CHAPTER 2

Emergency Obstetric Care: An important measure for Reducing Maternal Mortality

2.1 INTRODUCTION

Various studies described in this essay point to a fact that providing access to emergency obstetric care (EmOC) is an important strategy for preventing maternal deaths in developing countries. From clinical literature 75% of maternal deaths result from hemorrhage, obstructed labor, infection, toxemia and unsafe abortion (WHO,1986). In this same literature it has been stated that a majority of these deaths could have been prevented with timely medical treatment. The increased interest in EmOC is a response to the realization that while community based strategies will be needed to reduce maternal deaths in many areas they will do little good if there are no adequate medical facilities accessible to the population. In this essay, first of all many possible and so far popular methods to reduce maternal mortality have been discussed. Study data which show effectiveness of each approaches have been presented . However, these various approaches are related with each other. In order to have a clear picture, an **analytical framework** has been used that includes all of the major factors that affect maternal mortality (Maine,1993). Similarly the roles of the health

system and the community has been described using **Three Delays Model** (Thaddeus and Maine, 1994). This model concentrates on the time interval from the time that a woman can be recognized as having a complications, and the time when she gets medical care for that complication.

After identifying the most effective measure to prevent maternal deaths in a developing country like Nepal, the second major problem is in which level of health system the implementation program should be focused. From situation analysis carried out in Morang district of Koshi zone in Nepal, the Primary Health Center (PHC) should be the strata of health system in which EmOC should be implemented.

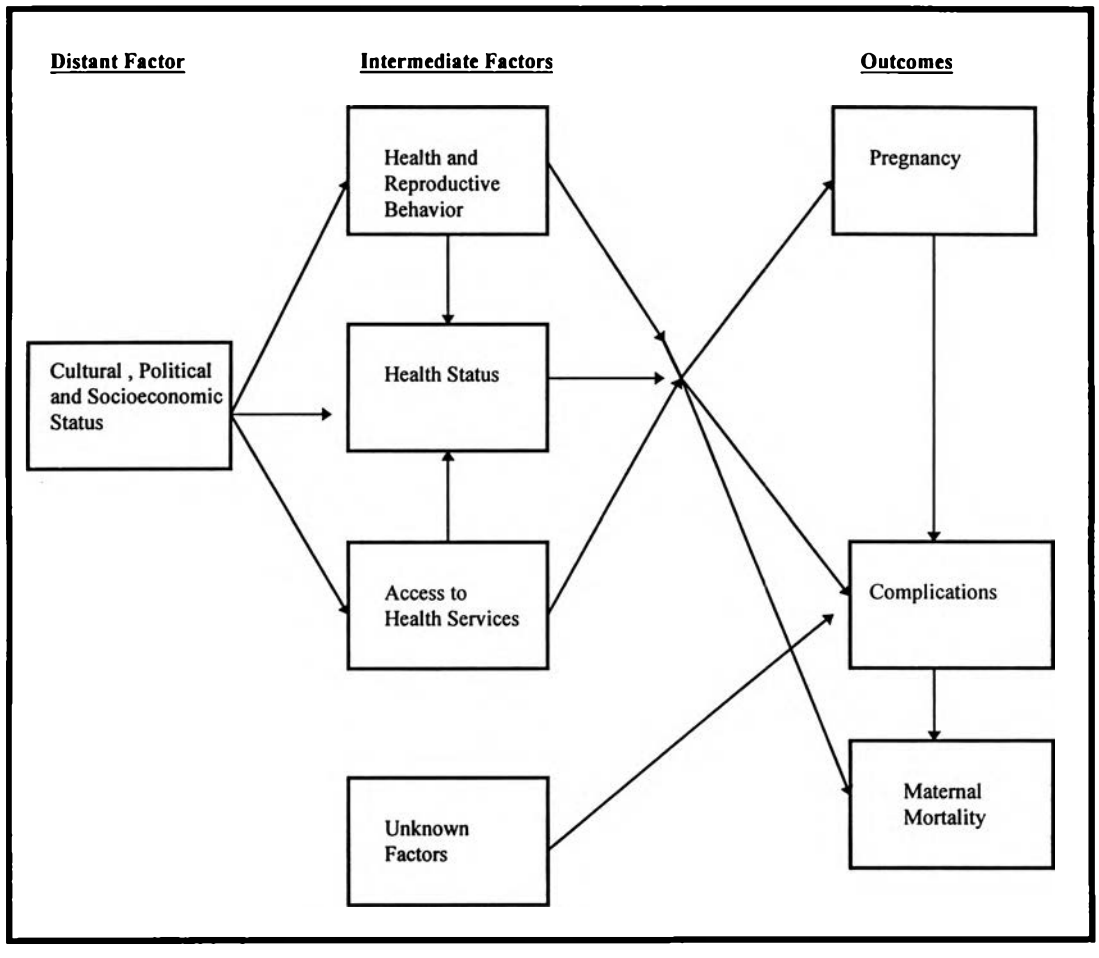
2.2 THE ANALYTICAL FRAMEWORK

With maternal mortality , as with most health problems, the causes can be viewed either narrowly or broadly. A narrow view would be to concentrate only on the medical diagnoses. A broader view would take into account the social, cultural and economic factors that contribute to maternal deaths.

Figure 2.1 depicts the major determinants of maternal mortality. Many of its components can be further subdivided. For example, socioeconomic status comprises not only income but education, access to food, the status of women and other factors as well. In addition, there are many relationships among factors that are not shown in

the figure. For instance, unknown forces influence all the components of this model. Only the relationships most important to this thesis are shown here.

Figure 2.1: The analytical framework of maternal mortality.



(Source: Safe Motherhood Programs; Options and Issues; Center for Population and Family Health, School of Public Health , Columbia University, New York,1993)

One of the benefits of this model is that it compels us to specify the chain of events by which a program might reduce mortality. Consider, for example, a proposal

to reduce maternal deaths by improving socioeconomic status (SES). First, SES must be shown to have an effect on at least one of the intermediate factors: health and reproductive behavior; health status; or access to health services. Furthermore, the chain of effects must then be extended to one or more of the three outcomes in the model: pregnancy; development of complications; death or disability. Finally, these three outcomes are sequential, e.g., one can't die a maternal death without being pregnant.

This framework will help to clarify whether it will be more effective to address the immediate causes of maternal mortality or the root causes. This model depicts that any improvement in more distant factors must operate through closer factors. When thinking about a particular activity to prevent maternal deaths, there are few questions:

- Will it decrease the incidence of pregnancy?
- Will it decrease the incidence of complications among pregnant women?
- Will it reduce the outcome of obstetric complications?

Unless the answer to one of these three questions is "yes", then the proposed activity cannot reduce maternal deaths. The components of the model are discussed briefly below.

2.2.1. Outcomes

a) Pregnancy

By definition, pregnancy is necessary precondition for maternal death. Thus, anything that reduces fertility will (all other things being equal) reduce maternal deaths in the population.

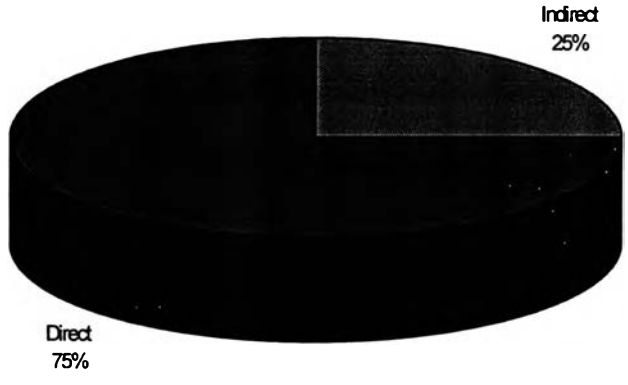
b) Obstetric Complications

A *direct obstetric death* is one due to complications of pregnancy, delivery or the postpartum period, including abortion complications. An *indirect obstetric death* is one due to existing medical conditions that are made worse by the pregnancy or delivery.

