CORRELATES OF MATERNAL MORTALITY: THE CASE OF ADAMA HOSPITAL, EASTERN SHOA

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Abstract

Maternal mortality is an indicator of disparity and inequality between men and women. It is also a sign of women's place in the society and their access to social services and economic opportunities. It is well documented that, of all human development indicators, maternal mortality ratio shows the largest discrepancy between developed and developing countries.

The main objective of this study was to identify major socio-demographic and pathogenic correlates of maternal mortality among women admitted for maternal cases in Adama hospital over the last seven years based on the hospital records. In the bivariate analysis all of the demographic variables, residence and almost all the pathogenic variables considered were found to be statistically significant. In the logistic regression analysis, contrary to what is expected and hypothesized, age and parity of the women show no statistical significance. Gravidity on the other hand, was found to be a significant predictor of maternal mortality, and as hypothesized, women of gravidity 4 and above are at higher risk of maternal mortality compared to their counterparts with gravidity 2-3.

Residence was also a highly significant variable with high predictive value. Consistent with expectation, women coming from outside Adama town were at higher risk of maternal death compared with their counterparts of Adama town.

Once the statistical association between the dependent and the independent variables were examined, to identify the relative contribution of each of the specific pathogenic factor to maternal mortality, a separate model was fitted. The result showed that all of the major specific pathogenic variables were statistically significant. In order of their importance in influencing maternal mortality they can be listed as: hemorrhage, infection, hypertensive disorder of pregnancy, malaria, obstructed or prolonged labour, anemia and abortion. Contrary to expectation,experiencing abortion was found to reduce the risk of maternal death in the hospital. The possible explanation given for this finding is the availability and effectiveness of post abortion care in the hospital.

The study thus, provide an insight as to what mainly causes maternal mortality in the areas around the study hospital which those concerned in improving maternal health might find useful.

CHAPTER ONE

INTRODUCTION

1.1 Statement of the Problem

Women, who constitute more than half of the world's population are entrusted with the survival and propagation of our species. Women are also the main stay of families, the key educators of children, health care providers, farmers, traders, and often the main, if not the sole, breadwinners. A society deprived of the contribution made by women is one that will see its society and economic life decline, its culture impoverished, and its potential for development severely limited (Reed, et al., 2000:4). Hence their reproductive health is of great importance.

Improved maternal health programs would not only improve women's health and that of their families, but also the labour supply, productive capacity and socio-economic well being of the society. Women's health, their status, and their multiple contributions are pivotal links between the health of a population and its prospects of sustainable development (World Health Organization (WHO), 1992:4). Yet, women are generally the most under-served and the poorest of the poor, despite their central role as key agents in the development process. In order to achieve meaningful and sustainable development, it becomes necessary to address the question of women's health and empowerment. Unless the question of maternal health is addressed, the major health challenges of any society would remain largely unmet. Therefore, women's basic right to be protected when they risk their health and life in the process of procreation must be respected.

In February 1987, the safe motherhood initiative was launched at an international meeting in Nairobi, Kenya, in response to high rates of maternal morbidity and mortality in developing countries. Since then, maternal health and safe motherhood have attracted the attention of planners and policy makers of most developing countries. Many African governments initiated similar programs in the late 1980s and early 1990s. The efforts received further impetus from the 1994 International Conference on Population and Development (ICPD) in Cairo, the 1995 world summit for social development in Copenhagen, and the 1995 fourth world conference on women in Beijing (US Population Reference Bureau, 1997:16).

Maternal mortality these days, is seen as an indicator not only of socio-economic development but also of gender inequality, since pregnancy related deaths are being regarded as one more example of the neglect of the needs and rights of women in developing countries (World Bank, 1991:101). Hence the success of a country's maternal health program is a reflection of its performance in meeting other development objectives, such as infant and child mortality reduction, gender equity and equality, as well as achieving proper population size and socio-economic improvement.

The socio-economic consequences of women's health problems are serious, although often they are not recognized or addressed. The burden of women associated with frequent pregnancy, poor maternal health, and childbirth and pregnancy complications drains women's productive energy, jeopardizes their income earning capacity, and contributes to their poverty. Too many women, especially in developing countries still die from maternal cases that can be cost-effectively

prevented, even in the poorest community. Despite the unacceptably high maternal mortality ratio in most of sub-Saharan Africa, planners and policy makers of the countries in the region, until recently, fail to perceive this as a problem (World Bank, 1999: 1).

Women's health is influenced by biological, environmental, social, economic and cultural factors. In all developed countries today, males tend to have higher mortality than females at all ages. But, in many developing countries, the reverse is becoming true for part or all of age-range 1 to 44 years. For adult women, one major cause of mortality is childbirth or pregnancy related (WHO, 1992:4).

Every minute of every day, at least one woman dies from complications of pregnancy and childbirth. Of the more than 585,000 maternal deaths that occur every year, 99 percent occur among women living in developing countries. Women in these countries face greater risks during pregnancy, childbirth and postpartum period because they are more likely to deliver without assistance from trained health workers and have limited access to adequate medical care in the events of complication (Shane, 1997:1). In developing countries, maternal mortality is the leading cause of death for women of reproductive ages. In parts of sub–Saharan Africa, there are more than 1,500 maternal deaths for every 100,000 live births. This tragedy occurs despite the fact that pregnancy is a natural biological process and that we know how and have the means to reduce the risks associated with pregnancy and childbirth. In the United States this ratio is only 12 in 100,000 live births. A comparison of death risks from pregnancy in different regions of the world is presented in Table 1.1

Table 1.1: Comparison of Death risks from Pregnancy in different Regions of the World.

Region	Life time risk of death
World	1 in 60
More developed	1 in 1,800
Developing	1in48
Africa	1 in 16
Asia	1 in 65
Europe	1 in 1,400
Latin America (Caribbean)	1 in 130
North America	1 in 3,700
Oceania	1 in 26

Source: Shane, 1997:11.

A mother's death has a profound consequence for her family. If she dies, the chance of dying for her children under age of 5 years is as high as 50 percent in some developing countries (US Population Reference Bureau, 1997:16). Twenty percent of the burden of disease among children under the age five is directly associated with poor maternal health. This same condition is responsible for more than 3 million deaths of newborns each year. Research from Bangladesh shows those children up to the age of 10 whose mothers died have three to four times the mortality rate of children whose mothers are alive or whose fathers died. A recent study from Tanzania also found a detrimental effect on children's education especially at the secondary level (World Bank, 1999: 4-5).

The road to Nairobi started when the world woke up (in 1987) to the reality of a major tragedy. This was no new epidemic; throughout the ages women have died from complications of pregnancy and childbirth. The realization that maternal mortality is largely avoidable, and that increasing the status of women would enhance safe motherhood are other factors, which happened to have woken us up. However, maternal mortality ratio is still extremely high in sub-Saharan Africa. It is 20 to 70 times higher than in the industrialized countries like the United Kingdom, 6 times higher than in the middle income developing countries like Singapore, and twice as high as in all low income developing countries like Pakistan (US Population Reference Bureau, 1997:16). This underlines the fact that maternal mortality is still a major tragedy in developing countries, especially in the sub-Saharan African countries. Indeed, of all basic health indicators, such as infant and child mortality, maternal mortality shows the greatest discrepancy between developed and developing countries. This wide gap in maternal mortality between developed and developing countries may be attributed to disparities in medical facilities; antenatal, delivery and postnatal care; reproductive factors; and economic and socio-cultural factors. Maternal mortality ratio is between 600 and 1,500 maternal deaths per 100,000 live births for most sub-Saharan African countries. There is no evidence yet that maternal mortality has fallen since the adoption of the safe motherhood initiative. The table below depicts maternal mortality ratio in sub-Saharan Africa, in the 1990s.

the country (World Bank, 1998: 68). The WHO/UNICEF study, using new indirect estimation techniques, estimated maternal mortality in Ethiopia in 1990 to be 1,400 maternal deaths per 100,000 live births. At the prevailing mortality and fertility rates, an Ethiopian women has a life time risk of maternal death of 1 in 9, which is higher than the African average and much higher than that of a developed country like the United Kingdom (1in 5,100) (Nigussie, et al., 1997:21).

Adama hospital is selected for the purpose of this study due to the accessibility of the area and the possibility of obtaining enough number of cases so that multivariate analysis is possible. This research therefore, intends to assess the correlates of maternal mortality with special reference to Adama hospital.

1.2 Significance of the Study

Maternal mortality is a reflection of women's health status, which in turn reflects the status of community health. Maternal mortality has a consequence that affects women, their children, and even their community. In recent years, there is an initiative to give priority to women in demographic research, development spending and national policies in different parts of the world. Yet, the extent and causes of maternal mortality are largely unknown. Research on maternal mortality is still in its infancy. In other words, there is a scarcity of research in the area. In most countries of Africa, including Ethiopia, the few available data are mostly hospital based, descriptive in type and related to only a few obstetric complications. This research will highlight the correlates of maternal mortality among women who, for maternal cases

were admitted in Adama hospital during the last seven years. By identifying correlates of maternal deaths, the study would provide valuable information to planners and policy makers devoted to improve maternal health in the study area.

1.3 Objectives of the Study

The research has the following general and specific objectives:

General objective:

- To examine the correlates of maternal mortality among women admitted for maternal cases in Adama hospital over the study period.

Specific objectives:

- To identify some socio-demographic correlates of maternal mortality among women admitted for maternal cases in Adama hospital over the study period.
- To identify the major pathogenic correlates of maternal mortality among women admitted for maternal cases in Adama hospital over the study period.

1.4 Literature Review

In developing countries, one-fourth of all deaths of women, on the average, is maternity and childbirth related (WHO, 1987a, cited in Melaku, 1996:7). Since the launching of the Safe Motherhood Initiative in 1987, knowledge of the causes of maternal disability and death and of the appropriate interventions in poor settings have increased considerably (World Bank, 1999:4). There are various factors that

contribute to the risk of maternal mortality. These factors according to shane (1997) can broadly be classified into: -

(i) Pathogenic factors

(ii) Health service factors

(iii) Demographic factors

(iv) *Economic and Socio-cultural factors*

1.4.1 Pathogenic Factors

In developing countries, it is quite difficult to have clear patterns of the direct cause of maternal death in population inquiries using lay interviewers. Most of the information on medically defined causes of maternal deaths in sub-Sahara Africa is derived from hospital records.

According to the WHO Technical working group on Reproductive morbidity, pregnancy-related pathogenic causes can be divided into two major groups: - "direct causes ", and "indirect causes". According to Shane (1997:7), Pathogenic factors account for almost all (94 percent) of maternal deaths in developing countries. Direct causes contribute 80 percent of the deaths, while indirect causes account for 20 percent.

