0.3	24	
TOTAL	66080	100.0	234	3.54
MOTHERS EDUCATION				
NONE	3686	5.6	11	2.98
PRIMARY	10833	16.4	61	5.63
SEC+	5036	7.6	13	2.58
N/S	46525	70.4	149	
TOTAL	66080	100.0	234	3.54
PROVINCE				
CENTRAL	7070	10.7	16	2.26
COAST	1937	2.9	14	7.23
EASTERN	5256	8.0	5	0.95
NYANZA	7672	11.6	89	11.6
RIFT VALLEY	12405	18.7	43	3.47
WESTERN	4732	7.2	10	2.11
OTHERS	27008	40.9	57	2.11
TOTAL	66080	100.0	234	3.54

Source: Study Data:

4.3 - Maternal Mortality Differentials

In this section the results of cross tabulations and the chi-square values are presented. Cross-tabulations have been used to assess the association between the dependent (maternal mortality) and each of the independent variables. The chi-square have been used to test the null-hypothesis that there is no association between the dependent and each of the independent variables. The chi-square test has been set at $\alpha = 0.05$ for all the cross tabulations.

4.4 - Maternal Mortality By Demographic Factors

a) Age of the Mother

Table 4.2 shows the distribution of maternal mortality by maternal age. It is evident from the table that higher maternal deaths occur at younger and older reproductive age groups with 0.7% and 1.9% maternal deaths in the (10-14) and (40-49) age groups respectively, and low maternal deaths in the mid reproductive age intervals between (20-35) e.g.only 0.2% maternal deaths in the age group (20-24). The observed relationship between maternal age and maternal death is statistically significant (at 99% confidence level). This observation confirm the study hypothesis that there is a significant positive relationship between younger and older ages (<14 and $40+$) and maternal mortality.

Table 4.2: Distribution of Maternal Mortality By Age of the Mother

	AGE GROUP OF THE MOTHER							
DID THE CASE DIE	10-14	15-19	20-24	25-29	30-34	35-39	40-49	TOTAL
YES	1 (0.7)	49 (0.3)	58 (0.2)	55 (0.4)	29 (0.5)	14 (0.6)	12 (1.9)	218 (0.3)
NO	133 (99.3)	14117 (99.7)	26507 (99.8)	14136 (99.6)	6243 (99.5)	2343 (99.4)	612 (98.1)	64091 (99.7)
TOTAL	134 (100)	14166 (100)	26565 (100)	14191 (100)	6272 (100)	2357 (100)	624 (100)	64309 (100)
DF = 6 Computed $X^2 = 66.83$ Significance = 0.000								

SOURCE: Study Data: Number of missing observations:1771
Note: In parentheses are the column percentages.

This finding is consistent with that of Mutura (1990) who found that there is a significant relationship between maternal related cause of death and maternal age. This outcome is also shared with that of (Maine, 1981) who found that risks are high for very young women, older women, women with no children, but are lower for women in between. The KMMBS (1994:55) also found that deaths by age are higher at very young and older reproductive ages. The same report indicated that majority of younger women are exposed to childbirth in marriage. Medical evidence shows that young pregnant women experience greater risks during childbirth because of undeveloped pelvic cavity.

The research findings are also consistent with the maternal mortality study in Giza, Egypt by Kane et, al. (1992). The study found that maternal mortality typically increases with age, the majority of maternal deaths often occur among younger women, because of higher fertility at younger ages. The maternal mortality ratios in Giza-Egypt (per 100,000 live births) showed an increase in deaths with age. The maternal mortality ratio for women aged 45-49 was 10 times higher than the ratio for women aged 25-29. The low maternal mortality ratio for women aged

15-19 was due to very low fertility rate resulting from very low proportions of women married in this age group.

b) Parity of the mother

Table 4.3 shows that women of high parity births (7 +) recorded the highest mortality incidence of 1.1% . This group exhibited a high risk factor. They were followed by those of parity levels 3-4 and 5-6 both at 0.6%. Parity levels 1-2 and 0 had the lowest incidence rates of 0.2% at each level. The cross tabulation results showed that the observed relationship is statistically significant (at 99% confidence level). This confirms the study hypothesis that higher parity status of women has a significant positive effect on their chances of surviving a pregnancy.

Table 4.3: Distribution of Maternal Mortality By Parity

DID THE CASE DIE	PARITY OF THE MOTHER					
	PARITY 0	1 THRU 2	3 THRU 4	5 THRU 6	7+	TOTAL
YES	14 (0.2)	69 (0.2)	46(0.6)	29(0.6)	25 (1.1)	210 (0.3)
NO	16367(99.8)	29866(99.8)	12161(99.6)	4991(99.4)	2159 (98.9)	65544 (99.7)
TOTAL	16408 (100)	29935(100)	12207(100)	5020(100)	2184 (100)	65754 (100)
DF = 4 Computed X^2 = 68.43 Significance = 0.000						

SOURCE: Study Data: Number of missing observations:326
Note: In parentheses are the column percentages.

Mutura (1990) had similar findings with the ones shown on table 4.3 on the relationship between the cause of maternal death and parity. The KMMBS (1994) showed that death rates computed based on parity status of women has a pattern of greater rates among higher parity women. Parity can influence one of the major disabilities that results from pregnancy - uterine prolapse, which is much more common among high parity women (Omran and Standley, 1976).

c) Marital Status

Table 4.4 shows the distribution of maternal mortality by marital status. The results of the cross tabulation showed no significant relationship between maternal mortality and marital status as indicated by maternal deaths of 0.4% for single, 0.3% for the married, and 0.3% deaths for the mothers who were either divorced, separated or widowed. The observed relationship was found not statistically significant.

Table 4.4: **Distribution of Maternal Mortality By Marital Status**

	MARITAL STATUS OF THE MOTHER			
DID THE CASE DIE	SINGLE	MARRIED	OTHERS	TOTAL
YES	38 (0.4)	171 (0.3)	3 (0.3)	212 (0.3)
NO	10354 (99.6)	54117 (99.7)	1030 (99.7)	65501(99.7)
TOTAL	10392(100.0)	54288 (100.0)	1033(100.0)	65713(100.0)
DF = 2	Computed X^2 = 0.730	Significance = 0.694		

SOURCE: Study Data: Number of missing observations:1188
Note: In parentheses are column percentages

Past researchers like Mutura (1990) have also found no relationship between maternal death and marital status.

4.5 - Maternal Mortality By Socio-economic Factors:

a) Ante-natal Clinic Attendance

Table 4.5 shows that women who regularly attended antenatal clinic, only 0.3% maternal deaths occurred in contrast to higher rates of 0.5% maternal deaths for those who never attended ante-natal clinic. The observed relationship is statistically significant (at 99% confidence level). This finding concurs with the hypothesis that ante-natal care attendance is significantly negatively associated with lower incidence of pregnancy deaths.

Table 4.5: Distribution of Maternal Deaths By Regular Attendance of Antenatal Clinic

	REGULARLY ATTENDED ANTENATAL CLINIC		
DID THE CASE DIE	YES	NO	TOTAL
YES	170 (0.3)	34 (0.5)	204 (0.3)
NO	53986 (99.7)	6486 (99.5)	60472 (99.7)
TOTAL	54156 (100)	6520 (100)	60676 (100)
DF = 1	X^2 computed 7.423	Significance = 0.006	

SOURCE: Study Data: Number of missing observations:5404

Note: In parentheses are column percentages

Several maternal mortality researches cite lack of antenatal care as a major preventable factor. Harrison (1989) recommends antenatal care as a way of reducing mortality from his research in Zaria, Nigeria. Mbizvo et al (1993b) showed that lack of antenatal care was a risk factor for maternal mortality particularly in rural areas. The odds ratio was 4.9 (95 percent confidence intervals [CI]:2.1 to 11) for Masvingo, and 3.1 (95 percent [CI]:0.5 to 15) for Harare. The Jamaica maternal mortality study did not identify lack of antenatal care as a risk factor (Keeling et al.,1991). The results suggests that either antenatal care is limited in its contribution to reducing maternal mortality or that its scope should be extended to include problems of patients' access to health facilities.