On average, one quarter of maternal deaths in developing countries are classified as indirect obstetric deaths, as Figure 2.2 shows (WHO,1986). These are often due to malaria, hepatitis, anemia or rheumatic heart disease. Since three-quarters of maternal deaths in developing countries are due to direct obstetric causes, such deaths are the prime focus of this thesis.

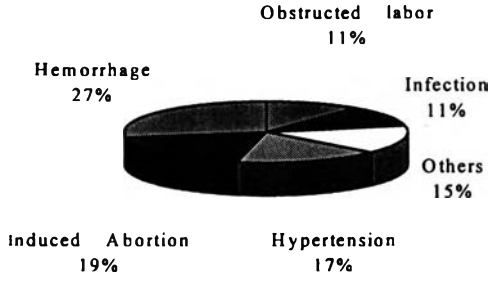
The most important direct obstetric causes in developing countries are hemorrhage, complications of illicit induced abortion, pregnancy- induced hypertension, infection and obstructed labor (including ruptured uterus) as shown in Fig 2.3 (Maine et al. 1987).

Figure 2.2: Direct and indirect obstretric deaths in developing countries



(Source: World Health Organization. Prevention of Maternal Mortality: Report of a World Health Organization Interregional Meeting, November 11-15, 1985. Geneva, 1986)

Figure 2.3: Medical Causes of direct obstetric deaths in developing countries



(Source: Maine et al. "Prevention of Maternal Deaths in Developing Countries:

2.2.2. Intermediate Factors

The framework in figure 2.1 shows four categories of intermediate factors: health and reproductive behavior, health status, access to health services and unknown factors. The first three of these are affected by socioeconomic status. Health status is influenced by behavior and access to services (Maine,1993).

a) Health behavior

Health and reproductive behavior affect maternal mortality through health status, pregnancy and complications. The things that people do and don't do for their health are influenced by many forces, including various aspects of socioeconomic status. What actions are taken when women develop obvious obstetric complications? For example, if women with prolonged labor stay home because they are afraid of the hospital or are kept at home because there are only male doctors at the local hospital, their chances of dying increase.

b) Reproductive Behavior

The relationships between maternal mortality and certain characteristics of reproductive behavior are mentioned in the literature (Maine,1993).

- Age: The age of a woman when she gives birth affects her chances of dying. It is probable that both biological and social factors contribute to this

phenomenon. For example, the higher rates often found among very young women in developing countries may be due to the fact that their pelvises are not yet mature. Older women have various health problems such as hypertension and diabetes and these cause obstetric complications. An example of the effect of the social factors is that young unmarried women are especially likely to resort to illegal abortion when they become pregnant.

In Nepal the rate of abnormal delivery (such as: cesarean section, forceps and vacuum) in adolescent pregnant women was 21.06% and in other group was 13.57% (Malla, 1996). It is seen that about 17.64% of admitted population to hospital are in the age group 15-19 years, which constitutes about 25% of maternal death and it is worse when it comes to the women of 35 years or above. There is about 4 times more death in this group (4.99% compared to 16.66%) (Malla, 1992).

- Pregnancy order: Similar relationship exists between maternal mortality and the order of pregnancy. Women having their first pregnancy are generally more likely to die than are women having their second or third, and then the risk rises again. Specially with young and elderly primipara the risk are higher.
- Desirability of pregnancy: Having an unwanted pregnancy can endanger a woman's life several ways. She may seek an illicit abortion. She may also not like to get health care. In Addis Ababa, Ethiopia, women who died from pregnancy-related causes were more likely to have had an unwanted pregnancy than were women who gave birth and survived (Kwast & Liff, 1988).

c) Health Status

Health status is influenced by distant factors and by other intermediate factors, that is, behavior and health care. For example, anemia can be the result of lack of money to buy food (SES) or of poor eating habits (Health Behavior). Anemia can be corrected by access to and use of adequate Health Services. Health Status may affect maternal mortality by influencing the likelihood that a woman will develop complications and by influencing the likelihood that a woman with complication will survive.

Women's health status in Nepal is influenced by the cultural values and beliefs that a girl has to get married and leave her parents home. Thus, it is believed that a girl is not the property of the parents but others property. Due to this reason, from the time a girl is born she is neglected, kept deprived of adequate nutrition and education. Always the male child is given the priority since he is the one who is going to keep the name of the father. As the girl grows because of poor nutrition she becomes anemic, her bony physical growth is hampered thus later at the time of pregnancy and delivery she has problems such as obstructed labour, anemia in pregnancy and cannot withstand even minimum amount of bloodloss leading to high maternal mortality or disability.

d) Access to Health Services

The medical technologies to prevent almost all deaths from common obstetric complications have been available for decades: blood transfusion, antibiotics and other drugs, cesarean section, contraceptives and safe abortion procedures. Consequently, in developed countries, most deaths from such common complications as hemorrhage and infection are prevented. Therefore, in developed countries the major causes of maternal death include embolism & ectopic pregnancy, which are more difficult to treat (Maine, 1993).

Access to health services implies that not only the facilities exists, but also that people have the information they need to use them properly, that the facilities can be reached by the people who need them, that the cost of care is reasonable, that the supplies and equipment are adequate and that the services are provided in a manner acceptable to patients and families (Thaddeus & Maine, 1994). To prevent most maternal deaths is not the invention of new and sophisticated medical technology but better access to services and availability of existing technology.

Access to Information: If women are to make effective use of the medical resources available, they need to know when to seek help. This knowledge is often lacking in developing countries. And especially in Nepal where women literacy rate is very low. In rural Senegal, some important indications of obstetric problems were not recognized as danger signals. For example some women there reported that fever, dizziness and pallor are part of a normal pregnancy (Maine, 1993).

Financial Accessibility: Once people realize that a family member is seriously ill, they will take on almost any expense to get the help they consider appropriate (Thaddeus & Maine, 1994). However, the rising costs of medical care in many developing countries place it effectively beyond the reach of many people. The result is additional maternal deaths. In Nepal, patients and families must buy essential supplies (such as drugs, gloves and sutures) before treatment can begin. This is one reason why the waiting time from admission to surgery for obstructed labour has increased in recent years- from 3.5 hours in 1983 to 6.9 hours in 1989 (Lingmei & Hui, 1988).

Physical accessibility: Even if women and their families recognize danger signals during pregnancy and delivery, they may be unable to reach the appropriate medical facility in time to save the woman's life. For example in rural China, 15% of maternal deaths occurred on the way to the hospital (Lingmei & Hui, 1988). Roughly speaking the further from a major hospital and the more difficult terrain the higher maternal mortality.

e) Unknown Factors

A large proportion of obstetric complications are not accounted for by any of the known risk factors. For example, it is not always clear why one patient lives and another dies when their conditions and treatment were similar. But for our purposes,

effect of unknown factors on the development of complications is by far the most relevant, and so only it is shown (Maine, 1993).