Direct Causes

The direct causes of maternal deaths are related specifically to the pregnant state and its management (World Bank, 1991:109). The most direct causes of maternal

mortality are complications of pregnancy such as antepartum and postpartum hemorrhage, infection, hypertensive disorder, obstructed or prolonged labour, and complications of abortion, which are responsible for nearly three quarters of maternal deaths (World Bank, 1999:4-5).

Hemorrhage

Globally, about 80% of all maternal death are the direct result of complications arising during pregnancy, delivery or puerperium. The single most common cause accounting for nearly a quarter of all maternal deaths is sever bleeding. Especially, postpartum hemorrhage, which is unpredictable and sudden in onset, is more dangerous when a woman is anemic. Globally, some 24% of all maternal deaths are due to hemorrhage. Blood loss can very rapidly lead to death in the absence of prompt and appropriate life saving care like blood transfusion (WHO, 1999: 13).

Hemorrhage after delivery is always a serious problem. If bleeding does not stop after half an hour, or if it is severe, it will be risky for the mother's life, unless she is taken to hospital as quickly as possible. Hemorrhage can also occur during labour. This can be caused by obstructed labour or problems with the placenta. An accidental hemorrhage can result from the separation of the placenta too early from the womb. Womb rupture or tear during delivery can also cause hemorrhage (Arkutu, 1995: 108-109). According to Shane (1997), globally, hemorrhage accounts for 146,000 maternal deaths every year. A hospital-based study in Nigeria identified hemorrhage to be the leading cause of maternal mortality, accounting for 9 percent of all the maternal deaths (Caffrey, 1979:274-277)

Infection (Sepsis)

Sepsis, which often is a consequence of poor hygiene during delivery, abortion or puerperium, accounts for some 15 percent of maternal deaths. Infection also happens when the amniotic sac ruptures long before delivery occurs, vaginal examinations are too frequent or when prolonged /obstructed labour occurs. Infection is the most preventable of the obstetric emergencies. Treatment of anemia reduces the risk of maternal death from infection, as anemic women are more susceptible to it.

Infection causes an estimated 87,000 maternal deaths each year. Unhygienic procedures during delivery or abortion, and failure to use appropriate antibiotics can cause many of these deaths (Shane, 1997:7). A study conducted in Dakar, Senegal revealed that among 154 maternal deaths recorded over a 12-month period, 55 were due to infection related causes (Garenne, et al., 1997: 14-24). Systematic postpartum care will ensure rapid detection of infection and its management by appropriate treatment (WHO, 1999:130).

A cross-sectional 5-year retrospective community based study conducted in 1990 to determine maternal mortality rate in Jimma town, southwestern Ethiopia identified sepsis, eclampsia and abortion as the major causes of maternal mortality in the area. The estimated maternal mortality ratio was 402 per 100,000 live births (Mersha, et al., 1996:30-34).

An investigation of causes of maternal mortality in Addis Ababa, Ethiopia from September 1981 to September 1983 found that puerperal sepsis and abortion were the leading causes of maternal morality, followed by viral hepatitis (Kwast, 1987:99-106).

Deaths from hypertensive disorder can be prevented by careful monitoring during pregnancy and treatment with relatively simple anti-convulsant drugs in case of eclampsia (WHO, 1999:14).

Obstructed / Prolonged Labour

This is one of the most common and dangerous complications of labour in Africa. Labour is obstructed if the baby cannot be delivered normally through the birth canal without serious damage or injury to the mother or baby. Obstructed labour can sometimes be predicted during antenatal care long before labour starts. Usually, however, the problem is recognized after the woman has been in labour for many hours without making any progress. Obstructed labour is the most common cause of prolonged labour, which is characterized by a continuous labour for many hours (more than 24 hours) without making any real progress towards delivery (Arkutu, 1995:107-108). Unattended obstructed labour may also lead to rupture of the uterus. Women with small pelvic size, those with birth canal damaged from trauma or disease, and women carrying a very large or abnormally placed fetus are at greater risk of obstructed labour. Where the birth canal is blocked, without access to safe delivery with cesarean section, many of these women will die. Globally, obstructed labour is reported to account for 47,000 deaths per year (or 8 percent of all maternal deaths), (Shane, 1997:7). It is more common where malnutrition is endemic especially, in populations with various traditions and taboos regarding the diet of girls and women. It is worse where girls marry young and are expected to prove their fertility, often before they are fully-grown. No other complication of delivery is

associated with as much chronic morbidity like fistulae as obstructed labour (WHO, 1999:14).

Indirect Causes

Approximately 20% of maternal deaths result from pre-existing conditions that are exacerbated by pregnancy or its management. One of the most significant of these indirect causes also known to underlie a substantial proportion of direct deaths particularly those due to hemorrhage and sepsis is anemia. Other important indirect causes of death include malaria, hepatitis, heart disease and increasingly in some settings HIV/AIDS (WHO, 1999: 14). Malaria and other parasites contribute to anemia during pregnancy. Anemia can reduce the ability to tolerate blood loss or infection, and cause spontaneous abortion. Anemia is highly prevalent among pregnant women in Africa. Although anemia alone can cause death, it is more often a contributing factor, making women less able to tolerate blood loss or infection. (Fortney and Kiragu, 1995:21).

Malaria, viral hepatitis (hepatic coma, or infective hepatitis) and anemia are reported to be the major indirect causes of maternal deaths in sub-Saharan Africa (World Bank, 1991:109).

The evidence on pathogenic causes of maternal mortality in developing countries as reported by the World Health Organization (1999) is summarized in Table 1.3.

Table 1.3: Pathogenic Causes of Maternal mortality in Developing Countries.

Causes	*Percentage*
Hemorrhage	24
Infection	15
Unsafe abortion	13
Hypertensive disorder	12
Obstructed labour	8
Other direct causes	8
Indirect causes	20
Total	**100**

Source: WHO, 1999:5

1.4.2 Health Service Factors

The World Health Organization (WHO) identifies four fundamental strategies that support safe motherhood initiative as: antenatal and postnatal care, family planning services, clean/safe delivery, and essential obstetric care. These are the four main health service factors determining maternal mortality. These health service factors can substantially reduce the death and disabilities associated with childbearing and enhance the survival of women and their children. A study conducted in Addis Ababa in 1983 found that maternal mortality rate was 457 per 100,000 live births. The most frequent causes of death were abortion complications, infectious hepatitis, hemorrhage and pre-eclampsia. This is a reflection of the failure of the health care system; a system most urban women who died had contact with or were near to. The situation in rural areas where health facilities capable of providing cesarean section,

blood transfusion, or necessary drugs, are miles away from the people was much worse (Nigussie, et al., 1997:21).

Distance from health facilities, coupled with inadequate transportation, limits the access of people to maternity services. In many developing countries, particularly in rural areas, the nearest health post may be several days journey from a village and over difficult terrain. There may be no transport to take a sick woman to a health facility and no means of calling in help from outside. Studies in Cuba, Egypt, Indonesia, Jamaica, Turkey and Tanzania demonstrate this fact (WHO, 1986b: 175-183).

Antenatal care

Antenatal care is health care and education provided during pregnancy. The main goals of antenatal care are to ensure that the mother and her baby are in good health and that any problem during the pregnancy is recognized and treated promptly. The provision of antenatal care clinic also offers an opportunity to counsel women about family planning and sexually transmitted diseases.

Pregnancy is not an illness, and majorities of women have normal pregnancy, safe delivery and healthy babies. Regular visits to an antenatal clinic enable the midwife, nurse, or doctor to detect the first signs of any pregnancy complication. Some traditional birth attendants (TBAs) have also been trained to recognize the signs of complications and to know when a woman must be taken to a hospital. The complications can then be treated before it becomes serious (Arkutu, 1995:53-60).

Ideally, the first antenatal visit should be made as soon as the woman thinks that she is pregnant, not later than the fourth month of pregnancy. The findings in these

status. Odd ratios were 2.5 for women who did not receive antenatal care compared to those received showing that women who did not receive antenatal follow-up are about 2.5 times more likely to die than those who did.

Place of delivery

Place of delivery is another crucial factor to consider while dealing with maternal mortality. However only 53% of pregnant women in developing countries deliver with the help of a skilled attendant. While many women are assisted by traditional birth attendants or only by relatives. Only 40% of women in developing countries give birth in a hospital or health center. An estimated 15% of pregnant women experience life threatening compilations that require emergency care, yet there are almost no data on the proportion with access to such care (WHO, 1999:16).

Women who have health problems or are at risk of developing serious complications should deliver in a health center or hospital so that the probability of maternal mortality will be minimized. A woman who has had no problem with her current pregnancy or with earlier pregnancies may be able to deliver safely at home, as long as she has a trained birth attendant with her. Families should know what to do if a complication develops, and especially where to take women if help is needed (Arkutu, 1995:60). To manage obstetric complications, the key life-saving components of maternity care are place of delivery with trained staff and a functional operating theatre, where blood transfusion and anesthesia are well administered. In the least developed settings, properly trained and supervised traditional birth attendants may help to improve hygiene during home deliveries and the referral of women with complications. However, even with training, traditional birth attendants

cannot treat serious complications, and high-level health providers with life-saving skills, are key to reducing maternal mortality (World Bank, 1999:2-7).

There is evidence that access to skilled assistance and well-equipped health institutions during delivery can reduce maternal mortality and reproductive morbidity, and improve pregnancy outcomes. In developing countries, the use of medical services for delivery and postpartum care lags far behind. Essential care for obstetric complications includes the ability to carry out surgery and provide anesthesia, blood transfusions, intravenous drugs, and other medical treatments that save mother's and the newborn's life (US Population Reference Bureau, 1997:16-17). Results of a case control study conducted in three hospitals in Dakar, Senegal revealed that the major risk factors associated with maternal mortality were: medical equipment failure (odds ratio, OR= 55.0), late referral (OR = 23.2), and Lack of ante-natal visit (OR = 16.9) (Garenne, et al., 1997: 14-24).

A Study was also documented on efforts by some developing countries to reduce one of the major causes of maternal mortality, the delay in treatment caused by the mother being some distance from natal facilities. A number of developing countries have attempted to reduced delays in treatment by moving women at risk into maternity waiting homes, located near a hospital, a few days prior to the date of confinement. Such countries are Uganda, Urlavei, Bangladesh, Cuba, Nicaragua, and Colombia (Irene and Talmanca, 1996: 1381-1390).

Family planning services

Family planning is one of the fundamental strategies of safe motherhood initiative, and it is believed to save mothers' lives. Family planning helps women to avoid unwanted pregnancies and abortions. It also helps women to avoid high-risk births, usually defined as births to very young women, births spaced less than 2 years apart and births to older women who already have more than 4 or 5 children (Goliber, 1997:37-38). Thus, family planning is indispensable in the endeavor being made to reduce maternal mortality. In addition to knowledge of a method, approval of the use of family planning and awareness of a source where family planning services can be obtained are basic preconditions for contraceptive use.

