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# **The Design and Evaluation of Maternal Mortality Programs**

Center for Population and Family Health  
School of Public Health  
Columbia University

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The views expressed in this publication are the views of the authors and do not necessarily represent those of the United Nations Development Programme.

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## Table of Contents

	Page
Preface.....	1
1. Introduction.....	4
2. A Strategy for Program Design and Evaluation.....	7
2.1 Which Activities Will Reduce Maternal Deaths? .....	7
2.2 The 3 Delays Model.....	11
2.3 Using Process and Output Indicators .....	13
3. Needs Assessment — What Do You Need to Know? .....	18
3.1 Are Life-saving Services Available?.....	20
3.2 How Many Women Are Using Life-saving Services? .....	22
3.3 How Many Life-saving Procedures Are Performed? .....	24
3.4 What Is the Quality of Life-saving Services? .....	25
3.5 How Should Services Be Improved? .....	26
3.6 How Can Utilization Be Improved?.....	27
3.7 What Will Upgrading/Expanding Services Cost? .....	28
3.8 Data Sources and Instruments.....	29
4. Program Design.....	31
4.1 Designing Interventions .....	33
4.2 The Implementation Plan.....	46
5. Monitoring and Evaluation.....	47
5.1 Deriving Indicators.....	49
5.2 Planning Monitoring and Evaluation Activities.....	54
5.3 Using Results for Program Management.....	55
6. Disseminating Information.....	58
References.....	60
Appendix A .....	67
Appendix B .....	126

## Preface

Women's health has long been a priority area of concern and activity for the United Nations Development Programme (UNDP). In order for gains in women's health to be sustainable, capacity development is key. UNDP is proud to present this manual, *The Design and Evaluation of Maternal Mortality Programs*, as part of its continuing commitment to learning and sharing lessons and experiences for developing human and institutional capacity in developing countries.

This is a technical document with a development aim. In its technical sense, the manual provides guidance and tools for the design and evaluation of maternal mortality programs—it is about what practitioners call "operations research" or "health systems research." But its broader purpose is one of development—to enhance the ability of people and institutions in developing countries to identify key challenges and generate effective responses to them. The manual offers a way of thinking about project design and evaluation, rather than just a set of instructions and forms to do it. In both its form and its function, the manual is about building capacity and ownership. With it, technical cooperation resources can be used to support local development efforts more effectively.

At another level, of course, the manual is about improving the health of women. Women are crucial to the social and economic development of their societies, as members of the work force and the backbone of households. They are the creators of new life, and the caretakers of daily life. Although saving a woman's life has tremendous benefits for her family and her community, it is the horrible and needless deaths of the women themselves that is our call to action. The technology to avert the vast majority of maternal deaths has been known for decades, yet it is still unavailable to large numbers of women in developing countries. Beyond the social and economic benefits, this manual is about saving women's lives *for their own sakes*.

The strategies and instruments presented in the manual were developed for and tested by the Prevention of Maternal Mortality (PMM) Network—a collaboration between Columbia University and multidisciplinary teams in West Africa. Since its inception almost 10 years ago, the activities of the PMM Network have embodied many of the concepts at the forefront of development thinking today. In fact, the experience of the PMM Network represents one of the field's great success stories in capacity development. Given continuing doubts about the effectiveness and sustainability of technical cooperation efforts, a review of the factors contributing to the success of the PMM Network is valuable and instructive.

The PMM Network was comprised of 11 teams carrying out operations research projects on maternal mortality in Ghana, Nigeria and Sierra Leone. A twelfth team from Columbia University in New York, with a Regional Office in Accra, Ghana, provided technical support and coordinated Network activities. Capacity development was always a central objective of the

PMM Network, and the demands of the research or the service activities were never allowed to compromise this commitment. Three principles characterize the approach to development taken by the Network:

**1. Collaboration for capacity development must be based on effective partnerships which acknowledge the contributions of all parties.**

Respectful collaboration has been a hallmark of the PMM Network. In this collaboration, the contributions of the various parties were acknowledged and valued from the beginning. The African teams brought their professional training and experience — obstetricians and midwives, social scientists and community medicine specialists, women and men in the community working together — as well as knowledge of their countries and customs. The Columbia team brought knowledge of the world literature, of operations research, and of participatory program development. African team members with expertise or experience in particular areas were involved as consultants in technical cooperation visits to other teams. Additionally, the funding agency — the Carnegie Corporation of New York — brought financial support in a form that was conducive to collaboration allowing sufficient time and space for program development, implementation and learning. More importantly, Carnegie provided an enabling environment for participation among many actors and so facilitated the development of new skills and approaches.

**2. Ideas and programs must be based in the realities of lived experience.**

At the heart of the approach to development practices applied in the PMM Network is the recognition that sources of learning must incorporate local experience; that for ideas and programs to take root within communities or within institutions, they must reflect the needs and realities of lived experience. Simply instructing individuals or institutions to change their behavior or to do things differently does not work, as history has taught us.

An atmosphere of mutual learning permeated the projects in West Africa. Before designing projects, the teams had extensive discussions with various parties — women and men in the community, providers of both traditional and modern health care, traditional leaders and government officials. The knowledge gained from these discussions helped shape the projects. Through listening to the experiences of the people concerned, the PMM teams realized that the solution to maternal mortality must be multisectoral. Improving medical care for women with serious complications is central, but the teams did not forget that many things affect people's ability to use services. The approach to program design described in the manual reflects this perspective.

**3. External support agents must take the role of facilitator rather than director.**

The role of a facilitator is to ensure local ownership so that people, whether in a ministry or a village, can contribute to and sustain a process of change. Facilitation is a time-consuming process, but one that is integral to capacity development.

In its technical support and coordination of the Network, the Columbia University team put into practice what is too often only the rhetoric of capacity development. It accepted that effective partnerships are not always easy, and viewed such difficulty as a necessary part of the capacity development process. It gave high priority to activities such as workshops (to which all Network members were invited) which built consensus and a shared sense of purpose. Ongoing cooperation, problem-solving, and sharing of lessons learned was a central feature of these workshops and the Network process.

In 1997, technical cooperation from Columbia University came to an end, and the PMM Network now continues as an entirely African entity. This by itself would be a fitting ending to a capacity development success story, but the capacity development process does not stop here. The African members of the Network have now committed themselves to sharing their expertise and experience with other colleagues in Africa and supporting the formation of new multidisciplinary teams, not only in Ghana, Nigeria, and Sierra Leone, but also in the countries of francophone West Africa and of East Africa. Technical cooperation with these new colleagues will focus on the design, implementation and evaluation of maternal mortality programs in their local areas.

This manual represents a distillation of project design and evaluation methods used by the PMM Network over 8 years of working together. We hope that it will be useful to the members of the "second-generation" Network as they carry on with their important work and share the knowledge they have gained with colleagues in other parts of Africa.