This research finding also contradicts the study of Maternal Mortality in Ile-Ife, Nigeria, A Study of risk factors by Okonofua et al.(1992). The study found no differences between the cases and controls in the use of antenatal care, contrary to the previous studies (Harrison, 1985; Ogunniyi and Faleyimu 1985; Walker, 1986) which suggests that non - use of antenatal care is a strong high risk factor in maternal mortality. The above study had these plausible explanations : It is

possible that the use of antenatal care may reduce the rates of pregnancy-related complications, but it is clear from this study that once complications develop at home, the prior use of antenatal care is unlikely to have a significant impact on the likely outcome. What then becomes important is the rapidity with which the patient gets to an appropriate health-care facility and the quality of care she receives at the centre.

b) Postnatal Clinic Attendance

The table 4.6 shows that there were 0.3% maternal deaths for women of parity 2+ attending postnatal clinic and 0.5% deaths for women of parity 2+ not attending postnatal clinic. This observation confirms the study hypothesis that postnatal clinic attendance is significantly negatively associated with maternal deaths.

Table 4.6: Distribution of Maternal Deaths By Parity 2+ Attended Postnatal clinic

	PARITY 2+ ATTENDED POSTNATAL CLINIC		
DID THE CASE DIE	YES	NO	TOTAL
YES	25(0.3)	67(0.5)	92(0.5)
NO	7967(99.7)	12187(99.5)	20154(99.5)
TOTAL	7992(100)	12254(100)	20246(100)
DF=1 X^2 computed=5.85	significance =0.0156		

SOURCE: Study Data: Number of missing observations:45834.
Note: In parentheses are column percentages

4.6 - Maternal Mortality By Social Factors

a) Education

The table below shows the results of maternal mortality by educational level of women. Women with primary level of education exhibited the highest maternal mortality incidence of 0.6%, whereas those with secondary education and above had the lowest maternal mortality incidence of 0.3%. Therefore higher level of maternal education (secondary+) comes out as having a positive effect on maternal mortality reduction. This observation confirms the study hypothesis that there is a significant negative relationship between higher education level (secondary+) of women and chances of surviving a pregnancy.

Table 4.7: Distribution of Maternal Mortality By Educational Level

	EDUCATIONAL LEVEL			
DID THE CASE DIE	NONE	PRIMARY	SECONDARY+	TOTAL
YES	11 (0.3)	61 (0.6)	13 (0.3)	85 (0.4)
NO	3675(99.7)	10767 (99.4)	5021 (99.7)	19463 (99.6)
TOTAL	3686(100)	10767(100)	5034 (100)	19548(100)
DF = 2 X^2 Computed = 9.341 Significance = 0.009				

SOURCE: Study Data: Number of missing observations:46532
Note: In parentheses are column percentages

It is widely known that women's education is related to maternal mortality (Royston and Armstrong 1989). It is also well known that the risk of dying is strongly influenced by one's position in society. In most circumstances and for most diseases, including maternal mortality, the poor and the disadvantaged are more likely to die than the more affluent people. Higher education for women enables to acquire better paying jobs, which in turn facilitates them to have access to better health insurance schemes for themselves and their families.

For women, their status in the family and in the community can be related to their level of education. Several themes for research have produced various interrelationships. First, education (through the association with a late age at marriage) is likely to be associated with lower fertility and hence with fewer pregnancies. Education could also be associated with the development of fewer complications among pregnant women if better-educated are in better health than others before and during pregnancy. Such women are likely to take preventive measures such the avoidance of risky behaviours e.g alcohol consumption. Finally, education could be associated with a greater likelihood of receiving appropriate care for complications that do arise for example: more educated women might be better informed about the symptoms of the complications and could therefore be more likely to make a timely decision to seek care when a complication arises. Such women might also be concentrated in urban areas and thus would live closer to health facilities, or they might have better access to the transportation needed to reach these facilities. Finally, educated women are more likely to receive more appropriate care when they do reach a health facility, either because they are better able to pay for that care or because, by virtue of their status they are more likely to be well-treated.

b) Province of Residence

Table 4.8 shows that Nyanza and Coast provinces had higher maternal deaths of 1.2% and 0.7% respectively in contrast to low rates of 0.2% for Other provinces, Central, Western and Rift-Valley. Eastern Province had the lowest incidence rate of 0.1%.The observed relationship was statistically significant (at

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b) Province of Residence

Table 4.8 shows that Nyanza and Coast provinces had higher maternal deaths of 1.2% and 0.7% respectively in contrast to low rates of 0.2% for Other provinces, Central, Western and Rift-Valley. Eastern Province had the lowest incidence rate of 0.1%.The observed relationship was statistically significant (at

99% confidence level). This concurs with the study hypothesis that there exists regional differentials in maternal mortality in Kenya.

Table 4.8: National Distribution of Maternal Deaths By Province of Residence

	PROVINCE							
DID THE CASE DIE	CENTRAL	COAST	EASTERN	NYANZA	R-VALLEY	WESTERN	OTHERS	TOTAL
YES	16 (0.2)	14 (0.7)	5 (0.1)	89 (1.2)	43 (0.3)	10 (0.2)	57 (0.2)	234 (0.4)
NO	7052 (99.8)	1922 (99.3)	5249 (99.9)	7538 (98.8)	12355 (99.7)	4721 (99.8)	26869 (99.8)	65706 (99.6)
TOTAL	7068 (100)	1936 (100)	5254 (100)	7627 (100)	12398 (100)	4731 (100)	26926 (100)	65940 (100)
X^2 computed = 181.362 DF = 6 Significance = 0.000								

SOURCE: Study Data: Number of missing observations: 140
Note: In parentheses are column percentages

4.7 - Summary of the Cross Tabulations Results on Maternal Mortality

The results of cross tabulation and the Chi-square test shows that the following factors were significant in influencing maternal mortality: age, parity, education, antenatal clinic attendance, postnatal clinic attendance and regional background of the mothers. Marital status was the only insignificant factor as found from the analysis.

4.8 - REGIONAL MATERNAL MORBIDITY DIFFERENTIALS IN KENYA

Unlike maternal mortality which can be described in general, there is no generally accepted definition of maternal morbidity. At the simplest level, the medical causes of maternal deaths also constitute the major maternal morbidities. Maternal morbidity is more difficult to consider as a single entity. There is not for example, a single indicator or measure, like maternal mortality ratio, which can be used to show the level of overall maternal morbidity. It is therefore hard to summarise the total burden on women of pregnancy-related conditions. There is also uncertainty about the unit of analysis when discussing morbidity. Whereas for death, the unit has to be the individual and it is an event which can only occur once, for morbidity either the woman or the pregnancy can be used and multiple episodes are possible.

A total of 19 hospitals (district and provincial) across the country were used to obtain information on maternal morbidity for the year 1993. The survey (KMMBS, 1994) sought to know if the patients admitted had suffered any of the following diseases: Anaemia, Sickle cell, Asthma, Tuberculosis, Heart related, Hypertension, Renal (Kidney), Thyroid and Pregnancy Complications.

Table 4.9: **Distribution of Women Diagnosed With Specific Maternal Morbidity Type:**

TYPE OF MORBIDITY	NUMBER DIAGNOSED	PERCENT
Anaemia	1787	2.7
Sickle cell	9	0.0
Asthma	12	0.0
Tuberculosis	12	0.0
Heart Related	10	0.0
Hypertension	19	0.0
Thyroid .	2	0.0
Pregnancy Complications	134	0.2

SOURCE: Study Data

4.8.1 - Anaemia

Anaemia directly or indirectly contributes to a significant proportion of maternal deaths in the developing world (see appendix). Severe anaemia can lead to cardiac failure in pregnancy, while lesser grades of severity are associated with decreased maternal well-being and contribute to maternal deaths from haemorrhage or infection. Anaemia may also contribute to perinatal morbidity and mortality by increasing the likelihood of intrauterine growth retardation and partum delivery.

a) Prevalence of Anaemia in Pregnancy

A recent update of the World Health Organization on the prevalence of nutritional anaemia in women indicates that about half of the pregnant and a third of non-pregnant women in the world suffer from nutritional anaemia. A comparison between developed and developing countries shows that while in the former approximately 10 per cent non-pregnant and 15 per cent pregnant women are anaemic (Hb < 110g/l), in developing countries the figure are 42 per cent and 56 per cent respectively.

b) Causes of Anaemia in Pregnancy

Anaemia in pregnancy is often of multiple aetiology. Iron and folate deficiency is by far the most important etiological factor and is aggravated by short birth intervals and parasitic and helminthic infections. Malaria, causing the destruction of red blood cells, contributes significantly to the prevalence of anaemia in a population and is often associated with iron and / or folate deficiency. AIDS should be considered in the differential diagnosis of a patient with anaemia. Haemoglobinopathies such as sickle cell disease contribute to the causation of anaemia in Africa.