Worldwide, more than halves of all married couples are practicing family planning, although the prevalence ranges from fewer than 10 percent in most of sub-Saharan Africa to more than 70 percent in most developed countries. An estimate of 150 million women in the developing world want to delay or stop pregnancy, but are not using family planning, largely, because of lack of knowledge, fear of side effects, and husbands' disapproval (Shane, 1997:19). Social and cultural barriers also inhibit the practice of family planning and enjoyment of sexual health by many African women. Contraceptive prevalence data show that over 80 percent of African women know about family planning method, while only about 20 percent use a method effectively (International Planned Parenthood Federation African Region (IPPFAR), 1996: iii).

In sub-Saharan Africa, where desired family size is still large, and contraceptive use is low, about one-fifth of births on average are reported as mistimed (US Population Reference Bureau, 1997:13). In majority of countries in the region, less than 10 percent of married women of reproductive age use contraception in the

1990s. Ethiopia, the second largest country in sub-Saharan Africa, shows few signs of change since the adoption of National population policy that calls for reducing fertility (Goliber, 1997:26-28).

One overriding concern is lack of access to reproductive health care for so many people, especially women, around the world. It is estimated that 350 million couples lack access to family planning methods, even though they wish to space or prevent pregnancy. The Ethiopian National ICPD report stated that less than 40 percent of the total population had access to modern health care services in 1993, and only about half of the few existing facilities provide family planning services (Nigussie, et al., 1997: 19). As the adverse effect of unwanted or too closely spaced births on the health of mothers is well documented, improving knowledge of methods, availability, and accessibility to family planning services certainly will help to reduce maternal mortality.

1.4.3. Demographic Factors

These risk factors associated with pregnancy related deaths are primarily maternal age, gravidity and parity (World Bank, 1991:111). Some women are more likely than others to suffer from complications, because of their age, the number of times they have been pregnant, problems they have had because of pregnancies, or because their general health is not good. Various studies have found out that older women (35 years and over), primiparae (parity = 0) and grand multiparae (parity more than 4) are more likely to experience a complication during pregnancy or delivery. Young women, whose pelvis is not fully developed, are more likely to have obstructed labour. Both young unmarried women and the older mothers with several children are

more likely to seek abortions because of unwanted pregnancy (Fortney and Kiragu, 1995:26).

A woman who has one or more of these risk factors is likely to experience complications during pregnancy and delivery and is thus at high risk of maternal mortality. She should therefore, be treated with extra care. She should be encouraged to attend antenatal care clinic early and often during pregnancy and to follow the advice of doctors, nurses, or midwives, about what to do and where to deliver. However, even, women who are perfectly healthy can still develop complications during pregnancy and childbirth. All women therefore, need to be familiar with danger signs, and be ready to use available health facilities when necessary.

Adolescent pregnancy

Adolescents, especially those in their teens are more likely to have problems, usually during labour. The physical demands of pregnancy and delivery are especially difficult for them to handle because their bodies are still growing and developing. This in particular, is true if they are having their first baby. During pregnancy, young teenagers are more likely than women aged 20 to 24 to develop complications of high blood pressure, premature labour, and prolonged and/or obstructed labour. Without appropriate intervention these complications may lead to maternal mortality. They should therefore, be advised to deliver in a hospital in order to receive proper medical attention (Goliber, 1997:39).

Childbearing is common among teenagers in sub-Saharan Africa. Evidences from DHS data revealed that the proportion of women aged 20-24 at the time of the survey who had given birth before the age of 20 was 55 percent in Botswana, 52 percent in Kenya, 70 percent in Mali and 54 percent in Nigeria. Most of these births are to

married women. Both teenage marriage and childbearing are common and expected in the region (Goliber, 1997: 39). A population-based study in Addis Ababa confirmed that teenage pregnancy is a risk factor for maternal mortality (Kwast, 1988:115-121). In the survey, teenage maternal mortality was found to be the highest among all the reproductive age groups (1,322 maternal deaths per 100,000 live births).

Too late pregnancy

Women, who are older, over 35 years, are also more likely to have serious complications during pregnancy and labour, especially if they already have a large number of children. They may suffer high blood pressure, problems with the placenta, or problems associated with a very large baby, deformities, abnormal presentation, and miscarriage (Arkutu, 1995: 63). Some of these complications may be fatal. Thus, pregnant older women should be encouraged to seek more careful medical attention during pregnancy and delivery because they are at a greater risk of maternal death. Studies of maternal mortality rate from three developing countries, Indonesia, Bangladesh and Egypt, among different age groups show that, women aged 35 to 39 had a maternal mortality rate twice as high as women aged 20 to 24, and for those over 40, the rate is five times as high (Viegas, et al., 1992:559-565).

Multi-parity (too many pregnancies)

After five or six pregnancies, women are more likely to suffer from complications such as high blood pressure, anemia, and abnormal presentation of the baby. The other main risks are problems caused by weakened muscles in the womb, which result in heavy bleeding, long labour and rapture of the womb (Arkutu, 1995: 63). Therefore, women who have had many children are advised to deliver in hospitals. A study in Jamaica shows that those having their fourth or subsequent births were 43

percent more likely to die than women with parity two. In Portugal, women having their fifth birth were three times as likely to die as women having their second baby, while women having their sixth or higher order births were at even greater risk (WHO, 1986b: 175-183). The findings of a study on maternal mortality in rural community of Illubabor, southwestern Ethiopia (Shiferaw and Tessema, 1993: 239-249) using a "sisterhood method", a new indirect technique, indicated a life time risk of maternal mortality of 1 in 23 women. The community was observed to experience high maternal mortality, which is compounded by high fertility as reflected by a total fertility rate of 7.6.

Pregnancy too close together

Pregnancy, delivery, and breastfeeding put a considerable strain on a woman's health. Pregnancy less than two years apart increases this strain and the risk of dying. Sever anemia, for example is common among women with frequent pregnancies. Older women who have had a large number of pregnancies close together face a much higher risk of dying during pregnancy and labour. Women who are 35 years of age or older, and have already had many pregnancies (more than 5), face a higher risk of complications and death during pregnancy and delivery (Arkutu, 1995:64).

The 1984 Zimbabwe reproductive health survey has shown that the risk of morbidity and mortality associated with pregnancy are greatest for women under age 18 or above age 35, women with four or more births and women whose last birth occurred within the past two years (Zimbabwe Reproductive Health Survey, 1984)

1.4.4. Economic and Socio-cultural Factors

There are varieties of socio-cultural factors, beliefs, and constraints that affect both care seeking and care-providing behavior. These include differences in the value placed on human life in different cultures as well as the value given to different ages and genders, and consequently the range of tolerance for loss of life and the different levels of energy (and resources) expended to save it.

Adverse socio-economic conditions and some cultural practices that are inimical to good health cause a number of maternal deaths. Socio-economic factors are closely associated with all other variables. Thus, for example, a period effect is observed in the link between high maternal age, low educational status and maternal mortality. Similarly, high parity women, often with short birth interval, predominate in the lower socio-economic group of many sub-Saharan African countries. Women with no or little education, tend to be underrepresented in population using ante-natal care services or seeking professional assistance at delivery; as a consequence they form the unbooked hospital deliveries that often end in maternal deaths (World bank, 1991:2).

Maternal mortality and disabilities are also influenced by social factors, particularly those that relate to a woman's perceived role in society such as education, access to income and resources, and degree of isolation (World Bank, 1999:15). In many societies girls are less likely to go to school than boys. This means that they do not have the chance to gain the basic knowledge and skills which could help them earn money, take care of themselves, making use of family planning and other health services, and participate in decision making in the family and the community (Arkutu,

1995:7). Poor women are more likely to die due to maternal cases as they make less use of skilled medical service providers during delivery and their access to referral services during obstetric emergencies is limited by transport costs and fees for services.

Poor economic conditions also hinder access to family planning, good nutrition and hygienic deliveries (World Bank, 1999: 8). Poor diet and inadequate nutrition can make girls anemic, unable to grow and gain strength, weak and vulnerable to disease. When women are small, not strong and especially their hips are narrow, labour could be difficult and they may not be able to deliver a baby safely (Arkutu, 1995: 5).

According to the analysis of data using multiple regression in a study on maternal mortality in Africa, in the years 1980 to 1987 maternal mortality in Africa is strongly influenced by socioeconomic factors such as access to safe water and percentage of urban population (Paul, 1993: 745-752).

In the housing probability survey in Addis Ababa, Ethiopia (Kwast and Liff, 1988:115-121), the risk of maternal death was higher among students and women of lower economic status.

Socio-cultural factors are also related to specific pathogenic causes, particularly through the intermediary of age and parity. Cultural influences leading to early marriage and early pregnancy are also prevalent in Africa, often compounding the health problems caused by traditional practices. Early sexual intercourse can cause tearing in the genital region, while childbearing at younger age is correlated with higher incidence of obstructed labour, anemia and obstetric fistulae. The youngest

age of marriage is found in Tanzania and Ethiopia. In Tanzania, the median age at first marriage is 17, by the age of 20, 95 percent of women have married at least once (The Center for Reproductive Laws and Policy, 1997: 11). Early marriage in Ethiopia, particularly in rural areas, is universal, and early childbearing within marriage is the norm. As some evidences show, girls marry at an age as low as 11 or 12 years. According to the 1990 Family and Fertility Survey (FFS), the mean age of first marriage for girls was estimated at 15.6 years. Over three-quarters (75%) of the first marriages took place before the girls attained the age of 18 years. Early marriage leads to early childbearing before the girls are physically and emotionally matured. The 1990 FFS shows that, 63 percent and 57 percent of the girls had given birth before the age of 20 years in rural and urban areas respectively. A recent study on age at first marriage in northern Ethiopia indicated that, the mean preferred age at marriage is 14.2 years for girls (Genet, 1997: 18-20).

A study in northern Nigeria shows that early childbearing contributes to the problems of cephalopelvic disruption, rupture of uterus and hemorrhage (Harrison, 1985:59-65). Death arising from the complications of induced abortion on the other hand is associated with the low socio-economic status and educational level. In some countries, traditional practices harmful to women, particularly teenage women continue to exist. For example an estimated 85 to 114 million women in over 30 countries have undergone some form of female circumcision or female genital mutilation (FGM). As many as 100 million African women have been circumcised, and at least one million African girls are circumcised every year. Female circumcision is nearly universal among women in the horn of Africa, including Ethiopia. For example, the 1995 Eritrean DHS reported that, 95 percent of females have been circumcised

(Goliber, 1997: 35-36). In Ethiopia, its prevalence is estimated to be 90 percent (The Center for Reproductive Laws and Policy, 1997:11).