2.2.3. Distant Factors

Socioeconomic Status

In most circumstances and for most diseases, mortality is higher among the poor and disadvantaged than among wealthy. Not only is maternal mortality lower in developed than in developing countries, but within countries it usually reflects class differences. The same is generally true of maternal mortality. People have posited various ways in which components of SES may influence maternal mortality rates. SES affects a woman's chances of obstetric death, by working through intermediate factors.

Formal education affects health behavior of women, which in turn affects their health status. Nutrition (e.g. better access to food) directly affects the health status of women (e.g. their blood count and the size of their pelvis) before and during pregnancy.

The health status of a woman affects the likelihood that a complication will develop during pregnancy, as well as the outcome among women who do develop complications.

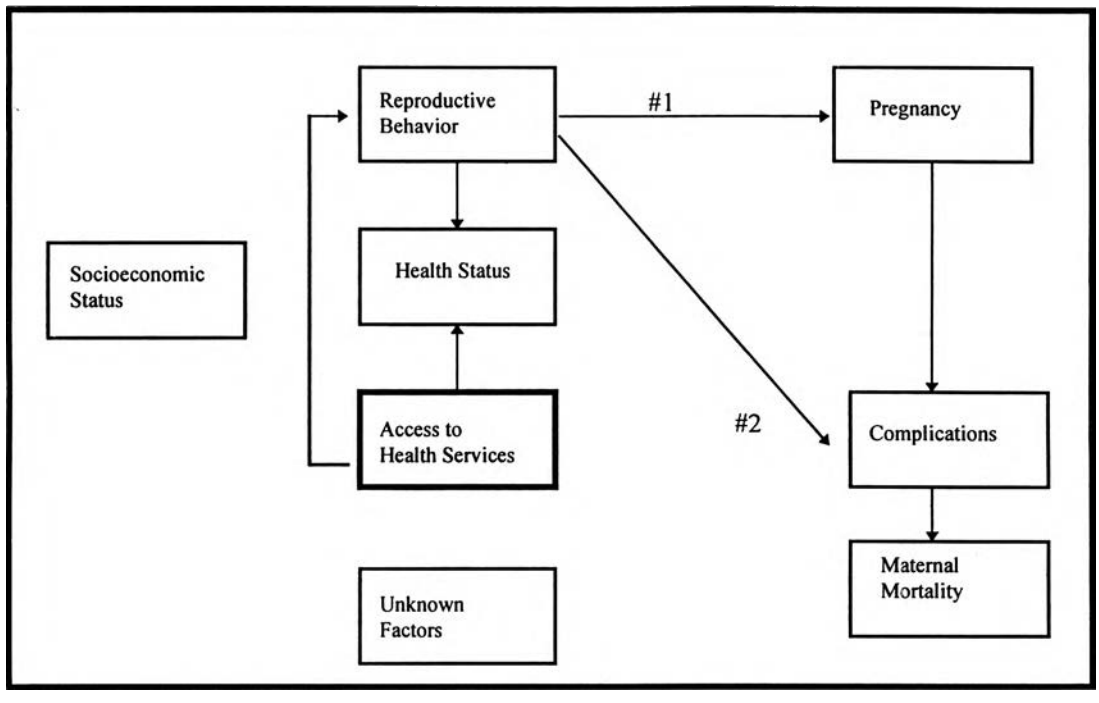
2.3. APPROACHES TO REDUCE MATERNAL MORTALITY

In discussions of how to reduce maternal mortality, a variety of activities have been proposed. Some of the program options are as follows:

2.3.1. Family planning has a major role to play: A woman is not at risk of maternal death unless she becomes pregnant. In addition, family planning has a variety of other benefits for the health and well-being of women and their families (Maine et al., 1996).

Figure 2.4 shows how family planning may reduce maternal mortality. First of all, family planning programs are designed to increase access to and use of health services—in this case, contraceptive information and supplies. This increased access is then intended to facilitate changes in reproductive behavior. The changes in reproductive behavior may then reduce maternal mortality via two pathway: (1) by reducing the number of pregnancies and thus reducing women's exposure to the risk of maternal mortality; and (2) by reducing the proportion of pregnancies that are high risk and, consequently, the number that result in obstetric complications.

Fig 2.4: Impact of family planning program

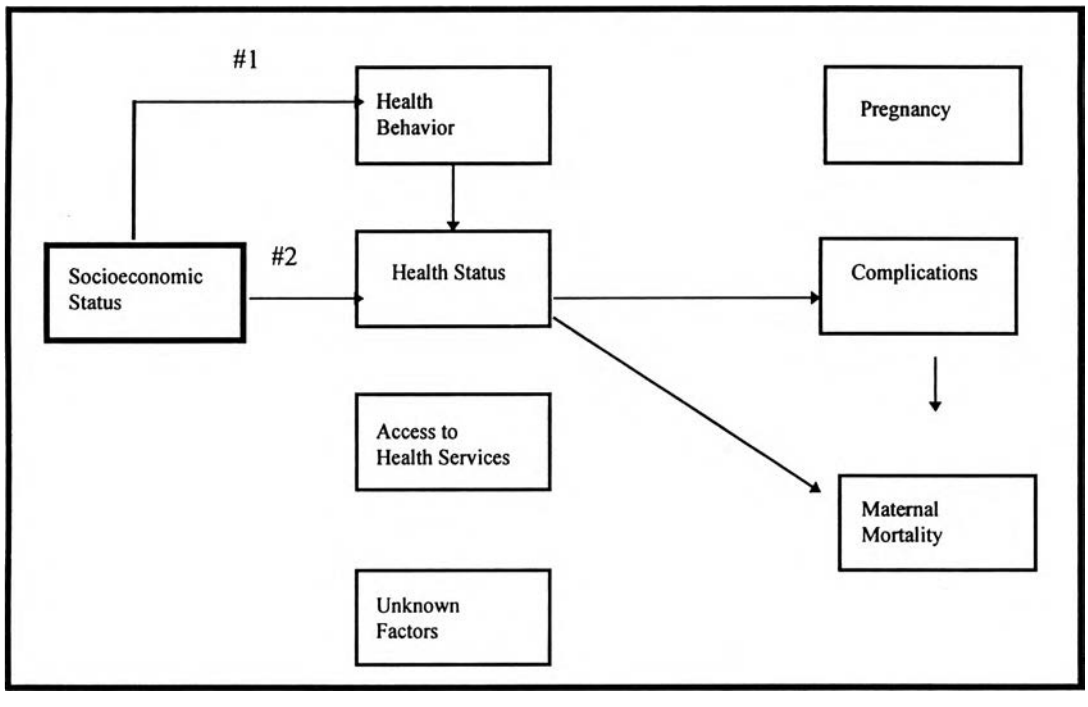


Family planning does not have an effect on the mortality risks associated with pregnancy and child bearing. However, researchers found that the family planning program led to a shift in the pattern of childbearing away from one high-risk group (older, high parity women) but towards another subgroup with equivalent or even higher mortality risks (younger, nulliparous women) (Fortney, 1987).

2.3.2. Improved Socioeconomic Status: In the case of maternal mortality, it is often said that improvements in various aspects of socio-economic status, such as nutrition, will greatly reduce maternal deaths. This is not, however , as the literature (Thaddeus & Maine,1994), explains;

In England and Wales, and the United States, infant mortality declined substantially and fairly steadily from the beginning of the 20th century, as living conditions, education and nutrition improved. Maternal mortality however, did not decline until the mid-1930s.