In normal pregnancy, there is a fall of about 5 g/l in the haemoglobin concentration. This is called the "physiological anaemia of pregnancy" and is due to the disproportionate increase in plasma volume with respect to the cell mass. This process occur mainly in the second and third trimesters and is not pathologic in itself, but could aggravate any anaemia already present.

4.9 - Differentials in Anaemic Morbidity By Demographic Factors

i) Age

Table 4.10 below shows that anaemic cases are more severe at 40+ ages (5.9%) compared to (2.2%) and (3.0%) for the 20-24 and 25-29/10-14 age groups respectively. Only 2.6% anaemic cases were found in the 15-19 age group compared to 3.7% in the 35-39 age group. The observed relationship was found to be statistically significant (at 99% confidence level) showing that maternal age highly influences anaemic diseases in pregnant women.

Table 4.10: Distribution of Anaemia Cases By Age

	AGE GROUP OF THE MOTHER							
	10-14	15-19	20-24	25-29	30-34	35-39	40+	TOTAL
NO	130 (97.0)	13826 (94.0)	26016 (98.8)	13807 (97.0)	6044 (96.1)	2275 (96.3)	588 (94.1)	62686 (97.3)
YES	4 (3.0)	371 (2.6)	596 (2.2)	421 (3.0)	244 (3.9)	87 (3.7)	37 (5.9)	1760 (2.7)
TOTAL	134 (100)	14197 (100)	26612 (100)	14228 (100)	6288 (100)	2362 (100)	625 (100)	64496 (100)
X^2 computed = 91.014 DF = 6 Significance = 0.000								

SOURCE: Study Data: Number of missing observations:1634
Note: In parentheses are column percentages.

ii) Parity:

Table 4.11 shows that the highest proportion of anaemic cases occur in women of higher parities i.e 4.0% for parity 5-6 compared to only 2.0% in women of parity 1-2 and 3.3% for women of parity 0. The observed relationship is statistically significant (at 99% confidence level).

Table 4.11: Distribution of Anaemia cases By Parity

	PARITY OF THE MOTHER					
	0	1-2	3-4	5-6	7+	TOTAL
NO	15873 (96.7)	29412 (98.0)	11927 (97.4)	4832 (96.0)	2072 (97.3)	64116 (97.3)
YES	548 (3.3)	597 (2.0)	315 (2.6)	200 (4.0)	117 (2.7)	1777 (2.7)
TOTAL	16421 (100)	30009 (100)	12243 (100)	5032 (100)	2189 (100)	65893 (100)
X^2 computed = 173.411 DF = 4 Sig = 0.000						

SOURCE: Study Data: Number of missing observations:187
Note: In parentheses are column percentages

(iii) Marital Status:

Table 4.12 indicates that the highest proportion of anaemia cases is found among women who reported that they were married 2.8%, followed by those who reported to be single at 2.1%. The observed relationship in the distribution of anaemia by marital status is statistically significant (at 99% confidence level).

Table 4.12: Distribution of Anaemia by Marital Status

	MARITAL STATUS OF THE MOTHER			
	SINGLE	MARRIED	OTHERS	TOTAL
NO	10193 (97.9)	52866 (97.2)	1019 (98.6)	64079 (97.3)
YES	219 (2.1)	1541 (2.8)	14 (1.4)	1774 (2.7)
TOTAL	10412 (100)	54401 (100)	1033 (100)	65893 (100)
X^2 computed = 24.893 DF = 2 Sig = 0.000				

SOURCE: Study Data: Number of missing observations:1007
Note: In parentheses are column percentages

There is a noted low percentage of anaemic cases among the Other groups (separated, divorced or widowed). The explanation could be that the single and (the separated, divorced and widowed) would not want to have any more children. Presumably the social implications of getting children when one is a widow, divorcee or single are so negative such that mothers in these categories opt not to give birth.

Table 4.12: Distribution of Anaemia by Marital Status

	MARITAL STATUS OF THE MOTHER			
	SINGLE	MARRIED	OTHERS	TOTAL
NO	10193 (97.9)	52866 (97.2)	1019 (98.6)	64079 (97.3)
YES	219 (2.1)	1541 (2.8)	14 (1.4)	1774 (2.7)
TOTAL	10412 (100)	54401 (100)	1033 (100)	65893 (100)
X^2 computed = 24.893 DF = 2 Sig = 0.000				

SOURCE: Study Data: Number of missing observations: 1007
Note: In parentheses are column percentages

There is a noted low percentage of anaemic cases among the Other groups (separated, divorced or widowed). The explanation could be that the single and (the separated, divorced and widowed) would not want to have any more children. Presumably the social implications of getting children when one is a widow, divorcee or single are so negative such that mothers in these categories opt not to give birth.

ii) Differentials in Anaemic Morbidity by Province

Table 4.14 shows that the highest percentage of anaemia cases are found in Coast Province (62%) followed by Nyanza (1.7%) compared to 0.1% and 0.4% for Central and Eastern Provinces respectively. The observed relationship in the distribution of anaemia by province of residence is statistically significant (at 99% confidence level).

Table 4.14: Distribution of anaemia cases By Provinces

ANAEMIA BY PROVINCE								
	CENTRAL	COAST	EASTERN	NYANZA	R-VALLEY	WESTERN	OTHERS	TOTAL
NO	7066 (99.9)	736 (38.0)	5233 (99.6)	7545 (98.3)	12324 (99.3)	4668 (98.6)	26721 (98.9)	64293 (97.3)
YES	4 (0.1)	1201 (62.0)	23 (0.4)	127 (1.7)	81 (0.7)	64 (1.4)	287 (1.1)	1787 (2.7)
TOTAL	7070 (100)	1937 (100)	5256 (100)	7672 (100)	12405 (100)	4732 (100)	27008 (100)	66080 (100)
X^2 computed = 26717 DF = 6 Sig = 0.000								

SOURCE: Study Data:
Note: In parentheses are column percentages

4.11 - Differentials in Maternal Morbidity By Socio-Economic Factors

i) Ante-natal Clinic Attendance

The table below shows that the proportion of anaemia cases are higher among women attending antenatal clinic (3.2%) compared to only (0.8%) among the non-attendants. The cross tabulation results between anaemia and antenatal clinic attendance shows that the relationship is statistically significant.

Table 4.15: Distribution of Anaemia By Ante-natal Clinic Attendance

ANTE-NATAL CLINIC ATTENDANCE			
	YES	NO	TOTAL
NO	52554 (96.8)	6488 (99.2)	59042 (97.1)
YES	1715 (3.2)	51 (0.8)	1766 (2.9)
TOTAL	54269 (100)	6539 (100)	60808 (100)
X^2 computed = 117.25 DF = 1 Sig = 0.000			

SOURCE: Study Data : Number of missing observations:5272
Note: In parentheses are column percentages

ii) Postnatal Clinic Attendance By Women of Parity 2+

Table 4.16 shows that the highest percentage of anaemia diseases (17.7%) occurred among women of parity 2+ attending post-natal care compared to only (1.0%) among the non-attendants. It is interesting to note that low anaemic percentages were reported for women of parity 2+ not attending postnatal care.