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## 1. Introduction

The World Health Organization (WHO) and UNICEF estimate that each year 585,000 women die from causes related to pregnancy and childbirth.<sup>1</sup> The disparity between developed and developing countries is greater for maternal mortality than for any other commonly-used index of health. Whereas levels of infant mortality are, on average, 10 times higher in developing than in developed countries, maternal mortality in developing countries is more than 100 times higher than in industrialized countries.<sup>2,3</sup>

Most maternal deaths are due to five obstetric complications: hemorrhage, sepsis, unsafe induced abortion, hypertensive disorders of pregnancy, and obstructed labor. While the vast majority of maternal deaths occur in developing countries, this does not mean that only women in developing countries develop medical complications during or after pregnancy.<sup>4</sup> Women in every country and every population develop complications, but women in developing countries are much less likely to get prompt adequate treatment, and are therefore more likely to die.

For an individual woman, the risk of maternal death is influenced both by the risk associated with pregnancy and by the number of times she becomes pregnant. Each time a woman becomes pregnant, she runs the risk of maternal death again, and the risk adds up over her lifetime. In developing countries, where both mortality and fertility tend to be high, the lifetime risk of maternal death can be astoundingly high. In some countries of Africa, it is estimated that 1 in 7 women will die of complications of pregnancy or delivery, compared with only 1 woman in several thousand in Europe and North America.<sup>5</sup>

In addition to the women who die, many more suffer from serious but not fatal health problems as a result of pregnancy or childbirth. Most women who have obstetric complications recover, but some suffer long-term disabilities including sterility and vesicovaginal fistula (VVF). VVF is a condition in which prolonged obstructed labor produces a hole between the vagina and the urinary system, resulting in chronic incontinence.<sup>6</sup> This is not only painful, but if left untreated (as is usually the case in developing countries) it can lead to social stigmatization and isolation.<sup>7</sup> Sterility commonly results from untreated or recurrent pelvic infection. Beyond frustration and disappointment, sterility can have profound social and economic consequences for women in societies where women's value is largely determined by the children they bear. There is little reliable information on the prevalence of maternal morbidity, but the number of women affected is sure to be several times greater than the number who die.<sup>8</sup> Fortunately, interventions that reduce maternal deaths will also reduce maternal morbidity.

Pregnancy-related complications are the number one cause of death and disability among women of reproductive age worldwide.<sup>9</sup> They account for the loss of more than twice as many disability-adjusted life-years (DALYs) than do STDs, HIV, or TB. There is no single cause for men that comes close to the magnitude of maternal mortality and morbidity. And what makes the persistence of high levels of maternal mortality and morbidity all the more tragic is that cost effective interventions (defined by the World Bank as those that cost less than US \$100 per

DALY saved) have been known for decades but are still not widely available or accessible in developing countries.

The Safe Motherhood Initiative (SMI) was officially launched at an international conference held in Nairobi, Kenya in 1987. Since 1987, awareness of the problem has been raised among policy makers, health professionals, and the general public. A variety of small studies have helped clarify the extent and nature of the problem.<sup>10</sup> They have also pointed the way to solutions.<sup>11,12,13,14,15</sup>

Now the task is to develop full-scale programs that use this knowledge. In order to do this, governments of developing countries may, if they wish, call on a variety of agencies for financial and technical assistance. But in the long run, the reduction of maternal mortality is the country's responsibility. Therefore, one of the most important ways in which United Nations and other agencies can assist governments is by helping them to identify cost-effective program designs and build local capacities to implement and sustain them.

We hope this manual will be useful in this process. This manual is intended to assist local personnel in gathering and interpreting the information they need to design and evaluate programs. The kind of information called for is different from much of what has been collected in the past. Much of the research to date has addressed such questions as "How many women die?" and "What do they die of?" Now, we need to focus on such questions as "What is preventing women from receiving life-saving treatment?" and "How is our program progressing?" This kind of approach has various names, including "health systems research" and "operations research." The identifying characteristic of such research is that it provides results that can be incorporated directly into program activities.

Operations research on maternal mortality is a relatively new field.<sup>16</sup> The largest body of experience to date is that of the Prevention of Maternal Mortality (PMM) Network in West Africa. The PMM Network began in 1988 with funding from the Carnegie Corporation of New York.<sup>17</sup> In its first phase, the Network consisted of a dozen multidisciplinary teams — seven in Nigeria, 2 each in Ghana and Sierra Leone, and a technical assistance team at Columbia University in New York. In 1997, it became an entirely African institution — the Regional Prevention of Maternal Mortality (RPMM) Network, with the coordinating office in Accra, Ghana.

Over the years, the PMM teams have worked to design and evaluate programs to help women who develop pregnancy-related complications to get life-saving care. These programs were designed to fit the particular geographic, economic, political and cultural circumstances in which each of the teams worked. The programs also were designed to be sustainable and replicable. The findings of the Network projects were reported at an international conference in Accra in 1996. A Book of Abstracts is available<sup>18</sup>, and the full proceedings of the conference will be published as a special supplement to the *International Journal of Gynecology and Obstetrics* in 1997. Much of the content of this manual draws on the experience of the PMM Network.

This manual is written not only for specialists in the area of maternal mortality, but also for planners and managers who are including efforts to reduce maternal deaths in their activities. And while the focus is on programs at the local or district level, it also contains information and tools for people working at the state or national level. These sections are adapted from *Guidelines for Monitoring the Availability and Use of Obstetric Services*, forthcoming from UNICEF and WHO.<sup>19</sup>

In Chapter 2, we begin with an overview of what is known about maternal mortality and the types of activities that reduce maternal deaths. We then discuss the limitations of traditional measures of impact for evaluating maternal mortality programs, and explain the rationale for process indicators. In Chapter 3 on "Needs Assessment", we describe the kinds of questions that need to be answered to design a program, and we discuss methods for gathering the information needed. Using the findings of the needs assessment to select program interventions is the subject of Chapter 4. The importance of understanding the causal pathways that lead from a proposed intervention to the desired outcome is emphasized. In Chapter 5, we demonstrate how process indicators can be derived directly from the causal pathways — an approach that can be used to derive process indicators for any intervention — and we discuss some practical issues in monitoring and evaluation. Chapter 6 deals with the dissemination of information gathered. The appendices contain sample data collection instruments and materials developed in the PMM Network and at Columbia University, for you to use and adapt as needed. The materials in Appendix A are relevant to maternal mortality programs at all levels. Appendix B contains instructions and forms designed specifically for guiding programs at the regional or national level.

## 2. A Strategy for Program Design and Evaluation

The strategy proposed in this manual is based upon two central concepts. First, women with obstetric complications must have access to emergency medical treatment if maternal deaths are to be substantially reduced. And second, the best way to evaluate progress in the reduction of maternal deaths is through the use of process and output indicators. These two concepts are discussed in detail below.

### 2.1 Which Activities Will Reduce Maternal Deaths?

In societies where maternal mortality is high there are usually many problems — poverty, illiteracy, low status of women, poor sanitation and nutrition, poor transportation, inadequate medical services. If we solved all of these problems, maternal mortality would decline substantially. But in many situations, this is not feasible in the near future. However, it is possible to reduce maternal deaths before solving all of these problems. What program planners, therefore, want to know is, "What are the 3 or 4 feasible activities which will substantially reduce maternal deaths in our population in the near future?"