Figure 2.5 Impact of socio-economic status



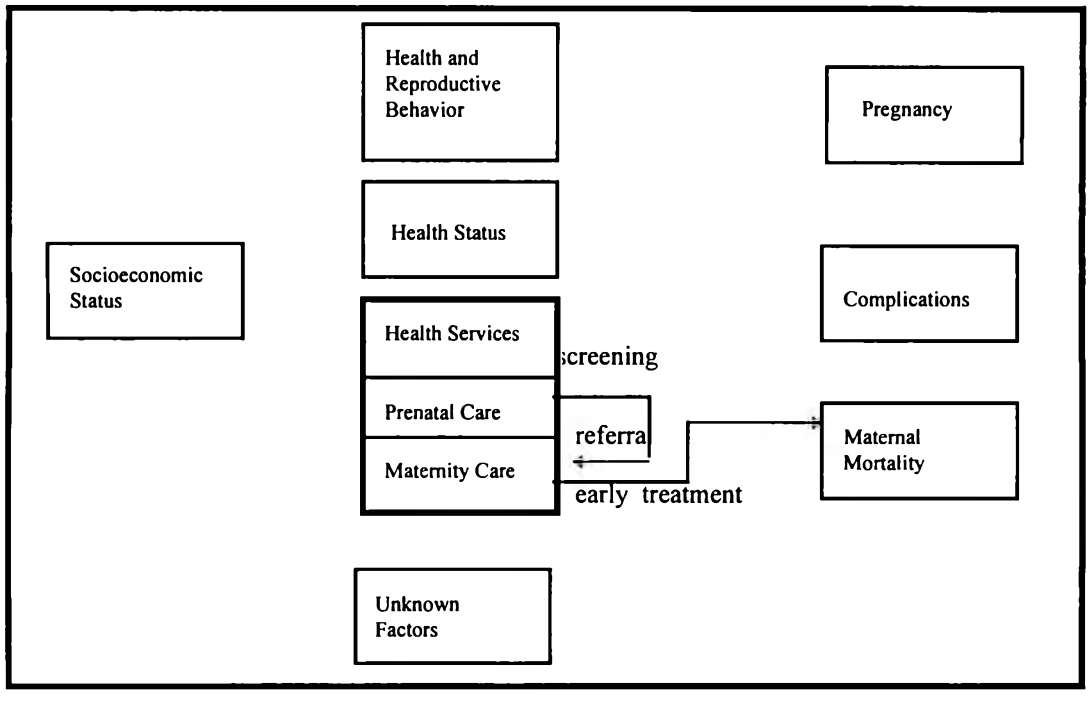
In figure 2.5, socioeconomic status is shown as influencing maternal mortality through two pathways. In pathway 1, formal education affects the health behavior of women, which in turn affects their health status. In pathway 2, nutrition (e.g., better access to food) directly affects the health status of women (e.g. , their blood count and the size of their pelvis) before and during pregnancy. The next step in the chain of events shown is the effect of the intermediate factors. The health status of the woman is shown as affecting the likelihood that a complication will develop

during pregnancy, as well as the outcome among women who do develop complications.

The lack of correlation between changes in education and maternal mortality and infant mortality shows that general socioeconomic development will not necessarily reduce maternal deaths to any substantial degree. In fact large part of the credit goes to the development of effective treatments for obstetric complications, such as antibiotics for infection and blood transfusions for hemorrhage (UNICEF, 1993).

2.3.3. Prenatal care is the intervention that is most often recommended in articles on maternal mortality in developing countries. Actually, prenatal care is a composite of a variety of services, including providing patients with information; treating existing conditions; treating complications; and screening for risk factors.

Figure 2.6 : Impact of prenatal care



There are a number of practical problems with prenatal care programs in developing countries. For example, a substantial proportion of pregnant women in Africa and Asia do not receive prenatal care at present. Moreover, those without prenatal care are those who need it most i.e., poor women in rural areas and urban slums. Even with good coverage and quality of care various components of prenatal care programs has to be taken into consideration in the following manner;

a) Patient education: Providing patients with information is intended to prevent obstetric complications by improving nutrition and hygiene. This itself cannot have an important impact on maternal mortality. However, during patient education sessions women should be told about signs and symptoms of the problems of

pregnancy and delivery. This could help a woman obtain prompt treatment for complications that arises. There is no reason to confine this education to prenatal visits or to pregnant women, since they are often not the ones who make decisions about their own medical care, specially during delivery (Maine, 1993). Thus the education of maternal health, pregnancy and its care should be started even before the woman thinks of being pregnant and not only the woman but the entire community should be educated about the importance of pregnancy and its outcome.

b) Treatment of complications: Most obstetric complications are not identifiable during pregnancy. Postpartum hemorrhage and infection are not predictable. Antepartum hemorrhage may be presaged by minor bleeding, but the condition needs to be treated at a facility equipped for surgery. There have been various attempts to predict obstructed labor but these are not very successful. Pre-eclampsia can often be detected, and bed rest and/or sedative prescribed. But a large proportion of cases of full blown eclampsia occur without warning during or after delivery.

c) Screening for risk factors: By thorough screening all pregnant women who will develop obstetric complications can be identified early in pregnancy. Once these women are identified they can either be treated or referred to an adequate medical facility for delivery. The difference between this and treatment of complications is that it concerns prediction of conditions that have not yet developed. The problem is the poor predictive power of screening. Prenatal screening does not

identify all (or even most) of women who develop complications (Thaddeus & Maine, 1990). The reason for this is that low risk women can develop obstetric complication. It is not known why this is so, hence the "unknown factors" (figure 2.1) box in the model of maternal mortality.

Data of both tables shown below are in conformity with the global findings that all women, even those with 'normal' pregnancies, are at risk of serious obstetric complications and identification of 'at risk' cases has a low predictive value and high proportion of false positivity.

Table 2.1:Type of labor by obstetric history

(Nepal, Koshi district hospital -1992)

Type of Labor	Obstetric History		Total
	High Risk	Normal	
Complicated	104	131	235
Normal	70	433	503
Total	174	564	738

(Source: Research Report on Prevention of maternal mortality in Hospital of Nepal, HMG/WHO,1992, Katmandu)

For comparison, data for Bangladesh is depicted:

Table 2.2: Type of labor by obstetric history

(Bangladesh, 3 districts-1992)

Type of Labor	Obstetric History		Total
	High Risk	Normal	
Complicated	119	185	304
Normal	921	3254	4175
Total	1040	3439	4479

(Source: Emergency Obstetric Care, Interventions for the Reduction of Maternal Mortality, Obstetrical and Gynecological Society of Bangladesh and Unicef, 1993)

The Kasongok Project Team found that the woman who were screened as having bad obstetric history (141 out of 156) during prenatal care had normal labor and those who were screened as having good obstetric history (36 out of 3,458) had abnormal labor.