Table 4.16: Distribution of Anaemia By Parity 2+ Attending Postnatal Clinic

PARITY 2+ ATTENDING POSTNATAL CLINIC			
	YES	NO	TOTAL
NO	6588 (82.3)	12182 (99.0)	18770 (92.4)
YES	1416 (17.7)	121 (1.0)	1537 (7.6)
TOTAL	8004 (100)	12303 (100)	20307 (100)
X^2 computed = 1934.89 DF = 1 Sig = 0.000			

SOURCE: Study Data: Number of missing observations:5272
Note: In parentheses are column percentages

4.12 - Differentials in Maternal Mortality By Anaemic Morbidity

Table 4.17 shows that the highest percentage of maternal deaths are caused by anaemia. The results shows that non-anaemic maternal deaths were 2.7 per cent whereas anaemia contributed 13.2% of all maternal deaths in Kenya. The observed relationship is statistically significant (at 99% confidence level).

Table 4.17: Distribution of Anaemia By Maternal Mortality

DEATH OF MOTHER/MATERNAL DEATH			
	YES	NO	TOTAL
NO	203 (86.8)	63951 (97.3)	64154 (97.3)
YES	31 (13.2)	1755 (2.7)	1736 (2.7)
TOTAL	234 (100)	65706 (100)	65940 (100)
X^2 computed = 98.98	DF = 1	Sig = 0.000	

SOURCE: Study Data: Number of missing observations:140

In Kwale District, a community survey found that anaemia contributed 11 per cent of all maternal deaths. The same study estimated anaemia deaths at 82 per 100,000 live births (WHO, 1991).

In Kilifi, a survey of 275 pregnant women found anaemia Hb < 11g/dl 75.5 per cent , Hb < 7g/dl 9.8 per cent. In Nairobi (City Council Clinics) among 10,764 women, 8.3 per cent were anaemic and in Machakos, between 1985-1987 pregnant women with anaemia were 9 per cent (Carla and Erica, 1991).

An Egyptian survey of maternal morbidity , found that 63 per cent were anaemic. The study confirmed the importance of anaemia in pregnant adolescents and in women who have recently had a pregnancy.

According to World Health Organization (1991), the contribution of anaemia o maternal mortality was estimated at 11 per cent.

4.13 - Differentials in Pregnancy Complications By Demographic Factors

) Age

Table 4.18 shows that the proportion of pregnancy complications are highest among the very high and very low reproductive age groups i.e 1.0% at 40+ and 0.7% at the 10-14 years. Pregnancy complications seems to be very low for the mid-reproductive ages (20-39) ranging between 0.1% to 0.4%.The observed elationship between pregnancy complications and maternal age was statistically ignificant (at 99% confidence level).

Table 4.18: Distribution of Pregnancy complications By Age:

	AGE GROUP OF THE MOTHER							
	10-14	15-19	20-24	25-29	30-34	35-39	40+	TOTAL
NO	133 (99.3)	14175 (99.8)	26573 (99.9)	14192 (99.7)	6265 (99.6)	2359 (99.9)	619 (99.0)	64316 (99.8)
YES	1 (0.7)	22 (0.2)	39 (0.1)	36 (0.3)	23 (0.4)	3 (0.1)	6 (1.0)	130 (0.2)
TOTAL	134 (100)	14197 (100)	26612 (100)	14228 (100)	6288 (100)	2362 (100)	625 (100)	64496 (100)
X^2 computed = 36.314 DF = 6 Sig = 0.000								

OURCE: Study Data: Number of missing observations:1634
lote: In parentheses are column percentages

) Parity

Table 4.19 indicates that majority of the women who developed pregnancy complications were of parity 7+ (0.8%). This relationship was statistically

significant (at 99% confidence level) showing that higher parity level of women highly influences pregnancy complications with low parities exhibiting lesser complications.

Table 4.19: Distribution of Pregnancy Complications By Parity

	PARITY OF THE MOTHER					
	0	1-2	3-4	5-6	7+	TOTAL
YES	16388 (99.8)	29964 (99.9)	12220 (99.8)	5017 (99.7)	2171 (99.2)	65760 (99.8)
NO	33 (0.2)	45 (0.1)	22 (0.2)	15 (0.3)	18 (0.8)	133 (0.2)
TOTAL	16421 (100)	30009 (100)	12243 (100)	5032 (100)	2189 (100)	65893 (100)
X^2 computed = 48.457 DF = 4 Sig = 0.000						

SOURCE: Study Data: Number of missing observations:187
Note: In parentheses are column percentages

iii) Marital Status

Table 4.20 shows pregnancy complications by marital status of the mother. The rates were uniform i.e 0.2% for those of single and married groups but higher for the others group (divorced, separated and the widowed). The results of this cross tabulation shows that the relationship is not statistically significant.

Table 4.20: Pregnancy complications By Marital Status:

	MARITAL STATUS OF THE MOTHER			
	SINGLE	MARRIED	OTHERS	TOTAL
NO	10390 (99.8)	54298 (99.8)	1030 (99.7)	65718 (99.8)
YES	22 (0.2)	109 (0.2)	3 (0.3)	134 (0.2)
TOTAL	10412 (100)	54401 (100)	1033 (100)	65893 (100)
X^2 computed = 0.442 DF = 2 Sig = 0.802				

SOURCE: Study Data: Number of missing observations:228
Note: In parentheses are column percentages

4.14 - Differentials in Pregnancy complications By Social Factors

i) Education

Table 4.21 shows that pregnancy complication rates for none and primary levels of education were the same at (0.2%) and women with secondary+ level of education experiencing higher complications (0.3%). The results of the cross tabulation shows that the relationship between pregnancy complications and maternal level of education is not statistically significant.

Table 4.21: Pregnancy Complications By Education

EDUCATIONAL LEVEL OF THE MOTHER				
	NONE	PRIMARY	SECONDARY+	TOTAL
NO	3677 (99.8)	10808 (99.8)	5020 (99.7)	19505 (99.7)
YES	9 (0.2)	25 (0.2)	16 (0.3)	50 (0.3)
TOTAL	3686 (100)	10833 (100)	5036 (100)	19555 (100)
X^2 computed = 1.042 DF = 2 Sig = 0.594				

SOURCE: Study Data: Number of missing observations:46525

Note: In parentheses are column percentages

ii) Province of Residence

Table 4.22 shows Western as the leading Province in Kenya by maternal pregnancy complications (0.8%) compared to 0.1% for both Coast and Nyanza Provinces and 0.2% and 0.5% for Central and Rift-Valley Provinces respectively. The observed relationship between pregnancy complications and province of residence is statistically significant (at 99% confidence level) indicating that Province of residence highly influence pregnancy complications in Kenya.

Table 4.22: Pregnancy complications By Province

PREGNANCY COMPLICATIONS BY PROVINCE								
	CENTRAL	COAST	EASTERN	NYANZA	R-VALLEY	WESTERN	OTHERS	TOTAL
NO	7054 (99.8)	1936 (99.9)	5256 (100)	7663 (99.9)	12342 (99.5)	4694 (99.2)	27001 (100)	65946 (99.8)
YES	16 (0.2)	1 (0.1)	-	9 (0.1)	63 (0.5)	38 (0.8)	7 (0.0)	134 (0.2)
TOTAL	7070 (100)	1937 (100)	5256 (100)	7672 (100)	12405 (100)	4732 (100)	27008 (100)	66080 (100)
X^2 computed = 198.877 DF = 6 Sig = 0.0000								

SOURCE: Study Data: Note in parentheses are column percentages

4.15 - Differentials in Pregnancy Complications By Socio-Economic Factors

i) Ante-natal Clinic Attendance

Table 4.23 reveals that women who attended ante-natal clinic suffered more pregnancy complications. However, the observed relationship between pregnancy complications and attendance of ante-natal care was found not statistically significant.