In some cultures, FGM is believed to keep sexual desire in check, reduce neonatal mortality and represents an important part of girls' initiation into womanhood (Inter Africa Committee (IAC) Newsletter, 2000: 12). However, it can have severe physical, social, and psychological consequences. According to the reports on the symposium for Religious Leaders and medical personnel on FGM as a form of violence against women in Bangul, the Gambia, from 20 to 23rd July 1998, some of the short-term health consequences include severe bleeding, shock from pain, and infection. The long term health consequences of FGM include painful menstruation, recurrent urinary tract infection, loss of control of urine, infertility, painful sexual intercourse and obstructed labour. Most of these long-term health effects can lead to maternal mortality.

In some societies childbirth is considered as impure and "polluting" and the woman in labour must withdraw to a secluded place. In Maiduguri, northern Nigeria, there is a belief that a woman's first child should be delivered at home. Where there is no health facility within the neighborhood, if complication arises, both the woman and the baby are likely to die. This belief, indeed, prevents women from taking advantage of modern delivery services. In Ethiopia other harmful traditional practices include massaging the abdomen of the women in labour and shaking a woman to speed up delivery of the placenta. These practices can aggravate the risk of maternal death (Almaz, 1991)

One of the associated problems that have bearing to maternal mortality is the generally low status of women. Many African women do not have the power to exercise their rights and make life decisions, particularly regarding their own sexuality and reproduction. Violence against women such as beating and sexual harassment can also lead to miscarriage or other injuries, which may result in maternal death. Due to their poor economic condition, almost all women in Africa work very hard especially in agriculture. Working too hard can strain a pregnant woman and can lead to complications. Over work, in combination with poor nutrition, make women more likely to get sick. Too much work also means less time to attend school and health facility (Arkutu, 1995: 7-8). These economic and socio-cultural factors are often the underlying factors that increase the risk of maternal deaths.

1.5 Conceptual Framework

Studies on maternal mortality are so scanty that ready-made conceptual frameworks are not available. For the purpose of this study, the conceptual framework in Figure 1.1 is proposed.

As it is shown in Figure 1.1, the independent variables: - demographic, residence and pathogenic factors influence the dependent variable, maternal mortality. Not all of these independent variables directly influence maternal mortality. The demographic and residence variables operate indirectly through the pathogenic factors to influence the risk of maternal death.

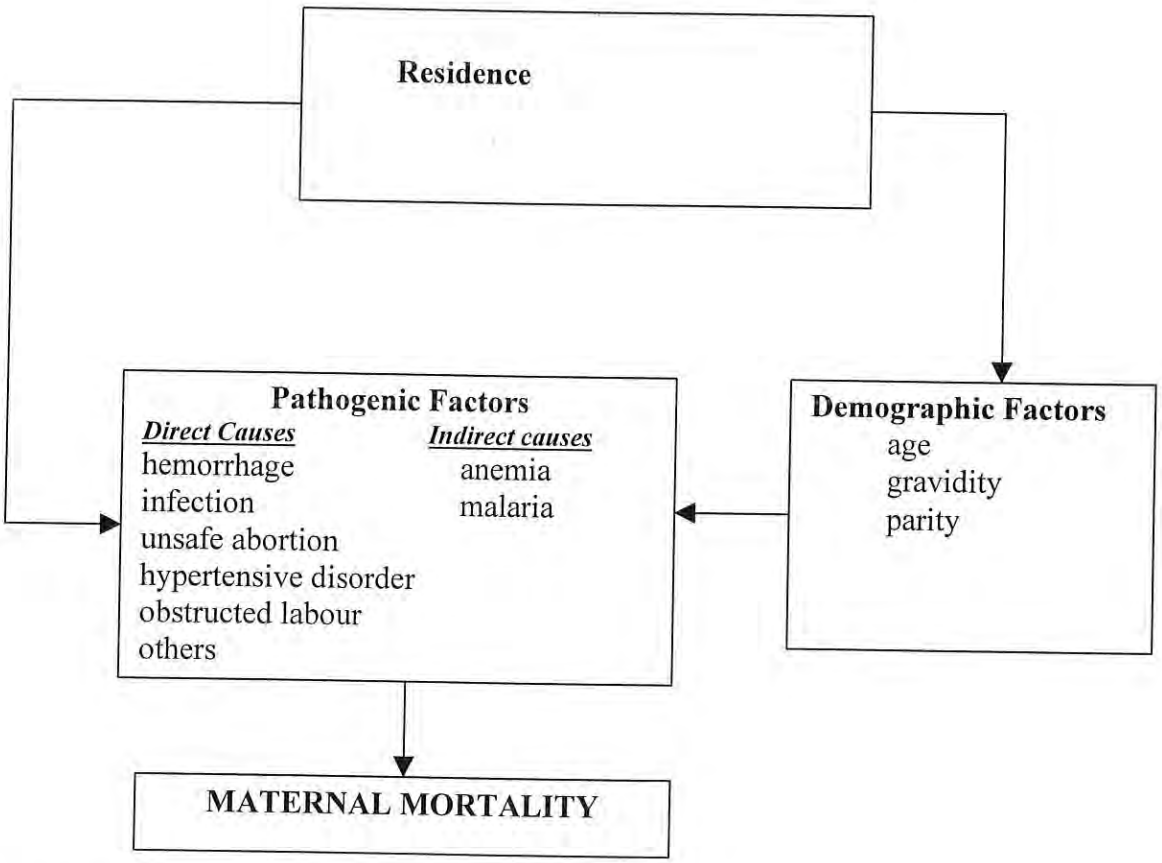
Pathogenic causes of maternal mortality are those related specifically to the pregnancy state and its management (direct causes), such as hemorrhage, infection, unsafe abortion, hypertensive disorder and obstructed labour. Others are pre-existing

conditions that are aggravated by pregnancy (indirect causes) such as anemia, malaria and other indirect causes that result in maternal death.

Demographic factors refer to the reproductive risk factors associated with pregnancy related deaths. Women with many, early, late and frequent pregnancies are more likely to have serious complications, such as hemorrhage, obstructed labour, high blood pressure, and anemia during pregnancy and labour. Without appropriate intervention most of these complications may be fatal.

Residence is also closely related to all other independent variables that cause maternal death. There is a link between high parity with frequent pregnancy and residence. There is also a link between residence and health service utilization. Therefore, these demographic and residence variables influence maternal mortality through the intermediary of pathogenic factors.

Fig.1.1 Conceptual Framework for the Study of Correlates Of Maternal mortality



Source: Developed by the Author.

1.6 Research hypotheses

The study has the following hypotheses:

(i) The likelihood of maternal mortality would be higher among younger women under age 20 years and older women aged 35 years and over.

(ii) The risk of maternal mortality would be higher among women with four or more gravidity and parity.

(iii) Women coming from outside Adama town, where the hospital is located are at higher risk of maternal mortality than their counterparts of Adama town.

1.7 Organization of the study

This thesis is organized into five chapters. Chapter one introduces the subject matter and sets the stage for the study. Chapter two contains the methodological aspect of the study. It particularly describes the data collection process, methods of data analysis, evaluation of data quality and limitations of the study. In chapter three, the background characteristics of the study population and study area are discussed. Chapter four investigates the correlates or determinants of maternal mortality among the study population. In the last and the fifth chapter, findings are summarized, conclusions are made, and relevant research recommendations are posited.

CHAPTER TWO

DATA SOURCE AND METHODOLOGY OF THE STUDY

2.1 Data Source

The data for this study were derived from records on deliveries, abortions and delivery complications in Adama Hospital. Because maternal mortality is a rare event, records covering 7-year period were examined in order to have adequate sample size that would sustain meaningful analysis of the data. The unit of analysis would be admission of a mother for maternal cases to Adama hospital.

The available information derived from the records for the purpose of this study include age, gravidity, parity, residence, diagnosis and survival status of women admitted in the hospital for maternal cases during the study period. The data collection process took about twenty days. The author and three university students did the data collection with a midwife as a supervisor. A total of 16,279 maternal cases among whom were 341 maternal deaths constitute the study population.

2.2. Data Entry, Cleaning and Methods of Analyses

The data was first coded and one experienced data entry operator carried out the data entry. Data cleaning and re-coding were performed following data entry. The data was analyzed using computer software called Statistical Package for Social Sciences (SPSS). Both bivariate and multivariate techniques of analyses were used in this study.

The dependent variable in this study is, whether a women admitted in the gynecology and obstetrics department of Adama hospital due to maternal cases has died or not. The independent variables available for this study comprise few socio-demographic and more of clinical variables. To examine the relationship between the dichotomous dependent variable (maternal mortality) and a number of independent variables, the logistic regression technique is employed as the most appropriate one. The logistic regression predicts the log of odds of the dependent variable as a linear function of the independent variables. This model is expressed as:

$$\ln(P_i / 1- P_i) = ß_0 + ß_1X_{i1} + ß_2X_{i2}+\ldots+ ß_kX_{ik}$$

Where, P_i = Chance of the i^{th} woman dying due to maternal cases.

$1 – P_i$ = Chance of the i^{th} woman not dying due to maternal cases.

$(P_i / 1- P_i)$ is the risk or odds of the i^{th} woman dying due to maternal cases.

$X_1, X_2, X_3,\ldots$ represent predictor variables.

Estimates of $ß_i$'s, the logistic regression coefficients are obtained by the maximum likelihood method. A positive value of $ß_i$ means the value of the factor by which the odds change (exp. $(ß_i)$) is greater than 1, implying an increase in the odds. A negative value of $ß_i$ means the value of the factor by which the odds change (exp. $(ß_i)$) is less than 1, indicating a decrease in the odds. A zero value of $ß_i$ means the factor by which the odds change (exp.$(ß_i)$) is equal to 1. Which means the odds remains unchanged.

The parameters in logistic regression model represent the increase or decrease in log of odds for the category code "one" compared to those of code "zero" holding the effect of all other factors controlled.

2.3. Definition of Concepts

A skill attendant/Health professional: Refers to exclusively to people with mid-wifery skills (e.g. Doctors, midwives, nurses) who have been trained to proficiency in the skills necessary to manage normal delivery and diagnose or refer obstetric complications.

Anemia: A disease in which the blood gets thin for lack of red blood cells. Signs include pale skin and lack of energy.

Antenatal care: A care or follow up given to a pregnant women by eligible health workers to make sure that she has a safe pregnancy.

Eclampsia: A potential fatal condition in which a woman with pre-eclampsia develops convulsion.

Gravidity: the number of pregnancies ever experienced by a woman.

Hemorrhage: A heavy bleeding that occurs during pregnancy or after delivery.

Hepatitis: A viral infection that harms the liver. Hepatitis increases the risk during pregnancy of liver failure and death.

Hypertensive disorder of pregnancy: Includes pregnancy induced hypertension and renal hypertension. It is a syndrome characterized by swelling of the face and hands, high blood pressure and protein in the urine after the 20^{th} week of pregnancy.