If we are to select a few activities, then we need to be as sure as possible that these activities really will reduce maternal deaths. In other words, we need to be careful about the "causal chain" linking maternal deaths and the program activities.<sup>20</sup> There are several conditions that must exist for a maternal death to occur. First, the woman must become pregnant. Second, she must develop a medical problem. Third, in order for the woman to die, the complication must either be treated inadequately (e.g., treated too late or not treated) or not treatable. A variety of studies have found that at least nine in 10 serious obstetric complications can be successfully treated with medical procedures that have been available for decades.<sup>21</sup>

Thus, in order to reduce maternal mortality, any proposed interventions must ultimately:

- reduce the likelihood that a woman will become pregnant;
- reduce the likelihood that a pregnant woman will experience a serious complication of pregnancy or childbirth; or
- reduce the likelihood of death among women who experience complications.

This manual focuses on interventions designed to reduce deaths among women who experience complications, for reasons explained below.

Reducing fertility is, without doubt, an effective way to reduce the number of maternal deaths in the society.<sup>22</sup> This can be easily illustrated by the lifetime risk of maternal death, which is a function of both the likelihood of surviving a single pregnancy and the number of pregnancies an average woman has. The lifetime risk can be reduced by either lowering the number of pregnancies or improving survival among pregnant women. Family planning programs help

prevent maternal deaths chiefly through reducing the number of pregnancies. A wide literature already exists on the evaluation of family planning programs.<sup>23</sup> Consequently, that topic is not covered in this manual.

Reducing the incidence of complications among pregnant women has long been the focus of maternal health programs. During the last decade, however, the potential of various activities to avert complications has been re-examined.<sup>24,25,26,27</sup> What these analyses show is that most obstetric complications can neither be predicted nor prevented.

That statement sounds unbelievable to many people. After all, it is well known that certain groups of women have much higher risks of death than do others. For example, numerous studies have shown that a woman's chance of maternal death is affected by her age.<sup>28</sup> Typically, mortality is lowest among women giving birth in their 20s. To illustrate this, we use data from a classic study in Matlab, Bangladesh.<sup>29</sup> These data were gathered before the successful family planning program reduced fertility.

As Figure 1 shows, the higher risk of maternal death associated with being less than 20 or more than 30 years old is reflected in the maternal mortality ratio (column 2) and the relative risk of maternal death (column 3).

However, if one looks at the sheer number of deaths, the picture is very different. The 10-year age group with the largest number of maternal deaths — women 20-29 — actually has the smallest relative risk. The reason for this apparent paradox is that there were many more births in this age group than in any other. So, even though their risk was relatively low, women in their 20s experienced more deaths than any other group.

**Figure 1. Maternal Mortality and Fertility by Age  
in Matlab, Bangladesh, 1968-70**

<b>Age</b>	<b>Maternal Mortality Ratio*</b>	<b>Relative Risk of Maternal Death</b>	<b>Number of Live Births**</b>	<b>Number of Maternal Deaths</b>
10-14	17.7	3.9	509	9
15-19	7.4	1.6	3,907	29
20-29	4.5	1.0	11,286	51
30-39	5.8	1.3	4,667	27
40-49	6.7	1.5	447	3

\* Maternal deaths per 1,000 live births.

\*\* Computed from number of maternal deaths and MMR reported by authors.

Relative risk is most appropriately used as a guide for clinical practice. Physicians and nurses can use relative risk to help them tailor advice and treatment to individual patients. Public health planners, in contrast, are less concerned with particular individuals than with preventing as many deaths in the population as possible. Therefore, for planning public health programs, the number of deaths is a more relevant indicator than the relative risk. Screening pregnant women to identify those at high risk will neglect low-risk women when, in fact, most complications and deaths will occur in this group.

One may reason that, if obstetric complications cannot be predicted, perhaps they might be prevented by early treatment of illness during pregnancy. This does not, however, seem to be effective either:

In a rural area of the Gambia, pregnant women were provided exemplary prenatal care as part of a research project of Britain's Medical Research Council. Risk screening was done twice during pregnancy, and urine tests were performed to detect toxemia. Each woman was visited once a month and any illness detected was treated. There was, however, no medical facility nearby at which serious obstetric complications could be treated. Despite having personalized antenatal care provided by the Medical Research Council, the level of maternal mortality was astronomically high: the equivalent of more than 2,000 maternal deaths per 100,000 live births. Reviewing the data at the end of the project, the researchers found that risk factors were not helpful in identifying which women were most likely to die.<sup>30</sup>

What such studies show is that most obstetric complications cannot be predicted or prevented. There is one major exception to this statement: complications resulting from unsafe induced abortion can be prevented. Providing access to safe abortion services would prevent a substantial proportion of maternal deaths — nearly one-fifth of maternal deaths in developing countries (excluding China).<sup>31</sup> While family planning can play a role in averting unwanted pregnancies, international experience has shown that it does not obviate the need for safe abortion services. Even with very effective methods of contraception, substantial proportions of women will experience unwanted pregnancies.<sup>32</sup> Furthermore, there is growing awareness that many pregnancies (especially among young women) are the result of non-consensual sex.<sup>33</sup>

Although most obstetric complications cannot be predicted or prevented, they can be treated. Since all pregnant women are at risk of obstetric complications, they need to have access to emergency obstetric care (EmOC). With adequate treatment, the vast majority of maternal deaths can be avoided. Therefore, prompt access to emergency obstetric care should be central to any effort to reduce deaths among pregnant women. For these reasons, interventions designed to reduce maternal deaths by improving access to EmOC are the focus of this manual. The specific services that constitute EmOC are described in the next chapter.

This approach is based on several premises: 1) a proportion of pregnant women will develop obstetric complications; 2) the majority of these complications cannot be predicted or prevented; and 3) women who suffer complications will therefore need prompt EmOC to save their lives and prevent long-term morbidity. This has important implications for program planning. It means that the focus is on providing services for women with complications, rather than all pregnant women. It also has important implications for evaluation in that the data can be collected from health facilities — i.e., population surveys are not required.

Finally, a word on cost. Providing emergency obstetric care does not usually entail building costly facilities. In many developing countries, facilities that are supposed to provide emergency obstetric services already exist. It may be that equipment has gone without repair, drugs are not available, or physicians lack training. Modest inputs and improved management and supervision are often all that are required for EmOC services in such facilities to function. Health centers and small hospitals can also provide life-saving services. Many countries can improve access to EmOC services by upgrading existing facilities and retraining existing staff. Programs to improve EmOC services are, by their very nature, not vertical; they are implemented within the existing health system. And because of this, activities undertaken to improve emergency obstetric services often have additional benefits in other areas. For example, a ready supply of blood at the hospital will help in the treatment of people injured in traffic or industrial accidents, as well as women with postpartum hemorrhage.

## **2.2 The 3 Delays Model**

While EmOC services are necessary if maternal mortality is to be reduced, they may not be sufficient. Even when services are functioning well, women with obstetric complications face a variety of barriers to using them. Some of these barriers are economic — e.g., lack of money

to pay for transport or services. Some of these barriers are cultural — e.g., the low value placed on women's lives. Some are geographic — e.g., long distances and poor roads. Anything that causes delay in getting treatment may cost women their lives.