Table 4.23: Pregnancy Complications By Regular Attendance of Ante-natal Care

ANTE-NATAL ATTENDANCE			
	YES	NO	TOTAL
NO	54161 (99.8)	6532 (99.9)	60693 (99.8)
YES	108 (0.2)	7 (0.1)	115 (0.2)
TOTAL	54269 (100)	6539 (100)	60808 (100)
X^2 computed = 2.614 DF = 1 Sig = 0.106			

SOURCE: Study Data: Number of missing observations:5272
Note: In parentheses are column percentages

ii) Parity 2+ Attending Postnatal Clinic

Table 4.24 shows that women who were of parity 2+ and were attending postnatal clinic suffered 0.1% complications of pregnancy compared to 0.2% for the non-postnatal clinic attendants. The association between women of parity 2+ attending postnatal care and complications of pregnancy was statistically significant (at 95% confidence level).

Table 4.24: Pregnancy Complications By Parity 2+ attending Postnatal Clinic

POSTNATAL CLINIC ATTENDANCE			
	YES	NO	TOTAL
NO	7999 (99.9)	12181 (99.8)	20280 (99.9)
YES	5 (0.1)	22 (0.2)	27 (0.1)
TOTAL	8004 (100)	12303 (100)	20307 (100)
X^2 computed = 4.944 DF = 1 Sig = 0.0261			

SOURCE: Study Data: Number of missing observations:45773
Note: In parentheses are column percentages

4.16 - Differentials in Pregnancy Complications By Maternal Deaths

Table 4.25 shows pregnancy complications to be a major contributor of maternal deaths in Kenya with a rate of 13.2% compared to 0.2% for non pregnancy complications. The observed relationship between pregnancy complications and maternal deaths in Kenya is statistically significant (at 99% confidence level).

Table 4.25: **Distribution of Pregnancy Complications By Maternal Deaths:**

DEATH OF MOTHER/MATERNAL DEATH			
	YES	NO	TOTAL
NO	203 (86.8)	65607 (99.8)	65810 (97.3)
YES	31 (13.2)	99 (0.2)	130 (0.2)
TOTAL	234 (100)	65706 (100)	65940 (100)
X^2 computed = 2032.783 DF = 1 Sig = 0.000			

SOURCE: Study Data: Number of missing observations:140
Note: In parentheses are column percentages

For all the remaining maternal morbidities (sickle cell, thyroid, tuberculosis, renal / kidney , hypertension, heart related and asthma) were not be computed statistically given the few number of cases that were captured for each of them by the survey and their chi-squares were very unreliable as they produced several empty cells and hence were dropped from further analysis.

CHAPTER FIVE

DETERMINANTS OF MATERNAL MORTALITY AND MORBIDITY IN KENYA:

To estimate the determinants of maternal mortality, a logistic regression model was fitted for the various socio-economic, demographic and social factors as specified in the operational model. Each of the independent variables was recorded and specified in the form of dummy variables. The dependent variable was specified as 1 and 0 as discussed below:-

5.1 - Definition of Dummy Variables in The Logistic Regression model Used

5.2 - Demographic Variables

5.2.1 - Age

AGEB1R1 - Indicates women in the age group 10-14. It forms the reference category.

AGEB1R2 - Indicates women in the age group 15-19 (coded 1 if the case, 0 otherwise).

AGEB1R3 - Indicates women in the age group 20-24 (coded 1 if the case, 0 otherwise).

AGEB1R4 - Indicates women in the age group 25-29 (coded 1 if the case, 0 otherwise).

AGEB1R5 - Indicates women in the age group 30-34 (coded 1 if the case, 0 otherwise).

AGEB1R6 - Indicates women in the age group 35-39 (coded 1 if the case, 0 otherwise).

AGEB1R7 - Indicates women in the age group 40+ (coded 1 if the case, 0 otherwise).

5.2.2 - Marital Status

SING - Indicates those women who reported that they were single. It forms the reference category.

MARR - Indicates those women who reported to be currently married at the time of interview (coded 1 if the case, 0 otherwise).

OTHS - Indicates those women who reported to have been involved in other forms of marriage e.g. divorced, separated, or widowed. It was coded 1 if the case, 0 otherwise.

5.2.3 - Parity

PARF1 - Indicates women who reported to be of parity 0. It forms the reference category.

PARF2 - Indicates those women who reported to be of parity 1-2 (coded 1 if the case, 0 otherwise).

PARF3 - Indicates those women who reported to be of parity 3-4 (coded 1 if the case, 0 otherwise).

PARF4 - Indicates those women who reported to be of parity 5-6 (coded 1 if the case, 0 otherwise).

PARF5 - Indicates those women who reported to be of parity 7+ (coded 1 if the case, 0 otherwise).

5.3 - Social Factors

5.3.1 - Education

NOED - Indicates women who reported no education. It forms the reference category.

PRIED - Indicates women who reported to have had primary level of education (coded 1 if the case, 0 otherwise).

SECED - Indicates women who reported to have had secondary level of education (coded 1 if the case, 0 otherwise).

5.3.2 - Province of Residence

CENPRO - Indicates women who lived in Central Province. It forms the reference category.

COAPRO - Indicates women who lived in Coast Province (coded 1 if yes, 0 otherwise).

EASPRO - Indicates women who lived in Eastern Province (coded 1 if yes, 0 otherwise).

NYAPRO - Indicates women who lived in Nyanza Province (coded 1 if yes, 0 otherwise).

RIVPRO - Indicates women who lived in Rift Valley Province (coded 1 if yes, 0 otherwise).

WESPRO - Indicates women who lived in Western Province (coded 1 if yes, 0 otherwise).

OTHPRO - Indicates women who lived in Other Provinces (coded 1 if yes, 0 otherwise).

5.4 - Socio-economic Factors

5.4.1 - Ante-natal Clinic Attendance

ANTYES - Indicates those women who attended antenatal clinic. It forms the reference category.

ANTENO - Indicates those women who did not attend antenatal clinic (coded 1 if the case, 0 otherwise)

5.4.2 - Postnatal Clinic Attendance

POSTYES - Indicates those women of parity 2+ who attended postnatal clinic (it forms the reference category).

POSTNO - Indicates those women of parity 2+ who did not attend postnatal clinic (coded 1 if the case, 0 otherwise).

5.5 - Logistic Regression Results

In this sub-section, the results of logistic regression are presented. The main objective of the analysis undertaken is to determine which variables have a significant effect on maternal mortality and morbidity. In order to determine such variables the logistic model were developed using the stepwise method. The procedure of stepwise selection starts by fitting just a constant term (the mean) to the observations i.e., the parameter $ß_o$. Then each of the possible variables is added to the model in turn, and the most significant, provided that the significance level is below some predetermined level, is selected for inclusion. This procedure is repeated until there is no further significant improvement in the fit of the model.

In the analysis, all the variables used as the reference categories were found to be constant as expected. These were: none level of education (NOED), age

group 10-14 (AGEB1R1), single marital status (SING), ante-natal clinic attendance (ANTEYES), postnatal clinic attendance (POSTYES), parity 0 (PARF1) and central province (CENTPRO). Since a constant was requested in the model, the above variables were therefore removed from the analysis as expected.

The interpretation of the results are based on the final model presented in table 5.1. This model include all the variables which were found to be significantly related to maternal death at $\alpha = 0.05$ level of significance. For each of the variables, the coefficients and their level of significance are presented.

Logistic regression procedures are used throughout the analysis. If p is the probability of maternal death (maternal death as the dependent variable), the logistic regression can be written as :

$$E[\ln(p/1-p)] = \alpha + \beta x$$

Where α is an estimated constant and β is the coefficient for the predictor variable. All explanatory variables are entered in categorical form. Logit coefficients corresponds in terms of sign and relative magnitude to effects on probabilities. That is, a negative logit coefficient implies a negative effect on probabilities. A positive logit coefficient implies a positive effect on probabilities. The effects that are relatively large in the logit metric correspond to large effects on probabilities. In addition the overall significance of the model are given.

5.5.1 : Limitations of Stepwise Regression Used:

Stepwise selection of independent variables - a method of selecting independent variables not in the equation which has the smallest probability of F is entered, if the probability is sufficiently small. Variables already in the regression

equation are removed if the probability of F becomes sufficiently large. The method terminates when no more variables are eligible for inclusion or removal.