Pregnancy induced hypertension, if untreated, may develop into pre-eclampsia/eclampsia.

Life time risk of maternal death: Takes in to account both the probability of becoming pregnant and the probability of dying as a result of the pregnancy cumulated across a women's reproductive years

Live birth: The complete expulsion of or extraction from its mother of a product of conception irrespective of the duration of pregnancy, which, after such separation shows evidence of life.

Maternal Morbidity: Any illness or injury caused by, aggravated by or associate with pregnancy or childbirth.

Maternal mortality rate: The number of maternal deaths per 100,000 women of reproductive age (15-49) in a given period.

Maternal mortality ratio: The number of maternal deaths per 100,000 live births in a given year.

Maternal mortality: The death of a woman while pregnant or within 42 days of termination of pregnancy from any cause related to or aggravated by the pregnancy or its management.

Nullipara: Woman who never experienced a life birth

Obstructed labour: A problem that occurs when the space in the bony birth canal of the mother is either too small or too distorted by disease to permit easy passage of the head of the baby during labour. Obstruction can result in death of the mother

Pregnancy induced hypertension, if untreated, may develop into pre-eclampsia/eclampsia.

Life time risk of maternal death: Takes in to account both the probability of becoming pregnant and the probability of dying as a result of the pregnancy cumulated across a women's reproductive years

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Maternal mortality: The death of a woman while pregnant or within 42 days of termination of pregnancy from any cause related to or aggravated by the pregnancy or its management.

Nullipara: Woman who never experienced a life birth

Obstructed labour: A problem that occurs when the space in the bony birth canal of the mother is either too small or too distorted by disease to permit easy passage of the head of the baby during labour. Obstruction can result in death of the mother

through infection and exhaustion, and death of the fetus through infection, birth injury and lack of oxygen.

Parity: The number of children previously born alive to a woman.

Post-natal care: Visits made by a mother to health institution or visited by a health worker (at home) within the first 42 days after giving birth.

Pre-eclampsia: A serious condition that sometimes develops during pregnancy. It is characterized by development of high blood pressure, protein in the urine and swelling of the feet, hands and face. Also known as toxemia.

2.4 Variables and their Specification

The following are the independent variables and dependent variable available for this study.

Variables	**Specification**
The dependent variable	
• Maternal mortality	1 = Mother died of maternal cases 0 = Mother survived
The independent variables	
• Age	1 = 15-19 2 = 20-34 3 = 35+
• Residence	1 = Outside Adama town 0 = Within Adama town
• Gravidity	1 = 1 2 = 2-3 3 = 4+
• Parity	1 = 0 2 = 1-3 3 = 4+

- Direct pathogenic causes — 1=Yes(with at least one of the direct cause) 0= No (None of them)
- Indirect pathogenic cause — 1=Yes(with at least one of the indirect causes) 0 = No (Non of them)
- Hemorrhage — 1 = Yes 0 = No
- Infection — 1 = Yes 0 = No
- Hypertensive disorder — 1 = Yes 0 = No
- Obstructed/ prolonged labour — 1 = Yes 0 = No
- Unsafe abortion — 1= Yes 0 = No
- Other direct causes (Ectopic pregnancy, retained placenta, and ruptured uterus…) — 1 =Yes 0 = No

- Malaria — 1 = Yes 0= No
- Anemia — 1= Yes 0=No

2.5. Data Quality

Most demographic data in developing countries usually suffer from errors. It is therefore important to assess the quality of data before any detailed analysis is made.

Due to both the absence of birth registration and high rate of illiteracy, age data in Ethiopia are highly affected by age miss-reporting and digit preference. Beyond such age reporting problems most mothers in Ethiopia who come to hospitals for maternal cases are either in labour or suffering from complications. Providing immediate treatment would be a priority business for health workers than requesting for other socio-demographic information. Consequently, records for some of the cases might be incomplete or not available.

In this study, to assess the quality of data, particularly the extent of age reporting errors, some attempts are made using the simple method of assessing the quality of data by graphic analysis. By this method, the single age distribution was displayed graphically. Figure2.1 shows a marked heaping at ages ending in 0 and 5. A considerable avoidance for ages ending in 1 is observed.

The Myers' Blended index indicates the proportion of persons in the study population for whom an age with an incorrect final digit is reported. Theoretical Myers' Blended index range from 0–90. The index value of 90 indicates the extreme case where all recorded ages end in the same digits while index value of 0 indicates no age heaping (Shyrock and Siegel, 1976).

Figure 2.1 Age Distribution of Women Admitted for Maternal Cases in Adama Hospital, 1993-2000.

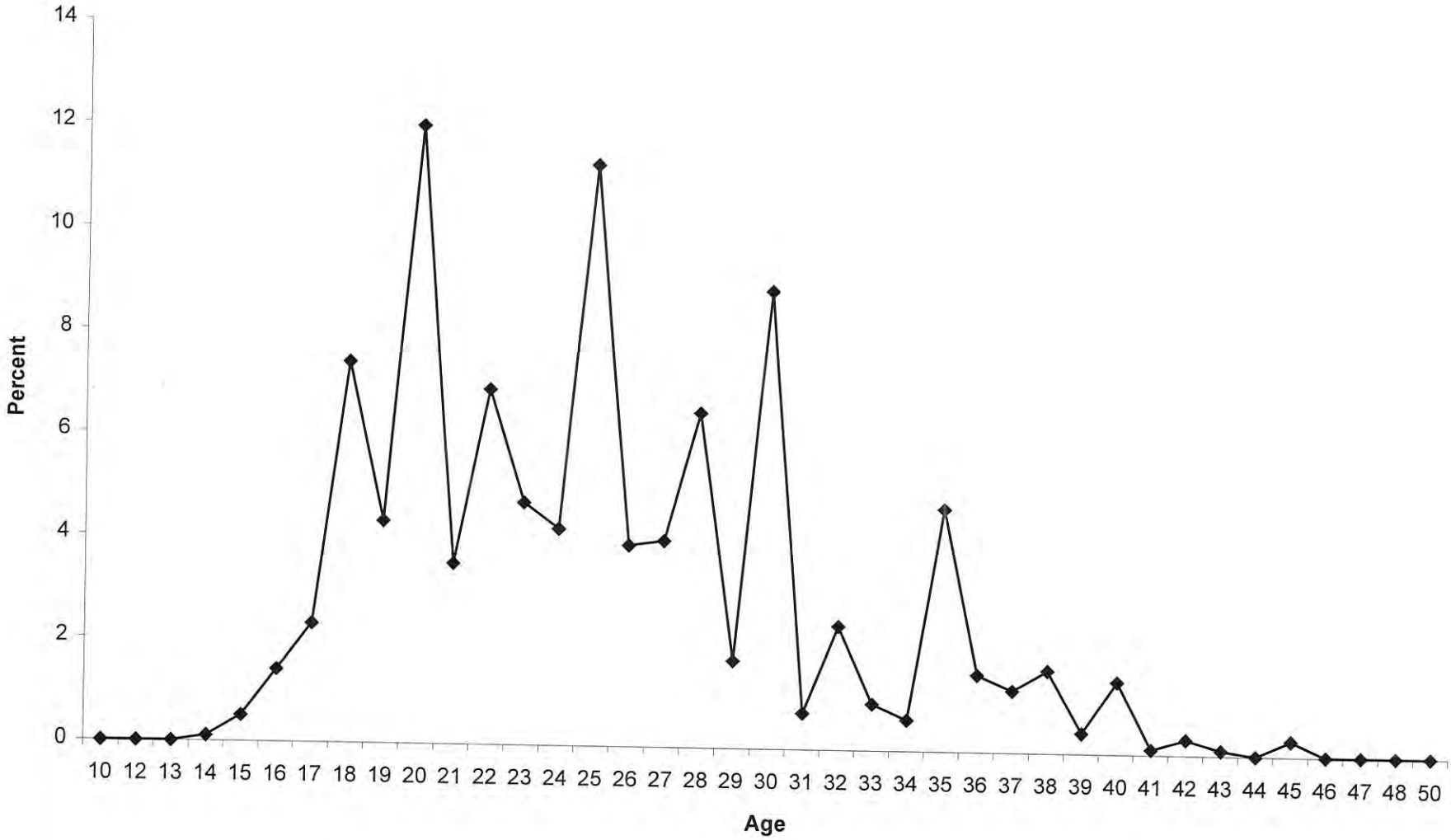

Table 2.1 Myers' Blended Index for Terminal Digit Preference by the Study population.

Terminal Digit	Deviation from 10
0	-12.87
1	5.70
2	0.26
3	4.32
4	4.80
5	-6.86
6	3.4
7	2.8
8	-5.00
9	3.42
Summary Index	**24.72**

The estimated Myers' Blended index of 24.72 indicates the existence of digit preference or avoidance in age reporting. By this index, age with incorrect final digit was reported by almost a quarter of the study population. However, since age in-groups rather than in single years of age will be used in the data analyses, the observed digit preference would not constitute a serious limitation of the study. Beyond age reporting errors, the data regarding residence obtained from the Adama hospital records are highly incomplete and do not contain sufficient information on place of residence of the woman in terms of zone, district, town, higher and peasant associations. This is particularly the case for those coming from outside Adama town, making it impossible to categorize the study population in terms of rural-urban

residence. The only possible residence classification is to simply categorize the women into those attending the hospital from within and from outside Adama town. This may provide an insight into whether or not a woman, having maternal problem experienced increased risk of maternal mortality due to delayed access to the hospital.

2.6 Methodological Problems in Studying Maternal morality

The study of maternal mortality is not as easy as other mortality studies like infant and child mortality. The study and documentation of maternal mortality and morbidity is particularly difficult in developing countries because of the shortage of data for assessing the problems. Despite its significance, pregnancy related mortality is a relatively rare event in comparison, for instance, with infant mortality. Therefore, it requires large sample sizes before sufficient cases of death can be obtained for any meaningful analysis. The problem is exacerbated because there is often no reliable informants to provide information on the deceased (Fortney and Kiragu, 1995:2).

The numbers and percentages, which were published by the World Health Organization, are only best guesses, because there are no reliable population-based statistics on the level and causes of maternal mortality in most parts of the world, but they provide a general idea of the scope of the problem (Reed, et al, 2000:4).

The concept of maternal mortality by itself must be first clearly understood. The investigator must critically see whether the death is really due to pregnancy and childbirth complication or is due to some other health problems but aggravated by pregnancy. Time here, is also a very important factor. It requires a careful

consideration whether the death occurs during pregnancy or within 42 days of termination of pregnancy.

The definition and classifications of complications of pregnancy are among the main difficulties. Since illnesses may progress slowly and one may be a risk factor for the other it may be difficult even for health workers to ascertain the exact and ultimate cause of maternal mortality. Two or more complications might be observed simultaneously by the time the woman was admitted.