While there are many factors that can cause delay, they can be grouped using a simple model called The 3 Delays (Figure 2). The model specifies the three types of delay that contribute to the likelihood of maternal death:

- (1) delay in deciding to seek care;
- (2) delay in reaching a treatment facility; and
- (3) delay in receiving adequate treatment at the facility.<sup>34</sup>

This model serves as the basis for developing indicators, discussed later in this book.

### **2.2.1 Delay 1: Deciding to seek care**

The decision to seek care is the first step that must occur if a woman with a complication is to receive EmOC. This decision may be influenced by many factors. First of all, there is the ability of the woman and her family or attendants to recognize a life-threatening complication. They must also know where to go for help. Medical personnel often assume that lack of information in the community is a major obstacle to treatment. In a given situation, this may or may not be true. It may be that people know when help is needed but choose not to go to the hospital because they know that it lacks a physician with obstetric skills. Simple, efficient methods for assessing the importance of various factors are discussed in the next chapter.

Cultural factors can play an important role in the decision to seek care. For example, in areas where stoicism is valued, and women are respected if they suffer in silence, family members may have difficulty identifying prolonged labor. Women's status and autonomy may also affect the decision to seek care. For example, in some communities no one will take a woman to the hospital unless her husband has given his permission. There are stories of cases in Northern Nigeria in which the woman developed a complication while the husband was away, and thus died.

The distance to the health facility, availability and efficiency of transportation, and cost of health care and transportation all influence people's readiness to seek care. In addition, the reputation of the facility can play a key role. People may not seek medical help promptly or at all if they believe the services to be of poor quality.

INSERT FIGURE 2 HERE

### **2.2.2 Delay 2: Reaching a medical facility**

Once the decision to seek care has been made, the woman must reach a facility where EmOC is available. Accessibility of health facilities will thus influence delay at this stage. Accessibility is a function of distance from the health facility, availability and efficiency of transportation, and cost.

Accessibility is also a function of the services offered at various levels of the health system. For example, the distance to a functioning EmOC facility is increased if personnel at nearby health centers cannot offer even basic EmOC services.

### **2.2.3 Delay 3: Receiving treatment**

It is important to remember that many women die in hospitals, having overcome barriers in Phases 1 and 2. The provision of emergency obstetric care is dependent on a number of factors, including number and training of staff, availability of drugs and supplies, and the general condition of the facility. In addition, there is the crucial element of management. A facility can have all the staff and supplies required, and yet provide very poor care. This is important to remember in evaluating performance. For example, a checklist of supplies and equipment does not tell you if care is actually being provided or how long it takes.

## **2.3 Using Process and Output Indicators**

To many people, it seems obvious that the best way to measure the success of health programs is to measure their impact on the outcome of interest. In the field of maternal mortality, "impact" indicators include maternal mortality rates and ratios, and the lifetime risk of maternal death. While this approach might seem straightforward, it is not. For a variety of technical reasons, it is extremely difficult to use impact measures to monitor progress in reducing maternal deaths.<sup>35</sup> At the level of individual projects or district-level programs, it is virtually impossible. (See Figure 3.)

An alternative approach is to use "process" and "output" indicators. These are designed to measure changes in the steps leading up to the desired outcome. In general, "processes" refer to program activities and "outputs" refer to the results of these activities. Outputs are really just intermediate program results that lie between program activities and the desired outcome of the program. The objective is to make inferences about program success by measuring changes in the process and output indicators.

For example, suppose we are operating a maternal mortality program in a rural area with few health facilities. Process indicators could show that:

- (a) hospital services have been improved (drugs, supplies and equipment have been purchased; staff have been trained; a blood bank has been established, etc.);

while output indicators could show that:

- (b) the number of women with complications receiving treatment at the hospital has increased;
- (c) the time from admission to treatment has decreased; and
- (d) the proportion of women admitted with complications who survive has increased.<sup>a</sup>

If we observe these changes in the process and output indicators, then we can be reasonably sure that more of the women who develop obstetric complications are getting adequate medical treatment, and that therefore fewer maternal deaths are occurring in the population. In an urban setting, where many treatment options exist, the analysis would be more complicated because multiple facilities would need to be considered.

The evaluation strategy proposed in this book is to assess progress in reducing maternal deaths by using process and output indicators. We realize that policy makers and funders may expect to see program evaluations that use maternal mortality ratios. However, for most programs it is neither feasible nor desirable to collect the data necessary to calculate maternal mortality ratios. For this reason, the use of process and output indicators to monitor maternal mortality programs is gaining wider acceptance.<sup>36,37</sup>

Using process and output rather than impact indicators to monitor programs is not as radical as it may sound at first. In the field of family planning, process and output indicators (e.g., number of contraceptives distributed, number of users, etc.) have long been considered valuable indicators of program performance. A similar situation is occurring with respect to child survival interventions, with the use of measures such as utilization of oral rehydration solution and immunization coverage. In these program areas, process indicators are commonly used for evaluation purposes, even though fertility and infant mortality are easier to measure than is maternal mortality.

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a The inverse of this — i.e., 1-% surviving, or the proportion of women admitted with complications who die — is the “case fatality rate.” This is an informative indicator, the use of which is discussed later in this manual.

### Figure 3. Why Not Use "Impact" Indicators?

Maternal mortality is the most common cause of death among women of reproductive age in developing countries.<sup>38</sup> Nevertheless, maternal deaths (like all deaths among young adults) are infrequent events, especially compared to deaths among infants. This has important implications for program evaluation. Because the number of maternal deaths per year in a study population will be relatively small, it is difficult to tell whether fluctuations are due to program interventions or to chance. To use deaths as the indicator of success, therefore, means that the study population will need to be very large. This increases the difficulty and cost involved. Of course, the easiest way to study a large population is to use routinely collected vital registration data. Unfortunately, in most of the countries where maternal mortality is high, vital registration systems are neither complete nor reliable.<sup>39</sup>

In order to overcome some of these difficulties, innovative survey designs have been developed and tested.<sup>40</sup> The most successful of these is the "sisterhood" method.<sup>41</sup> The conventional survey method consists of asking adult residents of a household whether there has been a maternal death in the household during the last 2-3 years.<sup>42</sup> With the sisterhood method, the interviewer asks each of the adults in the household whether they have any sisters, and whether any of their sisters ever died of maternal causes. Since the adults in a household (e.g., a husband and wife) often have different sets of sisters, this increases the number of women on whom information can be gathered from visiting a single house. Thus, the sisterhood method is very efficient.

The sisterhood method, however, is of limited usefulness for evaluating programs. Its most serious limitation is that the estimate of maternal mortality it provides refers to a period about 10 years before the survey.<sup>43</sup> For example, if you used this method to gather baseline data for program evaluation in 1997, it would provide you with an estimate of maternal mortality around 1987. You would then have to wait more than 10 years to see if the program had any effect.