This is depicted in the table;

Table 2.3 :Type of Labor, by Obstetric History, Kasongok, Zaire, 1971-1975

Type of Labour	Obstetric History		Total
	Bad	Good	
Obstructed	15	36	51
Not Obstructed	141	3,422	3,563
Total	156	3,458	3,614

Relative Risk : (15/ 156)/ (36/ 3,458) = 9.2

Sensitivity: 15/ 51 = 29%

False Positives: 141/ 156 = 90%

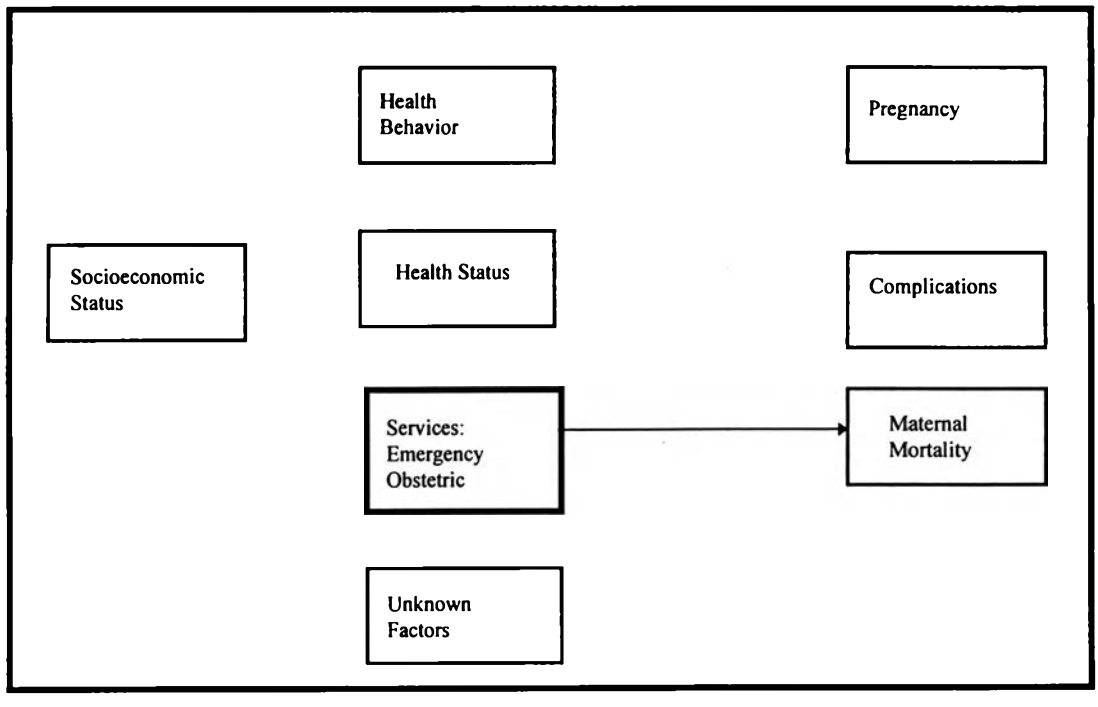
(Source: Kasongo Project Team, 1984, Concept paper on reduction of maternal mortality in Bangladesh during 1995-2000 by Deborah Maine UNICEF Feb. 1993)

2.3.4. Improve Emergency Obstetric Care (EmOC) Services

During the past few years, there has been a growing clarity about which are most efficient ways to prevent maternal deaths. Some complications can be prevented by appropriate management of pregnancy, labor and delivery (e.g., by clean delivery practices). But most life- threatening complications cannot be prevented. Furthermore, they cannot be actually predicted either (Maine, 1993). During pregnancy, delivery or the postpartum period, any woman can suddenly develop a serious problem, at which point prompt, adequate medical care is needed. Therefore, all pregnant women need

access to care for obstetric complications. With timely, adequate medical care, almost all maternal deaths can be averted. And the same services that prevent maternal deaths will also prevent the most serious kinds of maternal morbidity (e.g., fistulae).

Figure 2.7: Impact of EmOC



Now, there is an international agreement about a concept that prompt treatment of serious obstetric complications is the key to reducing maternal mortality in developing countries. There is a general belief among people that improving EmOC in developing countries is not possible-that it is too costly and difficult. They assume that emphasizing the importance of medical services means neglecting community involvement. But Thaddeus & Maine (1994) show that these assumptions are wrong .

At least 15% of pregnant women develop serious obstetric complications, even if they are in good health and receive antenatal care (WHO,1993). The EmOC

services can be provided in health centers and other peripheral facilities and by staff other than doctors (especially by qualified midwives).

The following chart illustrates the roles of various kinds of activities in the prevention of maternal deaths due to the major obstetric complications.

Table 2.4: Roles of various kinds of activities in the prevention of maternal deaths

Cause of death	Influence of Interventions			
	Family Planning	ANC	Trained birth Attendant	Case Management
Hemorrhage		+	+	+++
Induced abortion	++		+	+++
Eclampsia		++	+	+++
Puerperal sepsis		+	++	+++
Obstucted labour		+	+	+++

+ = Advocative ++ = Preventive +++ = Life saving

(SOURCES: Emergency obstetric care: Interventions for the Reduction of Maternal Mortality ; Obstetrical and Gynecological Society of Bangladesh & UNICEF September 1993: page 4)

From the above chart, case management is life saving for all the direct obstetric causes of maternal death.