A rising from stepwise regression method used in the study, the variables which were not significant were automatically removed from the model. The effects which though insignificant cannot be precisely be determined because of the missing regression coefficients. To address this problem, there was therefore the need to use the ENTER METHOD. This was not done and hence is a limitation of the results of the study.

Table 5.1: Logistic Regression Estimates on the Determinants of Maternal Mortality and the selected Independent Variables

	E	Q	U	A	T	I	O	N	S		
VARIABLES	1	2	3	4	5	6	7	8	9	10	11
RIFPRO											
B	-1.5553	-1.5606	-1.7079	-1.7894	-1.7745	-1.7264	-1.6823	-1.6645	-1.6519	-1.6045	-1.5918
SIG.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
EXP(B)	0.2111	0.2100	0.1809	0.1671	0.1696	0.1779	0.1860	0.1893	0.1917	0.1917	0.2036
AGEB1R7											
B		-1.7818	-1.7785	-1.7251	-1.5143	-1.2545	-0.8899	-0.5102			
SIG.		0.0000	0.0000	0.0000	0.0000	0.0000	0.0050	0.1173			
EXP(B)		0.1683	0.1689	0.1782	0.2200	0.2852	0.4107	0.6004			
ANTENO											
B			0.8438	0.8858	0.8870	0.9150	0.9159	0.8862	0.8840	1.0045	0.9956
SIG.			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
EXP(B)			0.1689	0.1782	2.4278	2.4967	2.4991	2.4259	2.4204	2.7306	2.7064
EASPRO											
B				-1.2280	-1.1706	-1.2077	-0.1575	-1.1279	-1.1434	-1.1771	-1.1870
SIG				0.0000	0.0000	0.0000	0.0001	0.0001	0.0001	0.0000	0.0000
EXP(B)				0.2929	0.3102	0.2989	0.3143	0.3237	0.3187	0.3082	0.3051
PARF3											
B					0.6091	0.8722	1.3002	1.9403	2.0271	2.0364	2.1029
SIG.					0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
EXP(B)					1.8388	2.3923	3.6707	6.9611	7.5923	7.6623	8.1901
PARF2											
B						0.7561	1.1850	1.8002	1.9127	1.9445	2.0705
SIG.						0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
EXP(B)						2.1300	3.2707	6.1997	6.7713	6.9993	7.9288
PARF4											
B							0.8367	1.4741	1.5580	1.5627	1.5898
SIG							0.0000	0.0000	0.0000	0.0000	0.0000
EXP(B)							2.3087	4.3670	4.7493	4.7719	4.8057
PARF5											
B								1.1546	1.2209	1.2144	1.2099
SIG.								0.0000	0.0000	0.0000	0.0000
EXP(B)								3.1728	3.3903	3.3682	3.3531
SECED											
B									-0.6644	-0.6591	
SIG.									0.0000	0.0000	
EXP(B)									0.5146	0.5173	
MARR											
B										0.3809	
SIG.										0.0000	
EXP(B)										0.6832	
CONSTANT	5.9944	6.0400	5.4248	5.4660	5.2253	4.9254	4.4782	3.8512	3.7618	3.7869	3.7994
SIG.	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
-2LL	2997.92	2975.8	2948.5	2934.8	2916.1	2897.5	2877.99	2854.49	2856.70	2840.17	2836.49

SOURCE: Study Data:

The overall significance of the model in table 5.1 is given by the equation:
Prob.of Maternal Death in Kenya = 3.7994-1.5918(RIFPRO) + 0.9956(ANTENO)-1.1870(EASPRO) + 2.1029(PARF3) + 2.0705(PARF2) + 1.5898(PARF4) + 1.2099(PARF5)

5.6 - Discussion of Results

5.6.1 - Effects of Province of Residence on Maternal Mortality

The variable province was intended to measure the disparities in the availability of health care-providers (the number of people per physician or nurse), access to health care and the availability of health facilities among the provinces in Kenya with reference to Central Province (the reference category) on maternal mortality.

In the regression model, being in Rift-Valley Province is the most significant variable and was therefore the first to be included in the model. In Kenya as in other countries such as Morocco (DHS 1988), residence has been shown to be the strongest predictor of maternal mortality.

A woman's region of residence was found to be negatively related to maternal death. Living in Rift Valley Province had a negative relationship on maternal mortality. The regression coefficient due to this variable is -1.5553, reducing the impact of maternal mortality by odds ratio of 0.2111. The effect of residence is equally important for the Eastern Province as a predictor of maternal mortality with a regression coefficient of -1.2280 and Exp (B) of 0.2929. This implies that women in Eastern Province were 0.2929 times less likely to suffer maternal death compared to their counterparts in Central Province (the reference category). The results of this study confirms the study's hypothesis which states that there exists regional differentials in maternal mortality incidence in Kenya.

Research elsewhere indicate that there are a number of other socio-cultural factors that act as barriers to prompt emergency treatment of the pregnant women (Prevention of Maternal Mortality Network-PMMN, 1992). These factors influence

the use of modern medical care system, knowledge and attitudes towards pregnancy and delivery. Okafor and Rizzuto, (1994) also note that lack of awareness of the symptoms of pregnancy complications and how to treat them is still a major obstacle to appropriate use of services in many areas.

While social and cultural factors may influence the knowledge and attitudes towards the use of modern medical care and hence the proper utilization; some relate to women status in society like female "circumcision", early marriage as practised in some provinces in Kenya may directly increase the risk of suffering maternal deaths.

5.6.2 - The Effects of Age on Maternal Mortality

This variable intended to measure differentials in rates of maternal mortality by reproductive ages, the reference category being 10-14 age group. There was a negative relationship between those women who reported that they were aged 40+ and maternal death.

Among the dummies for the reproductive age groups, women aged 40+ were 0.1683 times less likely to suffer maternal death compared to those in the reference (10-14). The regression coefficient due to this variable is -1.7818. The odds of suffering a maternal death if one is aged 40+ increases as more variables are introduced into the regression model and in the final equation the factor is as high as -0.5102. It however ceases to be significant when a secondary level of education variable is included in the equation.

This finding is consistent with that of Jarraya et, al. (1991) who documented very large differentials in rates of maternal mortality by age: For instance, the rate

was 154 for women younger than 18 years of age, and 264 for women older than 35, while the lowest risk is for women aged between 18-25 for whom the rate is 34 . A study in Morocco and Tunisia by Obermeyer (1993) had similar findings.

In Kenya, Obunga (1988) found a classic J-shaped relationship between age and maternal mortality. It is also consistent with that of Perkin (1969) who studied 18,000 deliveries in Bangkok, Thailand and found a J-shaped gradient by age in complicated deliveries. However, it contradicts the study done by Koenig et al. (1988) in Maltab, Bangladesh who found a U-shaped curve with minimum level stretching from 20 to 34 years and starting to rise at 35 years and above.

It is now established that young adolescents especially below 18 years of age and older mothers aged 40 years and above are more prone to maternal deaths than those in the prime reproductive age groups i.e between 20 and 30 years (Nortman 1974, Acsadi and Johnson-Acsadi 1986). Mhango et al.,(1986) indicated that maternal mortality was five times higher for women aged above 35 years and above than those for younger women and two times higher for women of parity 4 and above. This occurred for all cases but most strictly for haemorrhage and puerperal sepsis.

An examination of reproductive pattern in Kenya show that 10% total fertility rates in Kenya is contributed by women in age group 15-19, while 25% for women above age 35 (NCPD, 1993). The results of this survey (NCPD, 1993) indicate that though fertility rates may be declining in Kenya, there is persistently high fertility among the women who are at a higher risk of maternal deaths.

5.6.3 - The Effects of Ante-natal Clinic Attendance on Maternal Mortality

There exists a positive relationship between those women not attending ante-natal care and maternal death. The regression coefficient due to this variable is 0.8438. This implies that an increase in the number of women not attending ante-natal care would lead to an increase in the number of maternal deaths. Non attendance of ante-natal care when added into stepwise regression increases the odds of maternal death by 0.1683. It continues increasing the odds of suffering a maternal death in every other step when other variables are added into the equation. These results confirm the hypothesis which states that ante-natal care attendance by a woman during pregnancy is negatively associated with maternal death.