All maternal mortality surveys (including sisterhood surveys) are also limited in their ability to discriminate between real and apparent changes in maternal mortality. For example, if the original sisterhood study conducted in the Gambia in 1989 were repeated in 1999, and it showed a 25% decline in maternal mortality, the nature of the statistics is such that you could not be certain (at the 95% confidence level) that the change was real and not due to chance.<sup>44</sup>

Finally, there is always the danger of undercounting maternal deaths. For example, when the results of a sisterhood study were compared with population surveillance data in Matlab, Bangladesh, about one-fifth of maternal deaths had been missed.<sup>45</sup> These were mostly deaths of unmarried women, and deaths due to complications of abortion.<sup>46,47</sup>

Process and output indicators are not poor substitutes for indicators based on impact. Process and output indicators provide information that can be used to plan programs. They point to problems that need to be addressed — in the availability, utilization, and quality of services. Impact indicators do not provide such information. Knowing that Country X has a high maternal mortality ratio doesn't tell us what to do about it.

Process and output indicators also have advantages in evaluating program success. Impact indicators might provide information on whether or not there was a change in the event of interest (e.g., maternal death), but they provide no information on how the effect was achieved. Most programs will have many components. Without information on processes and outputs (e.g., changes in number of cesarean sections performed, time from hospital admission to definitive treatment, etc.), we cannot know which elements of a successful program are critical and worthy of replication. Moreover, without information on process and outputs, it is dangerous to conclude that the program was responsible for any impact observed.<sup>48</sup> (See Figure 4.)

#### **Figure 4. What Happens Without Information on Process**

In 1991, a paper appearing in *The Lancet* reported the dramatic success of a maternal mortality program in Matlab, Bangladesh.<sup>49</sup> Direct obstetric deaths were reduced by two-thirds in the program's intervention area, while they remained unchanged in the control area. The program consisted of several components: the posting of trained midwives at rural health posts; establishment of a maternity clinic, staffed by female physicians, available round-the-clock; and a system for referral and transport of women with complications. The success of the program was attributed mainly to the posting of the midwives. The paper contained little information on process and output indicators. Because the researchers were able to demonstrate the program's impact on mortality, the results carried considerable weight among policy makers. Key international agencies mobilized resources to support the training and posting of midwives to rural villages.<sup>50</sup>

A few years later a new team of researchers began to look for a fuller explanation for the decline. They collected and reviewed additional data in Matlab, this time focussing on process and output indicators. They found that the midwives provided valuable treatment to many women with complications in the intervention area. They also found that: 1) the maternity clinic staff provided life-saving services to many of the women referred by the midwives; 2) while a substantial number of women coming to the clinic were referred by the midwives, even more women came to the clinic on their own; and 3) many women who came to the clinic were subsequently referred and transported by ambulance to the district hospital, where surgery and blood transfusions were available.<sup>51</sup>

The new process and output data revealed that the program's success depended upon the existence of functioning health facilities where women with complications could get life-saving treatment. The program also benefitted from an effective chain of referral from the midwives to the clinic and from the clinic to the hospital. Referrals by the midwives, however, accounted for only a minority of the women with complications seen at the facilities. Without this information on process and output, incorrect or incomplete conclusions could be drawn.

### **3. Needs Assessment — What Do You Need to Know?**

Prior to starting new activities or modifying existing ones, you need to find out what emergency obstetric care (EmOC) services are available, how they are functioning, and what factors might limit people's utilization of them. This can be done by conducting a needs assessment. The needs assessment will help you to decide what must be done to improve the situation, and what resources will be required.

It is important not to make assumptions about how to address the problem without verifying them. Unchecked assumptions in the planning phase can lead to seriously misguided programs. For example, when discussing the apparent underutilization of some health facilities, it is not uncommon for people to assume that the problem is in the community — that people are uninformed, or that superstitions or customs are interfering. But, even relatively simple research (such as focus group discussions in the community) may show that these assumptions are wrong. Often people know when and where to go for medical care, but they don't go because they are aware that the facility has no drugs, the staff are usually not present, or patients are treated disrespectfully.<sup>52</sup> Thus, it is a good idea to verify basic assumptions before committing to a particular program design. This is true even for program planners born and raised in the area.

In addition to guiding program design, information collected during the needs assessment provides baseline data against which to measure progress. The needs assessment should also reveal whether the existing systems of record-keeping will need to be modified or supplemented in order to collect information for monitoring and evaluation.

Figure 5 shows the key questions that will need to be answered in the needs assessment. It also shows the information that will be required to do so, depending on the level at which you are working. Your project may cover a relatively small area, focussing on a single facility, or perhaps a district hospital and a few health centers. Or you may be working at the provincial level, responsible for improving obstetric services in a number of districts. You may even be monitoring maternal mortality prevention activities at the national level. Whatever the level, however, the process of planning and evaluation will be the same conceptually. You will want answers to the same basic set of questions: Are emergency obstetric services available? Are women with life-threatening complications using them? Are the services of good quality?

**Figure 5. Information for Planning and Evaluating Maternal Mortality Programs at Various Levels**

What You Need to Know	Information Needed		
	Local/District Level	State/Province Level	National/International Level
Are life-saving services available?	<ul style="list-style-type: none"> <li>➤ EmOC functions performed at facility</li> <li>➤ Number and distribution of functioning EmOC facilities</li> </ul>	<ul style="list-style-type: none"> <li>➤ Number and distribution of functioning EmOC facilities per 500,000 population</li> </ul>	<ul style="list-style-type: none"> <li>➤ Number and distribution of functioning EmOC facilities per 500,000 population</li> </ul>
How many women are using life-saving services?	<ul style="list-style-type: none"> <li>➤ Number of women with complications admitted to EmOC facilities</li> <li>➤ Met need: proportion of expected complicated cases in the population admitted to EmOC facilities</li> </ul>	<ul style="list-style-type: none"> <li>➤ Met need: proportion of expected complicated cases in the population admitted to EmOC facilities</li> </ul>	<ul style="list-style-type: none"> <li>➤ Met need: proportion of expected complicated cases in the population admitted to EmOC facilities</li> </ul>
How many life-saving procedures are being performed?	<ul style="list-style-type: none"> <li>➤ Number of cesarean sections (or other procedure) performed</li> <li>➤ Number of cesarean sections as a proportion of all births in population</li> </ul>	<ul style="list-style-type: none"> <li>➤ Number of cesarean sections as a proportion of all births in population</li> </ul>	<ul style="list-style-type: none"> <li>➤ Number of cesarean sections as a proportion of all births in population</li> </ul>
What is the quality of the care provided?	<ul style="list-style-type: none"> <li>➤ Case fatality rate among women with complications admitted to facility</li> <li>➤ Time from admission to treatment</li> </ul>	<p><i>Review of local data will be informative; aggregation of data generally not recommended</i></p>	<p><i>Review of local data will be informative; aggregation of data generally not recommended</i></p>
How should services be improved?	<ul style="list-style-type: none"> <li>➤ Treatment of complicated cases</li> <li>➤ Availability of drugs, supplies, blood, equipment</li> <li>➤ Staff skills, coverage, attitudes</li> </ul>		
How can utilization of services by the community be improved?	<ul style="list-style-type: none"> <li>➤ Cost of services; availability and cost of transport</li> <li>➤ People's confidence in health services</li> <li>➤ People's ability to recognize complications that need treatment</li> </ul>		
What are the costs of upgrading/ expanding	<ul style="list-style-type: none"> <li>➤ Cost of improvements at health facility</li> </ul>	<ul style="list-style-type: none"> <li>➤ Aggregate cost of improvements at health facilities</li> </ul>	<ul style="list-style-type: none"> <li>➤ Aggregate cost of improvements at health facilities</li> </ul>

existing services to provide EmOC?		➤ Average cost of improvements at health facilities	➤ Average cost of improvements at health facilities
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Depending on the level of the health system at which you are working, the level of detail which you will need to answer these questions will differ. In general, people working at the local level will be concerned with "micro" issues, such as the functioning and utilization of facilities in particular communities. People working at higher levels will be concerned with "macro" questions, such as the geographic distribution of facilities. Answering these "macro" questions will require aggregating information collected at the local level, and comparing the findings to a standard. Information gathered at the local level is thus the basis for state and national level monitoring.