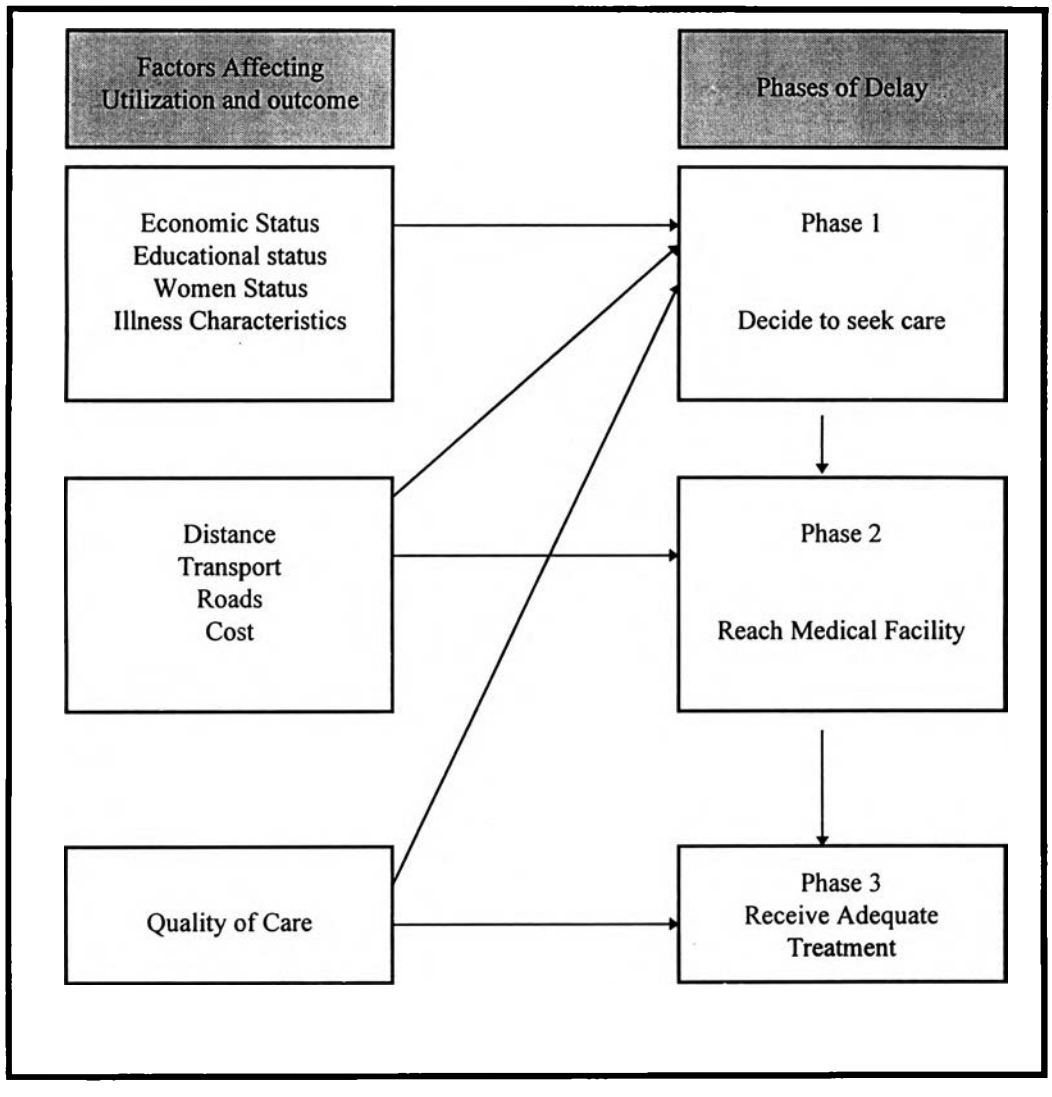
2.4. THE THREE DELAYS MODEL

This framework encompasses both biological factors and social factors that contribute to maternal deaths. Effective program to reduce maternal death must take into consideration the various forces that culminates in maternal deaths (Thaddeus & Maine, 1994).

Women with obstetric complications face a variety of barriers to obtaining care. Some of these barriers are cultural – e.g., the low value placed on women's lives. Some of the barriers are geographic--e.g., long distance and poor roads. Some are economic – e.g., lack of money to pay for transport. Thus, the problem is not solely medical, but community participation is critical to the success of such programs.

The roles of the health system and the community can be easily visualized using simple "3 Delays" model. This model concentrates on the time interval from the time that a woman can be recognized as having complications, and the time when she gets medical care for that complication. If she gets help in time, she will live. If she doesn't, she may well die or be permanently injured.

Figure 2.8: The Three delays Model



(SOURCE; Too far to walk: Maternal mortality in context. Thaddeus & Maine 1994. Social science medicine).

The three delays are as follows;

1. delay in deciding to seek medical care.
2. delay in reaching a facility where care is provided.

3. delay in receiving medical care at the facility.

Programs to prevent deaths among women with complications usually need to address all three delays. The priority, however, should be to make sure that the medical services needed to treat complications are functioning (Delay #3). It is irresponsible to advise people to seek care when the local health facility is not providing care for complications e.g., there are no trained staff or supplies or referral possibilities available.

Improving the functioning of hospitals and health centers does not need to be a hugely expensive undertaking. In most countries there are existing services that can be upgraded with modest input e.g., training in life-saving skills for nurses, midwives and physicians; repair of existing facilities and equipment, or purchase of critical equipment. Even where the government can no longer afford to provide drugs free of cost, delays can be reduced by having supplies on hand that the patients' families can purchase, rather than wasting precious time buying them in the town.

Delay #2 can be addressed both by the health system and by the community. The health system can reduce these delays by improving the capability for treatment of complications in peripheral facilities, such as health centers. Even though some women will need to be transferred to the hospital for definitive treatment, there are numerous life saving procedures that can be carried out by nurses, midwives and other personnel, if they have the appropriate training, supervision and supplies.

The community can reduce delay #2 by mobilizing its resources so that women with complications can be transported as quickly as possible. Depending on the situation, this may mean enlisting the help of transportation's workers, or it may mean organizing groups of villagers to carry women to the nearest road.

Delay #1 can be caused by a variety of factors: lack of recognition of the seriousness of the symptoms: lack of confidence in the medical system: concern about the distance to be traveled or the cost of the services; traditional belief; etc. The reasons for delay in deciding to seek care, and the appropriate remedies, need to be identified at the local level.

Where many women deliver at home, access to effective management of obstetric complications can be improved by ensuring that every woman delivers with the assistance of a person with formally recognized midwifery skills. This person must be able to recognize complications and either manage them or transfer the woman to an appropriate facility.

Until recently, little attention has been paid to what happens when a problem arises during pregnancy, childbirth, or the postpartum period. Even under the best of circumstances- when they have good nutrition, antenatal care, skilled delivery- women develop complications. Unless they have access to prompt and appropriate case management, maternal mortality will remain high.

In the past few years, there has been a global reappraisal of the potential of various program strategies to reduce maternal mortality. Out of this reappraisal has emerged a clearer understanding of the key elements required to achieve this goal. The re-evaluation of solutions to the problem of maternal mortality indicates that there are two important lessons to be learned from experience and existing research. These lessons are that all pregnant women are at risk of serious obstetric complications. Maternal mortality cannot be substantially reduced unless women have access to emergency obstetric care (Maine, 1993).

Prevention of Maternal Mortality Network (1996) discussed ways to solve the problems. Improving transport to emergency care does not necessarily require ambulances. Commercial transport owners and communities can be mobilized to provide affordable emergency transport for women with complications. Once services are available, community education and information activities can enhance utilization. The cost of such activities can be reduced and sustainability promoted by involving Ministry of Health personnel and community groups. In trying to improve communication and referral between health center and the hospitals various commuting facility was tried. But radio system proved to be more efficient, reliable and less expensive.

There is now a general agreement that almost all maternal deaths can be avoided if women have access to emergency obstetric care and that this must form the basis of any effective program to reduce maternal mortality.

2.5. A Cost-Effectiveness Exercise

This cost-effective comparison has been adapted from Maine et al (1993). It uses a hypothetical rural population. This serves only as a basis at which rational of using EmOC at different levels can be established.

In recent years it has become increasingly clear that there are not enough human and financial resources to implement all the health and development programs that one might wish. International donors and governments alike want to know about the relative benefits of program options and about their costs.

To conduct this analysis, a hypothetical rural population of one million is used. The crude birthrate is 46 which means that there would be 46,000 births each year. Their maternal mortality ratio is 800 deaths per 100,000 live births. Therefore, there would be 386 maternal deaths in this population each year, of which 276 (three-quarters) would be direct obstetric deaths.

As in the table direct obstetric deaths would be distributed as follows: Hemorrhage (antepartum and postpartum) =28 percent; infection = 11 percent; hypertension = 17 percent; induced abortion =19 percent; obstructed labor = 11 percent; and tetanus = 2 percent. The remainder would be due to conditions such as ectopic pregnancy and embolism.

Table 2.5: Estimated maternal deaths preventable by various programs, by complication.

Program	Hemorrhage (N=77) %	Infection	Hyper-tension	Abortion	Obstructed labor	Tetanus	Total	Total deaths (N=242)
Prenatal Care	5	5	33	0	0	80	11	26
Family Planning	20	20	20	50	20	20	26	64
Health Centers	30	50	10	30	10	0	25	61
HCs and Urban Hospitals	50	70	60	70	60	50	60	145

(Source: Safe Motherhood Programs; Options and Issues; Center for Population and Family Health, School of Public Health , Columbia University, New York,1993)

Limitation of this Exercise

There are a number of shortcomings in this cost effectiveness analysis that need to be mentioned. The figures do not include the cost of setting up programs, such as training costs. Since start-up expenses are not included, the cost of programs is probably underestimated. On the other hand, only the benefits of the program in preventing maternal deaths are included. This would tend to underestimate benefits,

since the same programs would probably prevent indirect deaths and non obstetric deaths among women as well as neonatal deaths among their offspring.

Prenatal Care for All Woman

Prenatal care avoids 11 percent of deaths. It is estimated that prenatal care costs about $5 per visit, including vitamin supplements and other medicines (Roberton, 1985). In this analysis, all pregnant women are assumed to have an average of two prenatal visits each. The cost of this program for 46,000 deliveries a year would be $460,000.