The explanation for the finding could be derived from the fact that women not attending ante-natal care are likely to suffer maternal complications hence higher maternal deaths such as malpresentation (e.g. breech) and cephalo pelvis disproportion (i.e. the baby too big for the mother to deliver) which can be detected too early during ante-natal clinic attendances. Early detection means that ruptured uterus would be avoided by using safer methods of delivery e.g. elective caesarian section. Thus for deaths from ruptured uterus to be prevented, an early diagnosis would be essential.

The research finding of this study is in agreement with past research of Obunga (1988) who found poor ante-natal clinic attendance especially among the mothers who had died of eclampsia , anaemia and ruptured uterus. Lack of adequate ante-natal and post-natal care contributed to increased maternal mortality in Nairobi during the period between 1977-1986.

5.6.4 - The Effects of Parity on Maternal mortality

A positive relationship was found to exist between those women who reported higher parities and maternal death. When fitted into the regression model, a coefficient of regression of 0.6091 was obtained. The odds of a mother suffering a maternal death if they are of parity 3-4 increases from 1.8388 to 8.1901 when other variables are added into the model. This implies that the more the number women of parity 3-4, the greater the likelihood of suffering maternal deaths.

Higher parities (7+) have strong positive effects on maternal mortality. A strong positive association was observed between those women of parity 5-6 and parity 7+ and maternal mortality. The regression coefficients due to these variables are 0.8367 and 1.1546 respectively. This means that an increase in the parity of a woman is more likely to cause more maternal deaths as indicated by the increase in odds ratio from 2.3087 for parity 5-6 to 3.1728 for women of parity 7+. The results confirm the hypothesis that higher parity of 5+ have a significant positive effect on maternal mortality.

Similar results have been found by Kane et al.,(1986) in their study in Giza-Egypt. They found women who had seven or more births to be highly affected by maternal death. Mutura (1990) and Obunga (1988) found maternal mortality to be higher among nulliparous women while mortality risks for parities one through three were substantially lower and increases again at parities 4 and above. Koenig's study (1988) revealed the same for the Maltab women; the risks were higher for nulliparous women and parities seven and above. These results are in agreement with others found elsewhere Perkin (1969), Nortman (1974) and Berry (1977).

The explanation for the finding could be derived from the fact that disabilities

that result from pregnancy, uterine prolapse is much more common among the high parity women (Omran & Standley, 1976). Higher parities (5 +) increases deficiency from anaemia in women. Such women also tend to have larger bodies and have greater incidence of ruptured uterus and post partum haemorrhage since the uterus is more fibrotic and may also fail to attend antenatal health care since they seem to be more confident of themselves having undergone the birth process severally (Parker B.R. not dated).

5.6.5 - The Effects of Education on Maternal Mortality

Education dummies were intended to measure the effect of primary and secondary + levels of education on maternal mortality with reference to a none level of education.

A secondary level of education was found to exert a negative effect on maternal mortality. There exists an inverse association between women who reported a secondary level of education and maternal death. The coefficient of regression was -0.6644 when this variable was added into stepwise regression. This implies that a woman with a secondary level of education has a lower probability of suffering a maternal death by an odds ratio of 0.5146 compared to women with a zero / none level of education.

It is difficult to determine how education mediates its beneficial effects on maternal mortality, but the most likely direct route is through the improvement of access to an appropriate health care facility. It has been stated elsewhere that better-educated women are more likely to utilise appropriate health-care facility and are more likely to report when there are complications of pregnancy (Loudon,

1986; Walker, 1986). The results showed a negative relationship between a secondary level of education and maternal death. For women, their status in the family and in the community can be related to their level of education, their occupation, and their level of personal income or wealth and their autonomy (for example their ability to own or make independent decisions to use health facilities). Several themes have been advanced to explain the inverse relationship between women's education and maternal mortality as discussed below:

First education (through its association with late age at first marriage) or increased use of contraceptives within marriage is likely to be associated with lower fertility and hence with fewer pregnancies.

Education could also be associated with the development of fewer complications among pregnant women if better-educated women are in general in better health than others before and during pregnancy. Finally, education could be associated with greater likelihood of receiving appropriate care for complications that do arise. More educated women might also be better informed about the symptoms of complications and could therefore be more likely to make a timely decision to seek health care when a complication arises. Such women might also be concentrated in urban areas and thus could live closer to health facilities, or they might have better access to transportation needed to reach those facilities. Finally, educated women might be more likely to receive appropriate and timely care when they reach a health facility, either because they are better able to pay for the care or because, by virtue of their status, they are more likely to be well treated.

Similar results were found by Harrison (1985) in Zaria that education was a strong determinant of maternal mortality in Nigeria. He found that among a group

of pregnant women who had at least a secondary education, maternal mortality was as low as that in more developed parts of the world.

5.6.6 - The Effects of Marital Status on Maternal Mortality

Odds ratios for marital status measures the effect of marriage (being married) and Others (separated, divorced, or widowed) on maternal death in comparison to the reference (single status).

Marriage exerts a negative effect on maternal mortality. The regression coefficient of married women was -0.3809. The odds ratio of being married was found to have an inverse effect on the likelihood of suffering a maternal death (OR = 0.6832 for hospitalized women) who reported that they were married at the time of the survey. This implied that married women were 0.6832 less likely to suffer maternal death.

According to Obunga (1988) socio-cultural factors appear to play a role in the maternity-related deaths among single nulliparous (those who have never been pregnant / women who have no children). Because of fear of rebuke by family for having gone against socio-cultural norms and expectations, such women try to conceal their pregnancies from the public by being evasive and avoid ante-natal clinics. They also starve themselves due to anxiety and depression. Thus almost one-half of them die of anaemia and eclampsia, two conditions whose detection and control greatly depend on early and regular prenatal clinic attendance / visits.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 - Introduction

The main objective of the study was to determine how socio-economic, demographic and social factors influence maternal mortality and morbidity in Kenya. The study was intended to capture the determinants of maternal mortality and morbidity using the hospital based data of the KMMBS (1994). The point of departure for this study was therefore to provide sufficient information on the determinants of maternal mortality and morbidity in Kenya given that the Kenya Maternal Mortality Baseline Survey of 1994 from which the data is derived had covered in details on the estimation of maternal mortality levels and patterns in Kenya. Other studies have been concentrated on obstetric complications or just one hospital based survey in particular district hospitals covering on patterns, levels and trends of maternal mortality in those specific districts.

The socio-economic factors examined were antenatal care attendance and postnatal clinic attendance by women of parity 2+. The demographic factors under study are: age, parity and marital status of women aged 10-49. The social factors analyzed in this study are education and province of residence of women admitted to the hospitals covered by the survey. From the specified variables, the study was able to establish the regional maternal mortality and morbidity differentials in Kenya.

The data used in this study was found to be fair given that there had never been any national survey on the subject (maternal mortality and morbidity). However, the hospital data on maternal morbidity by cause were not reliable as

they produced several empty cells when X_2 were computed (were highly unreliable) and an attempt was made to improve its quality with little success. Despite the condition of the KMMBS data, it was found to be comparatively better than the one available from the Ministry of Health (1997) which gave the number of maternal deaths in Kenya for the period 1990-1996 at only 1 with several unspecified complications of pregnancy, labour, delivery and puerperium complications.

6.2 - Summary Of Findings

(1) Maternal Mortality

The survey results indicate that what most demographers and medical doctors have found out in other countries is not very different from the situation in Kenya. The following conclusions can be drawn from the study.

i) The increasing death rate among women in the age groups 25-49 is not unusual since most women are involved in child bearing during this period i.e 0.2%, 0.4%, 0.5%, 0.6% and 1.9% for the reproductive ages 20-24, 25-29, 30-34, 35-39 and 40+ respectively. Maternal mortality in relation to age in Kenya exhibits a J-shaped trend i.e maternal mortality typically increases with age as shown in table 4.2. This suggests that older women age 40 and above who are at a risk of maternal mortality rate of 1.9%, the highest rate attained across the seven reproductive age groups (15-49).

ii) Maternal mortality in relation to parity in Kenya as seen in table 4.3 exhibits a J-shaped trend. Higher parities influence disabilities that result from repeated pregnancies for example, uterine prolapse in high parity women.