This manual focusses on the process of gathering and using information for planning and evaluating programs at the local level. But because people working at the state and national levels need to use information collected at the local level, it will be helpful to them as well. Additional guidance for people working at the state and national level is provided in Appendix B. This includes a discussion of how to sample facilities and aggregate data, as well as forms for carrying out these procedures.

As Figure 5 shows, people working at the local level will want to gather various kinds of information and explore questions in considerable depth. At higher levels of analysis, as a matter of practicality, fewer kinds of information will be used. Consider the monitoring of the number of life-saving procedures being performed: a program manager at the local level might choose to assess several different life-saving procedures (e.g., use of antibiotics and oxytocics), while a state or national level researcher might count only cesarean sections.

Figure 5 also reflects how the answers to some questions lose meaning in the aggregate: "How should services be improved?", for example, pertains to the particular facility; "How can utilization of services be improved?" pertains to the particular community. People working at the state or national level will want review the local information on such topics, but not necessarily aggregate them.

The key questions for the needs assessment are discussed briefly in the paragraphs below. Relevant data collection instruments (which are provided in Appendix A) are also described.

### **3.1 Are Life-saving Services Available?**

As discussed earlier, emergency obstetric services are central to the prevention of maternal deaths. Therefore, as part of your needs assessment, you will need to gather data from health facilities to ascertain whether life-saving obstetric procedures are actually being performed (regardless of whether or not they are "supposed" to be). The needs assessment first focusses on assessing EmOC services at district hospitals and health centers. You may be interested in assessing services at lower level facilities as well, which can be done using similar procedures. Assessing needs at the community level is a later step, which is discussed in Section 3.6.

In order to assess services at facilities, it is helpful to select a few important EmOC functions for study. Figure 6 lists functions that can be used to identify the level of care a facility is actually providing. These are not intended to serve as a complete list of services that should be available at a facility. Rather, they are “signal functions” that can be used for classification and monitoring. Using a short, defined list of signal functions to assess services is especially helpful when a program covers a large area and numerous facilities because it facilitates comparability of results.

If a facility review reveals that a facility is providing all of the first 6 functions listed, it may be considered a “Basic EmOC” facility. This is a facility that can perform most, but not all, EmOC services. A facility that is providing all 8 functions is considered a “Comprehensive EmOC” facility. The difference between Basic and Comprehensive EmOC is the capacity to give blood and perform surgery (e.g., cesarean section). In general, it is expected that a facility at the level of a health center would be providing Basic EmOC services, while a district hospital would be providing Comprehensive EmOC services.

**Figure 6. Signal Functions of Emergency Obstetric Care (EmOC)**

Facility Level	Signal Functions
Health Center	<p><b>Basic EmOC =</b>            Antibiotics (injectable)            Oxytocics (injectable)            Anticonvulsants (injectable)            Manual removal of placenta            Removal of retained products            Assisted vaginal delivery</p>
District Hospital	<p><b>Comprehensive EmOC =</b>            All Basic EmOC functions plus:            Cesarean section            Blood transfusion</p>

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The short list of signal functions does not mean that other functions are not important. For example, at the level of the Basic EmOC facility, administration of intravenous fluids can be extremely helpful in stabilizing a woman's condition before referring her to the hospital. At a Comprehensive EmOC facility, the ability to perform surgery of course entails a number of other important capabilities, e.g., administering anesthesia. People working with only a few facilities may thus wish to expand the list of functions examined in the needs assessment.

The Facility Functioning Assessment Form, provided in Appendix A.1, is a tool for use at district hospitals and health centers. It asks whether each of the 8 key life-saving procedures listed in Figure 6 was performed at least once in the last 3 months. Based on the answers to these questions, the facility may be classified as providing Comprehensive EmOC, providing Basic EmOC, or not providing EmOC. In this way, district hospitals that are not actually providing Comprehensive EmOC and health centers that are not providing Basic EmOC can be targeted for improvement.

The results of facility assessments can be used to assess whether there are a sufficient number of functioning EmOC facilities relative to the population. There should be at least 1 Comprehensive and 4 Basic EmOC facilities per 500,000 population.<sup>53</sup> It is also important to examine whether facilities are distributed so that most people have access to them. Marking the location of EmOC facilities on a map is a good way of doing this.

### **3.2 How Many Women Are Using Life-saving Services?**

Once you know whether life-saving services are available, you will want to know whether women are coming to the facilities for treatment. Here the focus is on utilization by women with obstetric complications, rather than overall utilization of obstetric services. The number of "institutional deliveries" is sometimes used as an indicator of safe motherhood activities. But in order to reduce maternal deaths, it is women with complications — not women having normal deliveries — who urgently need to be using health facilities. And in many developing countries, having all births take place in facilities is not a realistic goal for the foreseeable future. The priority is thus serving women with complications.

What is needed is a measure of the number of women with obstetric complications who receive treatment at EmOC facilities.

Ideally, we would be able to count this directly from facility registers.<sup>b</sup> Unfortunately, record-keeping systems in many countries are not designed to collect such information. Maternity ward registers often lack columns for recording obstetric complications. In these situations, it is important that record-keeping systems be upgraded as early as possible, and before services are improved, so that you will have baseline data for monitoring changes in utilization by women with complications over time. If it is discovered in the needs assessment that a facility register lacks a column for recording obstetric complications, then modifying these registers and training staff to use them should be the first priority. Even where the actual registers are suitably designed, staff may still need training in how to record information so that those women who arrive with life-threatening conditions can be easily counted. An example of a modified register head used successfully in West Africa is provided in Appendix A.2. An alternative is that if the facility maintains good patient files, it would also be possible to go through these to count the number of women with complications. But in the long run, a well-designed register is likely to be a more efficient means of collecting these data for ongoing monitoring.

A consistent definition of what will be counted as an obstetric complication is needed to ensure that the data are comparable over time and among facilities or geographic areas. For monitoring of programs to reduce maternal deaths, it makes sense to restrict the definition of an "obstetric complication" to only those conditions which carry a serious threat of death. It is also helpful to restrict the conditions counted to "direct" obstetric complications (i.e., those directly related to pregnancy or childbirth), because they are less likely to vary in incidence from place to place than are "indirect" obstetric complications (e.g., infectious conditions such as malaria, hepatitis, tuberculosis).