Unless the health problems arising from or aggravated by pregnancy are carefully registered, it may mislead the investigator to identify the real and ultimate cause of maternal death. For the purpose of this study, what were recorded in the registration books were all considered.

2.7 Limitations of the Study

Due to scarcity of adequate data from other sources as well as the difficulty and expense of conducting population based studies, many studies on correlates of maternal mortality in most developing countries including Ethiopia are hospital-based, a method that presents problems of its own.

Not all women deliver in hospital, and so hospital-based figures are only representatives of women who deliver there. They exclude many that deliver or die at home and never came to the attention of medical care providers. Furthermore, those who can afford to go to hospital may be of higher social status, more educated, and more likely to have had access to care during pregnancy; they may, therefore have a lower risk than women without access to services. This difference may lead to under estimation of community mortality or morbidity levels. At the same time, it is probable

that women who deliver in a hospital are those at high risk of complications. Or for whom a complication has already developed. Hospital-based studies and estimates may thus inflate the true population risk. It is difficult to estimate the combined impact of these opposing biases (Fortrey and Kiragu, 1995:4). Thus, hospital-based studies usually lack representativeness.

They are also limited in providing important demographic, social, and economic information. Rather they focus mainly on obstetric complications. In Ethiopia, as in any other developing country, most deliveries take place at home, in an unclean condition without the necessary facility and trained personnel. Even for those who give birth in hospitals, information recorded at times lacks accuracy and completeness.

This study therefore, lacks representativeness and could not examine some important socio-economic and health service factors, which are important determinants of maternal mortality due to lack of data. Since community-based studies on correlates of maternal mortality should be longitudinal, they are very expensive, as they require huge amount of money and well-trained health professionals. Thus, hospital-based studies not surprisingly remain important particularly in developing countries where adequate data are scarce.

CHAPTER THREE

CHARACTERISTICS OF THE STUDY POPULATION AND THE STUDY AREA

3.1 The Study Area

Ethiopia is among the poor developing countries with poor maternal health condition and high level of maternal mortality.

Adama town (Nazareth), the capital of Eastern Shoa Zone is found in Oromia region. It is located in central part of Ethiopia and is one of the large towns in the country. According to the 1994 population and housing census of Ethiopia the total population of Adama was 127,842. There are 20 kebeles (the smallest administrative unit in urban Ethiopia) organized under three woredas (the immediate upper body of administrative structure above the kebele).

Evidence from the records show that Adama hospital does not only serve people living in Adama town, but also people living in the surrounding rural areas, weredas, Zones, and even regions.

The Adama hospital has 130 health professionals and 101 administrative and support staff. The gynecology and obstetrics department is the busiest department of the hospital. There is only one gynecologist in the hospital and three midwife nurses in the department, who provide any kind of delivery service including cesarean section. Absence of blood transfusion service is the main problem that makes the attempt to save the lives of bleeding mothers difficult and sometimes impossible. Reports suggest that, often a number of women die on the way to Addis Ababa for blood transfusion.

3.2 Background Characteristics of the Study Population

3.2.1 Age Composition

The risk of maternal mortality varies with age at pregnancy. Women who get pregnant before their body is well developed are at a higher risk of maternal death. Since their general body condition is getting weaker, older women aged 35 years and over are also at a higher risk of maternal death. In this study, all cases of women below age 15 are included in the age group 15-19 and those above age 49 are included in the age group 45-49. From Table 3.1, it is observed that a high proportion of women belong to the age groups 20-24 (31.3 percent) and 25-29 (27.5 percent), the lowest proportion belong to age group 45-49 (0.4 percent).

Table3.1 Age Distribution of Women Admitted for Maternal Cases in Adama Hospital 1993-2000.

Age	Number	Percent	Women died	
			Number	Percent
15-19	2,628	16.2	52	15.3
20-24	5,095	31.3	82	24
25-29	4,473	27.5	95	27.9
30-34	2,196	13.5	41	12
35-39	1,517	9.3	54	15.8
40-44	300	1.8	12	3.5
45-49	70	.4	5	1.5
Total	16,279	100.0	341	100.0

Source: Adama Hospital Records.

As is given in Table 3.2, 16.1 percent of women admitted in Adama hospital for maternal cases over the study period were in their teens, 11.6 percent of them are 35 years and over. Thus, a total of 27.7 percent of the study population were at a

relatively higher risk of maternal death. The remaining 72.3 percent were in the peak reproductive ages 20-34,

Table3.2: Distribution of Women Admitted in Adama Hospital for Maternal Cases in three Age groups, 1993-2000.

Age	Number	Percent
15-19	2,628	16.1
20-34	11,764	72.3
35-49	1,887	11.6
Total	16,279	100.0

Source: Adama hospital Records

3.2.2 Parity and Gravidity

The risk of maternal death increases steadily after the fourth birth. Obstructed labour, ruptured uterus and postpartum hemorrhage represent serious risk factors in high party and high gravidity women (Kwast, 1987:99-06). Studies show that anemic women who lack the tolerance of blood loss and puerperal infection are often of high gravidity and parity.

As clearly seen from table 3.3, the study population dominantly is of lower gravidity and a high as 75.7 and 84.4 percent of them are of gravidity 1-3 and parity 0-3 respectively. Women with high gravidity (4+) and high parity (4+) constitute 24.3 and 15.6 percent respectively of the total study population.

Out of the total maternal deaths, the highest proportion (44 percent) occurred among women of high gravidity (4+) followed by women of 1 (34.6 percent) and those

with gravidity 2-3 (21.4 percent). Similarly nullipara women had a higher proportion of maternal deaths (35.2 percent) than women of parity 1-3 (33.1 percent) and those of high parity 4+ (31.7 percent).

Table 3.3 Distribution of Women Admitted for Maternal cases in Adama Hospital by Parity and Gravidity, and their Survival Status, 1993-2000.

Variable	All women		Women who died	
	Number	Percent	Number	Percent
Gravidity				
1	5,251	32.4	118	34.6
2-3	7,061	43.3	73	21.4
4+	3,967	24.3	150	44
Total	16,279	100.0	341	100.0
Parity				
0	7,457	45.8	120	35.2
1-3	6,280	38.6	113	33.1
4+	2,542	15.6	108	31.7
Total	16,279	100.0	341	100.0

Source: Adama Hospital Records.

Table 3.4 reveals that majority women of gravidity one, belong to age group 20-24 (42 percent) followed by age groups 15-19 (31.7 percent) and 25-29 (20.3 percent). Only 0.1 percent of women of gravidity 1 were aged 45-49. The fact that about one-third of all women of gravidity one were teenagers suggests that child bearing is initiated relatively early among the study population. Among women of gravidity 2-3, 38.6 percent are in age group 25-29 and 35 percent in age group 20-24. There are also women in the age group 15-19 (6.3 percent) within this category. Among women of gravidity 4 and above, 29.8 percent belong to age group 30-34 followed by 35-39 (27.6 percent) and 25-29 (25.6 percent). In all of the gravidity groups the proportions of women aged 40-44 and 45-49 are very small.

Women who never experienced a live birth are dominantly in the age groups 20-24 (41.6 percent) and 15-49 (30 percent). Then, it gradually decreases to the age groups 45-49.Women belonging to the age group 35-39 constitute a good proportion of higher parity women, whereas for the highest gravidity women, the largest proportion is in the age groups 30-34.

Table 3.4: Age Distribution of Women Admitted in Adama Hospital for Maternal Cases by Gravidity and Parity: 1993-2000

Variable	*15-19*		*20-24*		*25-29*		*30-34*		*35-39*		*40-44*		*45-49*		*Total*	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Gravidity																
1	2,235	31.7	2,969	42.0	1,430	20.3	297	4.2	114	1.6	9	0.1	7	0.1	7,061	100.0
2-3	330	6.3	1,836	35.0	2,026	38.6	718	13.6	306	5.8	27	0.5	8	0.2	5,251	100.0
4+	63	1.6	290	7.3	1,017	25.6	1,181	29.8	1,097	27.6	264	6.7	55	1.4	3,967	100.0
Total	2,628		5,095		4,473		2,196		1,517		300		70		16,279	100.0
Parity																
0	2,238	30.0	3,100	41.6	1,596	21.4	350	4.7	148	2.0	17	0.2	8	0.1	7,457	100.0
1-3	351	5.6	1,868	29.7	2,402	38.2	1,096	17.5	503	8.0	44	0.7	16	0.3	6,280	100.0
4+	39	1.5	127	5.0	475	18.7	750	29.5	866	34.1	239	9.4	46	1.8	2,542	100.0
Total	2,628		5,095		4473		2196		1,517		300		70		16,279	100.0

Source: Adama Hospital Records.

3.2.3. Residence

Another predictor variable that significantly affects maternal mortality is residence. Geographic factors can be barriers to maternity care. These barriers include not only distance to health facilities in miles and time but also condition of the road, nature of the terrain, availability of transport, and other factors hindering women's arrival to hospitals promptly to receive needed care.

Most women in Ethiopia do not have health facilities where proper antenatal, post-natal, and life-saving obstetric services are provided within their immediate neighborhood. Thus, when complications arise, they have to travel a long distance before they can get to a health facility. Due to the scarcity of transportation, people

living away form the hospitals have to trek long distance to reach a health care facility. The patient's condition can of course deteriorate with increasing delays in reaching a treatment facility, thereby raising the risk of maternal death.

Among the 16,279 women who were admitted for maternal cases in Adama hospital during the study period, 4,264 came from areas outside of Adama town, which constitutes almost 26 percent of the total study population. There were women from the surrounding rural areas, as well as the neighboring zone and even, regions. However, majorities (74 percent) of them were from Adama town where the hospital is located.

From Table 3.5, it is clear that, regardless of their age, gravidity or parity, women admitted to Adama hospital for maternal cases were predominantly residents of Adama town. The proportion of women attending the hospital from outside Adama town is however substantial. In fact, the proportion raises significantly among the high-risk groups of women, that is, those aged 35 and above, and those of high gravidity and parity.

This probably could be due to improved services in the hospital, or progressive improvement in service utilization in the hospital or a combination of these factors.

CHAPTER FOUR

CORRELATES OF MATERNAL MORTALITY

4.1. Bivariate Analysis of the Effect of Demographic Factors and Residence on Maternal Mortality

Evidence abound in the literature that the demographic characteristics of a woman that is, her age, gravidity and parity are important predictors of maternal mortality. The results of the bivariate analysis of the association of these variables with maternal mortality are presented in Table 4.1.