The high maternal deaths at parity 7 + shows that such women may be less capable of meeting the psychological demands associated with repeated pregnancy and child bearing.

iii) In the logit results, married mothers were found to be 0.6832 less likely to suffer from maternal death compared to the single mothers. This is an indicator that the unmarried mothers may be psychologically unprepared for the pregnancy and child bearing complications hence suffered more than the married. Other general characteristics of young mothers is that they have low level of knowledge and awareness of reproductive health care needed during pregnancy and childbirth and to some extent low level of income. The societal expectations to premarital pregnancy contributes to increased failure to attend prenatal and postnatal care especially among the single teenage mothers.

iv) Education: The results obtained for maternal mortality as measured by level of education, indicate that mothers with a secondary level of education and above have lower maternal mortality than those of primary level or with no education at all. Maternal mortality was found to decrease with an increase in educational attainment of the mother. Mothers with a secondary level and above of education were found to be less likely to die from maternal death compared to those with a none level of education. This confirms the results of earlier studies by Loudon, 1986 and Walker, 1986, that there is a negative relationship between maternal death and level of education attained by the mother.

v) Region / Province of residence : The results of the analysis from the survey showed maternal mortality per 1000 admissions to be highest in Nyanza Province and Coast Provinces with rates of 11.6 and 7.23 per 1,000 admissions respectively and lowest in Eastern Province with maternal mortality rate of 0.95 per 1,000 admissions. This is further confirmed in logit analysis which indicated that, Eastern Province had the greatest odds ratio of 0.2929 for maternal mortality reduction in comparison to Central Province. The regional disparities in maternal mortality further illustrates the regional differentials in the provision of health services (health infrastructure and health personnel) across the Kenyan provinces, for example, Nyanza has seven clinical officers per 100,000 residents whilst North Eastern Province has 15 (M.O.H, 1997).

(2) Maternal Morbidity

(i) Anaemia

Anaemia was observed to be responsible for a significant proportion of maternal deaths at ages 40+ (5.9%) which is the highest percentage obtained across the reproductive age groups with the lowest percentage of 2.2% recorded between ages 20-24. The results obtained also indicated that anaemia had the greatest impact at higher parities (7+) 5.3% and least impact at parity 1-2 (2.0%).

The results on education showed that mothers with a secondary level of education and above suffered least from anaemic conditions (2.0%) and increases among mothers with no education (31.2%).

(ii) Pregnancy Complications

The results of pregnancy complications shows that younger (10-14 years) and older (40+ years) women suffered most from pregnancy complications compared to those women who are in their mid-reproductive ages (20-39).

The results obtained from parity exhibited the same relationship to that of age. It showed that complications of pregnancy are greatest at parity 7+ and less at lower parities. It is important to state that age is compounding here since women of higher parity are also likely to be older.

6.3 - Conclusions

This study has shown that maternal mortality and morbidity are still a major source of concern throughout the country. Important insights have been gained on the determinants of maternal mortality and morbidity in Kenya. The finding that most maternal deaths occur at very young and older reproductive ages, higher parities (7+) and among non-attendants of antenatal care calls for the need to educate women on the necessity to have few children in the mid-reproductive ages, expand antenatal care facilities and the co-operation of pregnant mothers to use the available health-care facilities before and after pregnancy.

On the study's objective of determining the socio-economic factors underlying maternal mortality and morbidity, it has been found that maternal mortality is more common among women in the lower socioeconomic status when indices such as education, antenatal clinic attendance and postnatal clinic attendance are used. However, it is also now clear that complications of pregnancy are not necessarily fatal; they cause death only because they occur within the

context of severe socioeconomic deprivations that are prevalent in some notable provinces such as Nyanza, Western and Coast.

It has also been established through the survey that demographic factors (age and parity) have a positive relationship to maternal death and morbidity. It is clear from the study that maternal mortality and morbidity do increase with a rise in age and parity. Higher parities are associated with higher risks of maternal mortality and morbidity at older reproductive ages especially after (40+ years).

Regional disparities in maternal mortality and morbidity shown from the results of the hospital data calls for need to eliminate the variations that do exist in the availability of health infrastructure, health personnel and health care facilities across the Kenya provinces.

From the study's findings it can be concluded that most mothers in Kenya suffer and die because they are involved in child bearing as adolescents or very old mothers, lack education and constrained into roles where their worth is defined by the number of children they bear. Too many children with short birth intervals, too early and too late is a pattern of child bearing that carries immense risks for the health of mothers in Kenya.

6.4 - Recommendations to Policy Makers

The study has illustrated that wide disparities characterize maternal mortality and morbidity in Kenya. Faced with a weak economy, a growing population and rising HIV / AIDS prevalence rates and some specific problems such as drug resistant malaria, the Kenya health care system is facing some serious challenges.

Maternal mortality in Kenya can be prevented with the existing knowledge and technology. A number of policy implications can be drawn from the study. These are:

(i) Expand and Improve the quality and efficiency of delivery of prenatal and postnatal care

The study revealed a significantly higher incidence of maternal deaths among women who never attended ante-natal and postnatal care. Women and families should then be provided with high quality prenatal and maternal care before and after pregnancy to reduce the incidence of maternal deaths and diseases. Prenatal care can detect complications before they can turn into emergencies hence should be expanded to reach all pregnant mothers in notable provinces such as Nyanza and Coast that recorded higher incidence of maternal deaths and diseases.

(ii) Expand Maternal Education

As regards maternal education, the study recommends that education for women be enhanced and be made a priority in policy formulation in Kenya. This is in line with the study's finding that maternal mortality decreased with an increase in educational attainment of the mother especially a secondary +

level of education that exhibited a negative effect on maternal mortality and morbidity. Girls in Kenya should therefore be encouraged to attain a secondary + level of education.

(iii) **Improve the socio-economic status of women**

The study showed that younger and older maternal age has a deleterious effect on maternal mortality and morbidity. It also showed that the risk of mortality increased at higher parities (7 +). This indicates that women suffer and die because they are married as adolescents and are constrained into roles where their worth is defined by the number of children they bear. Too many children with short birth intervals and too late as revealed by this study is a pattern of childbearing that carries immense risks to the health of mothers which can be reduced by improving their socio-economic status. This can be achieved by policy makers if the educational costs for girls are reduced or by waiving school fees for girls who go beyond primary level so as to delay age at marriage. Women should also be given better jobs to improve on their incomes and nutrition.

6.5 - Areas for Further Research

1) The Kenya Maternal Mortality Baseline Survey (1994) collected maternal mortality and morbidity information from both household surveys and hospital based data, future research should therefore be done to analyze the household (community) based data to give an indirect measure of maternal mortality using methods such as the sisterhood method, orphanhood, widowhood or "networking".

2) Further research is required to understand why wide disparities exists in maternal mortality and morbidity among the Kenya Provinces.

3) Kenya is one of the worst affected countries by the AIDS pandemic in sub-Saharan Africa and the AIDS epidemic poses the greatest health challenge in its history. Considering the close association between the pandemic and reproductive health, it would be worthwhile to conduct research on the new trends of maternal mortality and morbidity in the face of the HIV / AIDS scourge.

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Appendix 1

	Anaemia deaths as % of all maternal deaths	Anaemia deaths per 100,000 live births
Kwale District, Kenya*	11	82
Malawi**	8	48
Ilesha, Nigeria**	9	83
Dakar Senegal	5	35
Tangail District, Bangladesh*	4	47
Thimpu, Bhutan**	7	55
Andhra Pradesh, India*	9	27
Ambala, Northern India*	16	38
Karachi, Pakistan**	7	194

* Community study
** Hospital study

Source:WHO, 1996.