Family Planning Programs

If 20 percent of pregnancies are prevented through family planning, it is estimated that this will prevent 20 percent of obstetric deaths due to most cause. Preventing a pregnancy through family planning is estimated to cost $ 40 for services and supplies (Gillespie et al.,1983). The program cost for this option is $368,000. This does not include start-up costs.

Ten Health Centers

Each health center serves 100,000 people. Without the ability to transport women for emergency treatment, a health center is estimated to prevent 25 percent of maternal deaths. In this cost-effective study, it is assumed that the buildings, housing and health facilities already exist, which is true in many places. Each of these health

centers would have five nurse-midwives to supervise deliveries and provide obstetric first aid. At least one midwife would be on duty at all times. In a population of 100,000 people there would be 13 deliveries a day. At $300 each per month, the salaries of the five midwives would come to $18,000 per year. Another $7,000 is allotted for supplies and equipment, for a total of $25,000 per health center per year. For 10 health centers the cost of the program would be $250,000.

Ten Health Centers with Transportation to an Urban Hospital

The total deaths prevented is about 60 percent of direct obstetric deaths. The average cost of treating an obstetric emergency in an urban hospital in a developing country is estimated to be $120. Five percent of women (2300) are assumed to require such treatment. Hospital treatment for these women would cost $276,000.

For the transportation add $30,000 per each vehicle, or 150,000 for the 5 vehicles for 10 health centers. These costs, added to the $250,000 for the health centers alone, brings the total cost of program to $526,000.

Cost-Effectiveness comparison

In terms of deaths prevented , the program with 10 health center and urban hospital was most effective preventing 60 percent of deaths. The most expensive is prenatal care, at 17,692, while the least expensive is 10 health centers and transportation to an urban hospital, preventing 60 percent of death.

Figure 2.9: Estimated deaths preventable by various programs

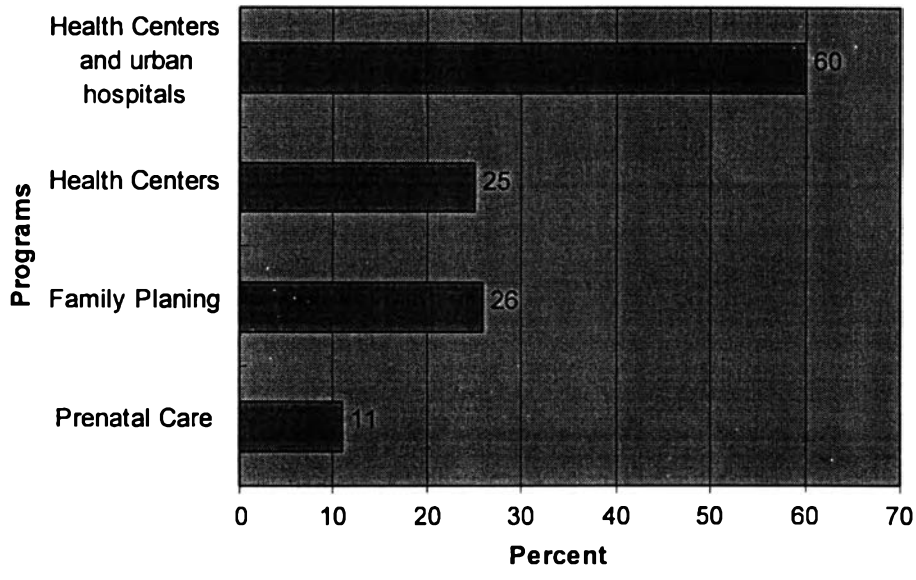
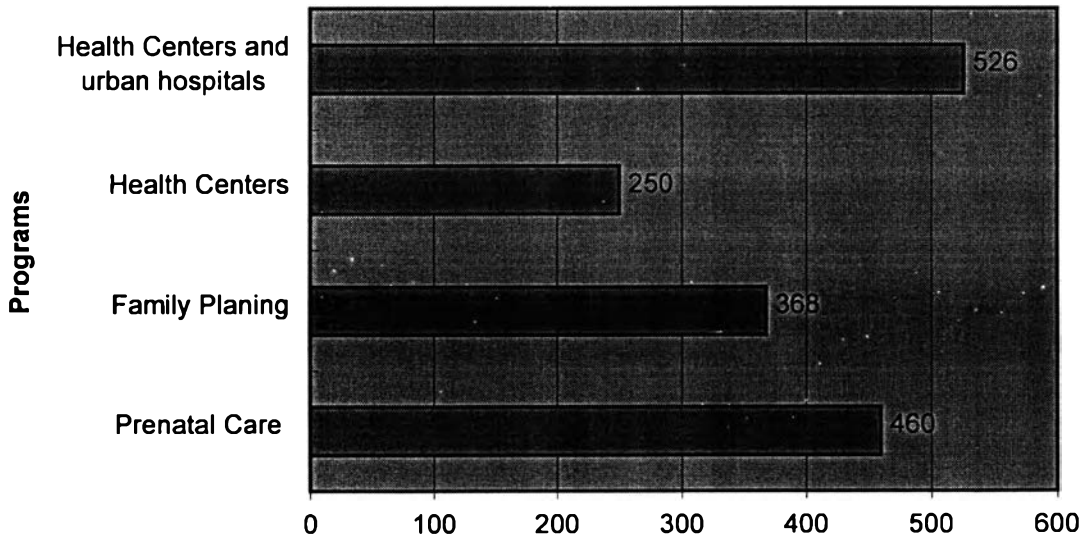
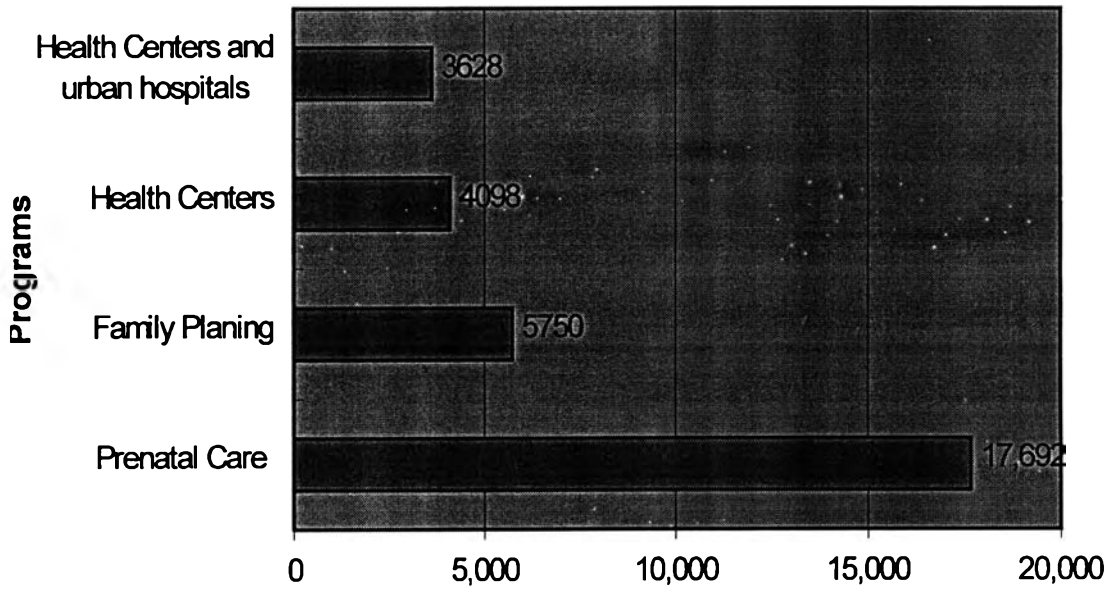


Figure 2.10: Estimated cost of various programs (in $000s).