A sample Facility Data Summary form for recording obstetric complications on a monthly basis is provided in Appendix A.3. The form specifies each complication to be counted, by type, so that the likelihood of confusion is reduced. These are: hemorrhage, obstructed/prolonged labor, ruptured uterus, post-partum sepsis, pre-eclampsia/eclampsia, induced/septic abortion, and ectopic pregnancy. Still, training and supervision of the person abstracting the data is important, and further specification of how each of these conditions is to be defined is advised.

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b Note that we are counting women who have complications upon admission. Although some women who come to the hospital for normal deliveries may develop complications while in the hospital, our primary objective is to ensure that women who develop complications outside the hospital are brought in for treatment. If, however, record-keeping systems are setup in such a way that it is easier to count all women with complications, that is acceptable too. Of course, the same criteria for defining complications should be used in either case.

The form can be used to monitor the number of women with complications at any health facility. Because the form is designed for hospitals, however, not all parts of the form will be relevant to lower level facilities. The form can be used to collect information on a number of other key indicators; these are described in Sections 3.3 and 3.4.

If you are assessing how many women are using life-saving services in a large area such as a region or a country, a useful indicator is "met need" for EmOC. Met need for EmOC is the proportion of women with obstetric complications who receive treatment at EmOC facilities. The number of women with complications in the population, however, is unknown. Therefore, we use an estimate. A conservative estimate is that 15% of pregnant women will develop complications that require emergency medical attention.<sup>54</sup> (This proportion may be considerably higher in some settings, e.g., where the incidence of unsafe abortion is high.)

The forms in Appendix B contain step-by-step instructions for the calculation of met need. The first step is to estimate the number of women expected to develop complications (assuming that this will be 15% of all pregnant women). Unfortunately, we do not know the actual number of women who become pregnant per year, because spontaneous and induced abortions are too difficult to count. Therefore, we use births as a proxy for pregnancies. To obtain the number of births per year, we multiply the population size by the crude birth rate. Then, multiplying this figure by 0.15, we arrive at an estimate of the expected number of women with complications in the population in a year. This is the denominator.

The numerator is the number of women with complications admitted to health facilities. Dividing the numerator by the denominator and multiplying by 100 thus gives an estimate of the met need — the proportion of women with obstetric complications in the population who receive EmOC.

If met need is less than 100%, this indicates that some women who need EmOC services are not receiving them. If met need is 100%, it is reasonable to conclude that most women who need EmOC services are receiving them. Since the true incidence of complications in the population may be greater than 15%, it is possible that even if met need is 100%, there may still be women in need of life-saving services who are not receiving them. It is also for this reason that the level of met need may turn out to be greater than 100%. Therefore, if a met need of more than 100% is found, this should not be taken to mean that there is necessarily a problem with the data — e.g., overdiagnosis of complications.

### **3.3 How Many Life-saving Procedures Are Performed?**

At the level of individual facilities, this question could be specified in a number of ways: the number of blood transfusions to obstetric patients, the number of dilation and curettage procedures for incomplete abortion, the number of obstetric patients receiving anti-convulsant drugs or antibiotics, or the number of cesarean sections performed. These same indicators can then be used for project monitoring and evaluation. The choice of indicator(s) should be made keeping in mind the quality of records. For example, records on surgical procedures are often better kept than those on the administration of drugs. Also, some important life-saving procedures that do not require special equipment (e.g., manual removal of placenta) are probably less likely to be recorded.

In some situations, and particularly for large areas, it will not be feasible to monitor so many different indicators, and it will make sense to choose one or two. One of the key procedures used to treat obstetric complications is the cesarean section. Without it, many women with obstructed labor (and some with eclampsia) will die. Cesarean section is also the procedure for which information is most often available. This is because operating theater registers are usually among the best kept records in a hospital. These two features make cesarean section a particularly good choice for monitoring the performance of life-saving procedures.

It is expected that a minimum of 5% of all births in a population will involve complications that require cesarean sections. Because of the potential for overuse of the procedure, a maximum level of 15% of all births has also been set.<sup>55</sup>

The Facility Data Summary form, provided in Appendix A.3, shows how to collect information on the number of cesarean sections on a monthly basis.

### **3.4 What Is the Quality of Life-saving Services?**

One way of assessing the quality of obstetric care is to calculate the proportion of women admitted to a hospital with complications who die. This proportion is called the obstetric case fatality rate (CFR). For many years, people have calculated a similar proportion called the "hospital maternal mortality rate" — the maternal deaths as a proportion of all births (or live births) in the hospital. We discourage use of the latter, because it fluctuates as the number of normal births in the hospital changes. Moreover, its meaning is unclear — it is certainly not an indicator of the level of maternal mortality in the population, because in many countries most deaths take place outside the hospital. CFR does not measure the population level of maternal mortality either, for the same reason. But it does reflect the quality of EmOC in the facility by measuring the likelihood of survival once women with complications

reach the hospital. (CFR is also influenced by the condition in which the patient arrives.) The goal for CFR is to have no more than 1% of women reaching the facility with complications die.<sup>56</sup> A recent survey of first referral hospitals in 10 districts in India found CFRs ranging from 1% to 7%, indicating that the quality of services in many districts was relatively good.<sup>57</sup>

Calculating CFR is not recommended for health facilities that refer most women with serious complications to higher-level facilities for treatment. This is because women with poor prognoses are likely to be referred out, resulting in a low CFR that is unrelated to the quality of care received. CFRs should therefore only be calculated for facilities that are the usual endpoint of the referral chain, such as a district hospital.

It is important to remember that CFR is most meaningful at the level of individual facilities. If CFRs from several different facilities in a state or country are aggregated, important information will be lost. An average CFR of 2% for all hospitals in Country X may sound good, but it may conceal the fact that while hospitals in the capital are doing well, some hospitals in the provinces have CFRs of over 25%. A more useful way to analyze CFR at the state or national level is to plot CFRs from individual facilities as separate points on a graph (a “scattergram”). Another way is to assess the proportion of facilities with CFRs at various levels — e.g., X% of facilities have CFRs less than 1%, Y% of facilities have CFRs between 1% and 5%, and Z% of facilities have CFRs greater than 5%.

The number of women with complications admitted to the facility is the denominator of the CFR. Thus, the ability to calculate this indicator also depends on the establishment of systems for counting the number of women with complications admitted (as described in section 3.2). Records of deaths, including cause of death, are usually available. The Facility Data Summary Form (Appendix A.3) is designed to collect data on the number of obstetric deaths that occur in a facility, by complication. It also provides rows and instructions for calculating CFR. If the number of women with complications is sufficiently large, trends in CFR can be monitored on a monthly basis. Monthly data make it possible for program managers to respond rapidly to changes in the indicator. If the number of women with complications per month is small, the CFR will be subject to large monthly fluctuations, and instead, quarterly or even annual measurements will need to be used.

As discussed earlier, prompt treatment is critical to preventing maternal deaths. Unfortunately, all too often there are delays even after a woman with a complication arrives at a facility for treatment. Measuring the time interval from admission to treatment is another way of assessing the quality of care provided. When using this indicator, it is crucial to set clear criteria (before starting the study) concerning which women will be included and what constitutes “treatment.” In order to avoid “comparing apples and oranges,” it is important not to include in the study women with widely varying needs — e.g., women with postpartum hemorrhage

and women having normal deliveries. Confining the study to women who require emergency cesarean section, for example, clearly defines both the population and the "treatment."