As can be observed from the table, the proportion of maternal deaths among women under study was lowest among those aged 20-34, intermediate among the teenagers and highest among those aged 35 years and above. During the inference period (1993-2000), 1.9 percent of women aged 20-34, admitted for maternal cases in Adama hospital died, 2.0 percent of those aged 15-19 died, while 3.8 percent of the older women (35 and over) died. Overall, 2.1 percent of the women died during the period. The chi-square test indicates that there exists statistically significant association between age and maternal mortality ($p<0.01$).

There is also a statistically significant association between gravidity and maternal mortality ($p<0.01$). Higher incidence of maternal death was observed among women of gravidity 4 and over, than the other gravidity groups. From the total of 3,964 such women, 3.8 percent of them died, during the reference period, whereas only 1.7

percent of women with gravidity 1 have died. Parity also showed a statistically significant association with maternal mortality ($p<0.01$). The proportion of women who died of maternal cases among the three parity groups was1.6 percent for women of parity zero, 1.8 percent for women of parity 1-3 and 4.2 percent among higher parity women. These findings are similar to findings in other studies, which show, higher maternal mortality among women who experienced many pregnancies and childbirth.

From the 16,279 registered admissions in the hospital over the study period, 74 percent were from Adama town where the hospital is located and only 26 percent were from areas outside Adama town. However, among mothers who came from somewhere else outside Adama town, as large as 6.4 percent died which by far is greater than the percentage (0.5) that died among those living within Adama town. This clearly suggests that availability of facility within the neighborhood where women can have prompt and easy access to proper antenatal, postnatal, and life-saving obstetric services can significantly reduce maternal mortality. It is not therefore surprising that residence shows a statistically significant association with maternal mortality.

Table 4.1 Maternal Mortality among Women Admitted for Maternal Cases in Adama Hospital by some Demographic Variables, and Residence, 1993-2000

Variable	Number of women	Percent		Total	
		Women who Survived	Women who Died		
Age					
15-19	2,628	98	2.0	100.0	$X^2 = 29.12$
20-34	11,764	98.1	1.9	100.0	Df=2
35+	1,887	96.2	3.8	100.0	P<0.01
Total	16,279	97.9	2.1	100.0	
Gravidity					
1	7,061	98.3	1.7	100.0	$X^2 = 73.90$
2-3	5,251	98.6	1.4	100.0	Df= 2
4+	3,967	96.2	3.8	100.0	P<0.01
Total	16,279	97.9	2.1	100.0	
Parity					
0	7,457	98.4	1.6	100.0	$X^2 = 68.75$
1-3	6,280	98.2	1.8	100.0	Df = 2
4+	2,542	95.8	4.2	100.0	P<0.01
Total	16,279	97.9	2.1	100.0	
Residence					
Within Adama Town	12,015	99.5	0.5	100.0	$X^2 = 534.18$
Outside Adama Town	4,264	93.6	6.4	100.0	Df= 1
Total	16,279	97.9	2.1	100.0	P= <0.01

Source: Adama Hospital Records

Note: 1. Df = degrees of freedom

1. X^2 = Chi-square
2. P = Level of significance

4.2. Bivariate Analysis of the Effect of Pathogenic Factors on Maternal Mortality

An examination of the pathogenic factors as shown in Table 4.2. revealed that 6.2 percent of women who had at least one of the direct causes of maternal death (hemorrhage, infection, hypertensive disorder, obstructed labour, unsafe abortion and some other direct causes) died. This compares with only 0.4 percent of deaths among those who did not experience any direct cause of maternal death. Indirect causes too are found to be significantly associated with maternal mortality. Among women who had at least one of the indirect causes of maternal mortality, 15.0 percent died, which also is by far higher than the percentage dead (1.8) among their counterparts who did not experience any indirect cause of maternal mortality. Overall, direct causes account for 87.1 percent of all maternal deaths recorded in Adama hospital during the reference period. This compares with the finding cited earlier that 80 percent of all maternal deaths in developing countries, are due to direct causes (WHO, 1999:5)

Table 4.2. Maternal Mortality by Direct and Indirect Pathogenic causes among Women admitted in Adama Hospital for Maternal cases, 1993-2000.

Variable	Women Survived		Women Died		
	Number	Percent	Number	Percent	
Direct Causes					
Yes = 1	4,521	93.8	297	6.2	x^2= 552.65
No = 0	11,417	99.6	44	0.4	Df= 1, P< 0.01
Indirect Causes					
Observed	352	85.0	62	15.0	x^2 =343.69
Not observed	15,586	98.2	279	1.8	Df= 1, P< 0.01

Source: Adama hospital Records.

As is clearly seen from Table 4.2 above, the direct and indirect pathogenic factors are highly associated with maternal mortality. However, the results conceal the differential association of the individual direct and indirect factors. It is therefore necessary to examine the extent to which each specific direct and indirect pathogenic factor is associated with maternal mortality.

Table 4.3 examines the bivariate analysis of the major specific direct and indirect pathogenic causes of maternal mortality. Among women who suffered from severe bleeding (hemorrhage), 23.1 percent died. Of women who had pregnancy and childbirth related infection, 17 percent died. Another important correlate of maternal mortality is anemia. Out of 250 women who were diagnosed to have anemia, 19.2 percent died. Among 245 women who had hypertensive disorder, 14.7 percent died. There were 756 women who experienced obstructed labour, among whom 8.1 percent died. About 14.5 percent of women who had malaria died. The least incidence of death was registered among women who experienced abortion (1.7

percent). Among the total of 341 recorded maternal deaths over the study period, 4.4 percent of them were found to be due to other direct causes such as ectopic pregnancy and rupture of uterus.

Generally, the bivariate analysis shows that almost all of the direct and the indirect pathogenic causes of maternal death are significantly associated to maternal mortality ($p<0.01$). The only variable observed to be significant at ($p<0.1$) is abortion.

Table 4.3 Percentage Distribution of Women by the Major Pathogenic Causes of Maternal Mortality and their Survival Status, 1993-2000.

Pathogenic causes	*Number Of Women*	*Percent*		*Total*	
		Women Who survived	*Women who died*		
Direct Causes					
Hemorrhage					
Yes	*519*	*76.9*	*23.1*	*100.0*	*X2=1155.70*
No	*15,760*	*98.6*	*1.4*	*100.0*	*Df=1*
					P<0.01
Infection					
Yes	*529*	*83.0*	*17.0*	*100.0*	X^2= 593.36
No	*15,750*	*98.4*	*1.6*	*100.0*	Df= 1
					P<0.01
Hypertenisve disorder					
Yes	*245*	*85.3*	*14.7*	*100.0*	X^2= *192.53*
No	*16,034*	*98.1*	*1.9*	*100.0*	*Df=2*
					P<0.01
Obstructed/Prolonged labour					
Yes	*756*	*91.9*	*8.1*	*100.0*	X^2=*137.97*
No	*15,523*	*98.2*	*1.8*	*100.0*	*Df=1*
					P<0.01
Unsafe abortion					
Yes	*3,091*	*98.3*	*1.7*	*100.0*	X^2=*3.16*
No	*13,188*	*97.8*	*2.2*	*100.0*	*Df= 1*
					P<0.1
Other direct causes					
Yes	*452*	*95.6*	*4.4*	*100*	X^2= *12.31*
No	*15,827*	*98.0*	*2.0*	*100*	*Df = 1,*
					P<0.01
Indirect Causes					
Malaria					
Yes	*255*	*85.5*	*14.5*	*100.0*	X^2=*194.70*
No	*16,024*	*98.1*	*1.9*	*100.0*	*Df=1*
					P<0.01
Anemia					
Yes	*250*	*80.8*	*19.2*	*100.0*	X^2= *362.23*
No	*16,029*	*98.2*	*1.8*	*100.0*	*Df=1*
					P<0.01

Source: Adama Hospital Records.

4.3 Multivariate Analysis of Correlates of Maternal Mortality

Having examined the statistical association of variables with maternal mortality, multivariate statistical technique was employed to determine the relative importance of each of these factors controlling for the effect of other variables.

Since the dependent variable is dichotomous (either a woman has died due to maternal factors or not), the logistic regression technique was preferred as a multivariate method of analysis. In the logistic regression model, the dependent variable was classified as '1', if maternal death occurred and, '0' otherwise. The independent variables were also coded as dummy variables and interpretation is made in comparison with the reference category. In logistic regression, the coefficient ß represents the increase or decrease in the log odds of occurrence of an event (maternal mortality in this study) associated with a unit change in the independent variable controlling for the possible confounding effects of all the other variables.

The term exp. (ß) represents the multiplicative estimates in the odds of an event for a unit change in the independent variable holding the effects of all other predictors constant.

4.3.1 Demographic and Residence Variables and Maternal Mortality

Age, parity, and gravidity are the only available demographic variables, which along with residence have been considered in this hospital-based retrospective study. Among these variables only residence and gravidity emerged as significant predictors of maternal mortality in the multivariate analysis.

As the results in Table 4.4 show, women living outside Adama town and admitted in Adama hospital for maternal cases were 11.63 times at a higher risk of maternal death than their counterparts who live in Adama town, which is consistent with the research hypothesis. Women of gravidity 4 and above are 1.9 times (or by 90 percent) at higher risk of maternal death than their counterparts of gravidity 2-3. The results for women with gravidity 1 were found to show an insignificant excessive risk of maternal mortality compared to women in the reference category.

Although the effect of parity and age seem to be insignificant, they were however, in the expected direction. Higher risk of maternal mortality (3.7 percent) was observed among the older women (35 years and above) compared to the middle aged mothers (20-34 years). Regarding parity, the odds of maternal mortality was raised by a factor of 1.064 (6.4 percent) among women of parity 4+ as compared to those with 2-3.

Table 4.4: Logistic Regression Results of the Effect of Demographic and Residence Variables on Maternal Mortality in Adama Hospital, 1993-2000.

Variable	β	SE(β)	Exp.(β)
Age			
15-19	0.599	.1742	1.1734
20-34 (RC)			1.000
35+	0.0367	.1616	1.0373
Gravidity			
1	0.4295	.3303	1.5364
2-3(RC)			1.0000
4+	0.6425	.1976	1.9012**
Parity			
Nullipara	-0.4700	.3243	.6250
1-3 (RC)			1.000
4+	0.0618	.1920	1.0637
Residence			
-Within Adama			1.000
-OusideAdama	2.4540	.1313	11.6349***
Model chi-square = 492.207			
Number of Cases(N) = 16,279			
Degree of Freedom (DF) = 7			

*** Significant at P<0.01 level, ** Significant at P<0.05 level, * Significant at P<0.1 level.

4.3.2 Pathogenic Factors and Maternal Mortality

Analysis of the effect of pathogenic factors on maternal mortality showed statistically significant results. These pathogenic factors which are classified into direct and indirect causes of maternal mortality, include hemorrhage, infection, hypertensive disorder, obstructed/prolonged labour, unsafe abortion, malaria and anemia. The findings in Table 4.5 show that controlling for the possible effects of the other confounding variables women who experienced any of the direct pathogenic variables, except abortion were at higher risk of maternal death than their counterparts who did not.