(Source: Safe Motherhood Programs; Options and Issues; Center for Population and Family Health, School of Public Health , Columbia University, New York,1993)

Figure 2.11 Estimated cost per death prevented, various programs (in $).



(Source: Safe Motherhood Programs; Options and Issues; Center for Population and Family Health, School of Public Health , Columbia University, New York,1993)

The last figure 2.11 shows the cost per death prevented for the various program models. The most expensive is prenatal care, at $17,692 while the least expensive is 10 health centers with transportation for urban hospitals, at $ 3, 628 per death prevented. Second least expensive is the 10 health centers without access to the urban hospital. This analysis shows that of many possible way to reduce maternal mortality cost effective way is to provide basic EmOC at Health Center with transportation facility and provide Comprehensive EmOC at Urban area. Which is

practical for Nepal. In fact cost of transportation can be further minimized if we can provide private transportation with the help of community.

2.6. SITUATION ANALYSIS OF NEPAL

Recently, much attention has been focused on the problem of maternal mortality in developing world. Each year, ninety- eight percent of half- million maternal deaths occur in the third world. The highest number of these deaths occur in Asia. Even within Asia there is a wide variation in maternal mortality rate (MMR) amongst the different countries. At one extreme are countries such as Hong Kong, Thailand and Malaysia with an MMR of 4, 7 and 11 per 100,000 births (Juneja et al., 1994) respectively and at other extreme are countries such as India, Bangladesh and Nepal, with an MMR of 453, 560 and 515 per 100,000 live births respectively. In most of these countries there has been substantial reduction in maternal mortality by EmOC (Juneja et al., 1994).

Maternal mortality is a serious public health concern in Nepal. According to official estimates the current level of maternal mortality is 515 per 100,000 live births (Malla & Pradhan, 1994). This is about 100 times higher than the level of maternal mortality in Northern Europe. Every two hours a mother dies in Nepal leaving 3 to 4 children helpless (Malla, 1992). This expresses the seriousness of the problem. Maternal mortality is an important indicator to assess the health status of a woman. These, quite apart form injuries of various kind to the genito-urinary tract, impair the

woman's physical and social state. When not fatal, these conditions lead to prolonged ill health.

Functioning EmOC services in Nepal are at present only in the Zonal hospitals and few district hospitals. Goal of Reproductive health targets by the year 2001 (9^{th} plan period) is to have functioning EmOC services in 30 district hospitals and to reduce maternal mortality rate by 20 percents (from 515 per 100,000 to 400 per 100,000 live births) (Malla & Pradhan, 1994).

Majority of obstetricians in Nepal i.e. more than 90% are located in the district capitals. By contrast, the proportion of the population living in urban areas is estimated at 11% (Malla, 1992). As economic conditions deteriorate in many areas, medical personnel seek employment in wealthier countries. In the meantime, the number of people needing care continues to grow.

Even when personnel are available, this does not mean that care is adequate. When in- depth studies are conducted, inadequate or erroneous medical treatment is usually found to have contributed to a substantial proportion of maternal deaths in hospitals.

2.6.1 Causes of Maternal Deaths in Nepal

The causes of maternal deaths in Nepal are mainly due to direct obstetric causes which are postpartum hemorrhage, abortion, pregnancy induced hypertension, puerperal sepsis, obstructed labor, other obstetric causes (Malla, 1992).

The Government of Nepal with the assistance of international agencies have initiated activities for the reduction of maternal mortalities by promotion of programs such as antenatal care, clean delivery practices and family planning. However, relatively few actions, have been taken to provide EmOC for woman who develop complications during pregnancy and delivery. Hence the maternal mortality still remains high in comparison to other developing countries.

2.6.2. The health infrastructure of Koshi Zone

The infrastructure of Koshi zone is broadly divided into 1) Zonal hospital 2) District hospital 3) Primary Health Centers 4) Health Post (in some areas only) 5) Community level 5) Family and decision makers level.

In Nepal to date, efforts to address maternal well being have been focused on family planning, antenatal care (TT immunization and identification of high risk pregnancies), TBA training and promotion of safe birth practices. These activities can influence maternal mortality by reducing the number of unwanted pregnancies,

decreasing the incidence of puerperal sepsis through the promotion of "clean birth practices", reducing birth trauma by promoting the services and availability of trained birth attendants.

2.6.3. Identification of the level in which EmOC service can be provided

The World Health Organization addressed this issue in a publication entitled "Essential Obstetric Function at First Referral Level to Reduce Maternal Mortality". The First Referral is defined as "The district or sub-district hospitals or health center to which a women is usually sent when she is in serious difficulty" (Maine, 1993)

Essential obstetric functions (EOC) includes the capability to

- perform cesarean sections;
- administer anesthesia;
- give blood transfusions
- perform vacuum extractions;
- perform manual removal of placenta;
- carry out suction curettage for incomplete abortion;
- insert intrauterine devices and
- perform contraceptive sterilization;

Unfortunately in Nepal these functions can be performed only at the teaching hospitals, central hospitals, zonal hospitals and few district hospitals, to which most

women do not have access. Even if it is not possible for the primary health center to carry out the essential obstetric functions (EOC), there is still much that could be accomplished at this level. Most importantly Health centers could provide basic EmOC. This care could include such measures as starting antibiotics for women with obstructed labor or premature rupture of the membrane; starting a drip of plasma expander and oxytocic drugs for women with hemorrhage; and administering sedatives for women with eclampsia. These relatively simple measures would mean that women would reach the hospital in better condition and thus have improved chances of survival. A health center is also a good point at which to organize transportation to the hospital. In addition 90 percent of Women in Nepal deliver at home and 93% of people live in rural area (HMG/WHO, 1986) and PHC is the closest facility in the community where obstetric emergency can be tackled, stabilized and referred to district hospitals.

It is estimated that first level (i.e. PHC) obstetric care could result in a reduction of 80-85 percent in maternal mortality (Marilyn, 1996). Safe motherhood initiative and Child Survival Revolution emphasize on mortality reduction and have stimulated the shifts in the delivery of health care from tertiary to primary levels (Mbaruku & Begstrom, 1995).

Availability of good quality EmOC services can prevent many deaths once maternal health complications have arisen (Wendy et al., 1996). Maternal mortality cannot be reduced unless women have access to EmOC (Haque and Mostafa, 1993).

Health Center that provides EmOC services can prevent maternal deaths. For some conditions (e.g. some cases of postpartum hemorrhage), these services are sufficient (Maine et. Al, 1996).

2.7. Summary

There exist various activities to reduce maternal mortality such as family planning programs, improvement of socio-economic status, prenatal care and EmOC. From analytical framework it can be established that EmOC is needed for reduction of maternal deaths and disabilities. Many of the complications are due to unknown factors which cannot be identified at the time of pregnancy and have an important impact on maternal mortality. The Three delays model highlights not only making facility available but a more realistic approach should be taken that is the facility should be physically, economically and behaviorally accessible. The cost effective exercises further strengthens rational for using EmOC as an important way for reducing maternal mortality. It establishes that health centers in itself can reduce 25% of maternal mortality; however providing access to urban Hospital that has comprehensive EmOC from health center can reduce maternal mortality up to 60%.