Women who experienced excessive bleeding are at higher risk of maternal mortality by a factor of about 25.1 as compared to their counterparts who did not. Infection raised the likelihood of maternal death among women by a factor about 23.6 Women who experienced any of the hypertensive disorders (hypertension, eclampsia, and pre-eclampsia), were about 12.6 times at higher risk of maternal mortality than their counterparts free of them. Obstructed or delayed labour was observed to increase the odds of maternal death by a factor of 8.2.

Contrary to what is expected, experiencing abortion was found to decrease the risk of maternal death by about 47 percent if all variables were controlled. This finding suggests that, probably, women who underwent abortion might have received proper post-abortion care in the hospital against life threatening abortion complications.

Each of the indirect predictors considered in the study also had a strong influence on the risk of maternal mortality. Malaria increased the risk of maternal mortality by a factor of 10, and anemia by a factor of 3.5.

Table 4.5 Logistic Regression Results on the Relative Effect of each of the Major Pathogenic Factors on Maternal Mortality, Adama Hospital, 1993-2000

Variable	β	SE(β)	Exp.(β)
Direct causes			
Hemorrhage			
No (RC)			1.000
Yes	3.2216	0.1512	25.0671***
Infection			
No(RC)			1.000
Yes	3.1618	0.1833	23.6136***
Hypertensive disorder			
No (RC)			1.000
Yes	2.5316	0.2267	12.5737***
Obstructed/prolonged labour			
No(RC)			1.000
Yes	2.1083	0.1728	8.2344***
Abortion			
No(RC)			1.000
Yes	-0.6364	0.1961	0.5292***
Indirect causes			
Malaria			
No (RC)			1.000
Yes	2.3040	0.2411	10.0141***
Anemia			
No(RC)			1.000
Yes	1.2557	0.2204	3.5102***
Model chi-square = 1018.957***			
N = 16,279			
Df = 7			

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

Table 4.6 presents the results of the logistic regression containing all the pathogenic and non-pathogenic variables (Model 3), as well as analyses of the pathogenic (Model 2) and the demographic and residence variables (Model 1), earlier discussed. The results in Model 3 show that residence retained its significant influence ($p<0.01$) on the risk of maternal mortality in the presence of pathogenic variables, although the odds ratio slightly reduced from 11.63 to 11.51. The higher risk of maternal mortality for women living out side Adama town supports the hypothesized relationship between residence and maternal mortality.

The effect of gravidity on the risk of maternal mortality was reduced by the presence of pathogenic factors. For instance, the odds of maternal mortality for women of gravidity 1, was reduced from 1.536 to 1.182 and from 1.901 to 1.495 for women of gravidity 4 and above. These results are consistent with the research hypothesis regarding the relationship between the risk of maternal mortality and gravidity and parity.

The effect of all pathogenic variables remain statistically significant ($p<0.01$). Experiencing abortion still shows a negative association with maternal mortality. The likelihood of maternal mortality associated with each direct pathogenic variable slightly increased in model 3 as a result of the presence of the demographic and residence variables. This suggests that the demographic and residence variables may have influence on the incidence of the direct pathogenic causes of maternal mortality. For the indirect pathogenic causes however, the likelihood of maternal mortality decreases slightly.

Table 4.6. Results of Logistic Regression Models for Non-Pathogenic, Pathogenic and all the Variables considered in the Study

Model 1			Model 2			Model 3		
Variable	SE(B)	Exp.(B)	Variables	SE(B)	Exp.(B	Variables	SE(B)	Exp.(B
Age						***Age***		
15-19	*.1742*	*1.1734*				*15-19*	.2022	1.0154
20-34(RC)		*1.0000*				*20-34(RC)*		1.0000
35+	*.1616*	*1.0373*				*35+*	.1908	1.0648
Gravidity						***Gravidity***		
1	*.3303*	*1.5364*				*1*	.3542	1.1817
2-3(RC)		*1.0000*				*2-3(RC)*		1.0000
4+	*.1976*	*1.9012****				*4+*	.2341	1.4947*
Parity						***Parity***		
0	*.3243*	*0.6250*				*Nulipara(P=0)*	.3483	.8951
1-3(RC)		*1.0000*				*1-3(RC)*		1.0000
4+	*.1920*	*1.0637*				*4+*	.2306	1.3977
Residence						***Residence***		
Within Adama(RC)		*1.0000*				*Within Adama(RC)*		1.0000
Outside Adama	*.1313*	*11.6349****				*Outside Adama*	.1577	11.5052***
			Hemorrhage			***Hemorrhage***		
			No(RC)		*1.0000*	*No(RC)*		1.0000
			Yes	*.1512*	*25.0671****	*Yes*	.1648	26.6974***
			Infection			***Infection***		
			No(RC		*1.0000*	*No(RC*		1.0000
			Yes)	*.1833*	*23.6136****	*Yes)*	.1926	25.4544***
			H.disorder			***H.disorder***		
			No(RC)		*1.0000*	*No(RC)*		1.0000
			Yes	*.2267*	*12.5737****	*Yes*	.2372	13.9586***
			Obs./Pro.Ibr			***Obs./Pro.Ibr***		
			No(RC)		*1.0000*	*No(RC)*		1.0000
			Yes	*.1728*	*8.2344****	*Yes*	.1820	8.2305***
			Abortion			***Abortion***		
			No(RC)		*1.0000*	*No(RC)*		1.0000
			Yes	*.1961*	*.5292****	*Yes*	.2054	0.5549***
			Malaria			***Malaria***		
			No(RC)		*1.0000*	*No(RC)*		1.0000
			Yes	*.2411*	*10.0141****	*Yes*	.2544	8.1413***
			Anemia			***Anemia***		
			No(RC)		*1.0000*	*No(RC)*		1.0000
			Yes	*.2204*	*3.5102****	*Yes*	.2393	3.1544***
Modelchi-square= 492.207 N = 16,279 Df = 7			***Modelchi-square= 1018.95 N = 16,279 Df = 7***			***Modelchi-square= 1392.272 N = 16,279 Df = 14***		

*** Significant at P<0.01 level, **, Significant at P<0.05, *Significant at P<0.1

CHAPTER FIVE

SUMMARY AND RECOMMENDATIONS

5.1. Summary

Maternal mortality is not only a health problem but it also is an indicator of the performance of a country in meeting overall socio-economic development objectives. Furthermore, it is a reflection of the neglect of the needs and rights of women particularly in the developing world. Hence, studies on maternal mortality are of great importance in proposing policy actions and development activities through which the tragedy of maternal death can be reduced.

The purpose of this retrospective hospital-based study was therefore, to identify some socio-demographic and pathogenic correlates of maternal mortality and to examine the extent of their effect with special reference to women admitted for maternal cases in Adama Hospital during the reference period (1993-2000).

To meet these objectives a total of 16,279 women who have been admitted in the hospital because of maternal cases over the last seven years were considered.

The available demographic variables age, parity, and gravidity along with residence all show statistically significant association with the dependent variable in the bivariate analysis.

Examination of the demographic variables affecting maternal mortality revealed that among the three different age groups considered, higher proportion of women died in the age groups 35 years and over, and in the age group 15-19 compared to

women aged 20-34 during the reference period. High parity and gravidity were observed to increase the incidence of maternal mortality. The data also showed that while 0.5 percent of women admitted in the hospital from Adama town died, a high as 6.4 percent of women admitted in the hospital who came outside Adama town die.

Analysis made on the pathogenic factors confirmed that they are highly and positively associated with maternal mortality. Among women who experienced at least one direct cause of maternal death, 6.2 percent died while 15.0 percent of those who experienced at least one of the indirect causes of maternal mortality died. Overall, 87.1 percent of all maternal deaths that occurred in Adama hospital during the study period were due to direct causes, a finding about similar to that reported by WHO (1999) for developing countries.

The principal method of analysis employed in this study was the logistic regression technique. The analysis in the general model (model 3) showed that among the demographic variables gravidity had significant influence on maternal mortality ($p< 0.1$). It increased the risk of maternal mortality by 49.5 percent among women who experienced 4 or more pregnancies compared to those who experienced 2-3. Residence highly influenced the risk of maternal mortality ($p<0.01$). Controlling for the effect of all other variables, women living outside Adama town were 11.5 times at higher risk of maternal death compared to their counterparts living in Adama town. This could be due to the fact that women living far away from the health facility lack proper ante-natal, post-natal, and life saving obstetric care. Moreover when complications arise, such women might not get immediate treatment as they are far from the hospitals. This increases the risk of maternal mortality.

In the multivariate analysis both the direct as well as indirect causes of maternal mortality were examined. These factors, except abortion had a strong and positive influence on maternal mortality.

The finding lists more significant demographic, residence and pathogenic predictors in order of their relative importance in raising the risk of maternal mortality as: Hemorrhage, infection, hypertensive disorder, residence, obstructed/prolonged labour, malaria, anemia, and gravidity

Unexpected result obtained is the less significance ($p<0.1$) and negative influence of experiencing abortion on maternal mortality ($\beta= -0.589$ and $\exp.(\beta)= 0.5549$) suggesting that it reduces the risk of maternal death by about 44.6 percent.

5.2. Recommendations

Given the above findings of analyses the following recommendations are made:

1. In rural areas where health facilities are not available, traditional birth attendants should be trained so that they can help provide care for pregnant women and be able to easily identify complications for early referral. They must also apply the "three cleans":- Clean hands, Clean surface for delivery, and Clean cord care to avoid the risk of death due to infection.
2. As lives of mothers with most of the direct obstetric causes are saved only by prompt intervention, strengthening the screening of high-risk mothers at clinic or health center level for early referral to enable mothers receive proper and early obstetric care before complications arise or get serious should be developed.

3. Obstetric and gynecological services should be strengthened to enable women of high-risk pregnancy receive the necessary care at the place of residence.

4. The capacity of health centers to provide obstetric service should be enhanced by the provision of skilled health workers and the necessary facilities.

5. The provision and supply of family planning, antenatal, delivery and postpartum services should be expanded particularly for women of remote areas.

6. As the predominant cause of maternal mortality found in this study is excessive bleeding (hemorrhage), blood transfusion services should be available in hospitals to save lives of a number of women facing this problem.

7. In hospitals and other health institutions, the economic, social, demographic, health services utilization, characteristics and health conditions of women attending these institutions should be recorded clearly, accurately and completely to enhance the quality of hospital records for research purposes.

8. Community based-studies on correlates of maternal mortality are also recommended to obtain more representative findings for the purpose of policy and interventions towards reduction of maternal mortality in the country.

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DECLARATION

I, the undersigned declare that this thesis is my original work, has not been presented for a degree in any other university and that all sources of materials used for the thesis have been duly acknowledged.

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