### **3.5 How Should Services Be Improved?**

If a particular hospital is not performing critical EmOC functions, or has an unacceptably high CFR, the next step is to ask why. The answers to this question are expected to provide information directly relevant to improving the situation.

There are many reasons why a health facility may not be providing adequate EmOC. It may be lack of drugs and supplies, or that equipment such as the blood bank or anesthesia machine is broken. Staff may not have the training to perform life-saving obstetric procedures. Or if staff are skilled, they may not be readily available on a 24-hour basis, or even for more than a fraction of the day. Poor procedures for managing complicated cases can also be a problem.

A good place to start in investigating what needs to be done is to make a site visit and carry out a straightforward inventory of key staff, equipment and supplies. Sample checklists of minimum required personnel and materials for the hospital and health center levels are provided in Appendices A.4 and A.5. Such checklists can also be useful for ongoing monitoring and supervision visits once the program has begun.

While an inventory checklist is a good way of identifying what human and material resources are lacking, it cannot tell you why they are lacking. For this, interviews with health facility staff are required. Health facility staff may be helpful in identifying the reasons for the problems, and perhaps even in identifying solutions. Interviews may also include questions on whether protocols for the treatment of obstetric complications exist, and whether they are practiced. It is important to interview a variety of staff — e.g., midwives, nurses, doctors and technicians — to avoid bias and get a well-rounded picture. Interviewing only the chief medical officer, for instance, could give a very distorted impression of things. The midwife in charge of the maternity ward is often most knowledgeable about the day-to-day functioning of the facility with regard to obstetric patients. A sample interview guide for use with health facility staff is provided in Appendix A.6.

Another method of identifying specific areas in need of improvement is to conduct case reviews of women admitted with obstetric complications (both survivors and non-survivors). This could involve both qualitative and quantitative information gathered from health facility staff, patients and/or relatives, and health facility records. Whatever methods and sources used, the focus of this

inquiry should be identification of factors — sometimes called “critical events” — that contribute to delays in treatment. Important quantitative data include time of arrival and time of life-saving treatment (such as surgery, administration of drugs, and blood transfusion), and cost of treatment and supplies. Qualitative information includes how treatment decisions were made, the process involved in deciding to seek care, and the patient's and/or her family's experience at the facility. Guides for collecting both types of data are provided in Appendices A.7 and A.8.

### **3.6 How Can Utilization Be Improved?**

Community-level needs assessment is an important part of designing any program to reduce maternal deaths. Even when facilities are functioning well, there may be significant barriers to women with complications using them. The research required to shed light on these barriers is relatively simple and inexpensive — usually community focus groups or in-depth interviews are sufficient. A community survey is not necessary.

Poor utilization of EmOC is frequently blamed on ignorance or traditional beliefs in the community. As noted earlier, however, the community's justified lack of confidence in poor quality services is often a more important factor. If this is the case, improving services and informing the community about the improvements may go a long way toward reducing maternal deaths. Some community members may not use the facility because they feel they are not treated with respect by health staff. This also would need to be addressed at the facility. Another possibility is that there are financial and geographic barriers to women reaching care. Or perhaps transport is only available on certain days. Or there may be a need to educate communities and traditional birth attendants on the signs of life-threatening complications and the importance of seeking prompt medical care. This is the kind of information that can only be learned from the community. Understanding the reasons for poor utilization will help you to design programs that allow women with complications to get the care they need.

Community data should be gathered from men as well as women, since men are often influential in determining whether women will seek treatment or not. Special groups such as traditional birth attendants, village leaders, and transport owners may also be helpful in identifying barriers and potential solutions. A sample Community Focus Group Discussion Guide is provided in Appendix A.9.

### **3.7 What Will Upgrading/Expanding Services Cost?**

When governments and international agencies consider implementing or replicating programs to reduce maternal deaths, they will want to know how much the programs will cost. Information on cost is key to dispelling the common assumption that improving EmOC will be prohibitively expensive. Activities to reduce maternal deaths will almost always be carried out within existing health systems, whether government or private. This usually means that most of the funds required have already been paid out — the hospital has been built, the doctors educated, etc. In many instances, therefore, what people in the ministry of health, for example, will be interested in is information on the cost of the additional inputs required to upgrade or expand EmOC services. This is called the "marginal" cost. Unfortunately, such information is rarely collected as a part of evaluation.

An example of a form for collecting data on the marginal cost of improving EmOC at hospitals is provided in Appendix A.10. Such improvements can often be collaborative efforts, with resources mobilized from governments, private agencies, and communities. The form in Appendix A.10 has been designed to measure the contributions of each.

Collecting information on the cost of community activities is also useful, as they are often more expensive than people expect. For example, conducting a community information, education and communication (IEC) campaign might include the cost of producing IEC materials for distribution, booking venues for IEC events, providing refreshments or other hospitality, and traveling to different locations. In addition, community activities often require donations of time or other resources by important opinion leaders who are not employed within the health system — traditional leadership, for example. Most community activities also require the dedication of ongoing efforts and resources to sustain their effects over time.

### **3.8 Data Sources and Instruments**

Figure 7 summarizes the data sources and relevant tools or instruments for collecting each kind of information required for the needs assessment.

**Figure 7. Information, Data Sources and Instruments for Needs Assessment**

What You Need to Know	Data Source(s)	Tool or Instrument
Are life-saving services available?	➤ Facility site visits	➤ Facility Functioning Assessment Form (Appendix A.1)
How many women are using life-saving services?	➤ Facility register(s)	➤ Suggested register headings (Appendix A.2) ➤ Facility Data Summary Form (Appendix A.3)
How many life-saving procedures are being performed?	➤ Operating room log book ➤ Blood bank log book ➤ Patient treatment notes	➤ Facility Data Summary Form (Appendix A.3)
What is the quality of the care provided?	➤ Facility register(s) and death records (to calculate CFR)	➤ Facility Data Summary Form (Appendix A.3)
How should services be improved?	➤ Supervision visits ➤ Health facility staff ➤ Case reviews	➤ Supervision Visit Checklist (Appendices A.4 & A.5) ➤ Health Facility Staff Interview Guide (Appendix A.6) ➤ Health Facility Questionnaire and Patient/Family Interview Guide for Case Studies of Women with Obstetric Complications (Appendices A.7 and A.8)
How can utilization of services by the community be improved?	➤ Community members	➤ Community Focus Group Discussion Guide (Appendix A.9)
What are the costs of upgrading/expanding existing services to provide EmOC?	➤ Project records	➤ Summary Form for Costs of Hospital Improvements (Appendix A.10)

## 4. Program Design

The information gathered during the needs assessment will help to determine which interventions are most important in a particular setting. For example, if it is found that cesarean sections are not being performed at the district hospital because there is no one trained to do them, a priority might be to arrange for such training. If women with complications are arriving at the hospital in poor condition because fluids and antibiotics are not available at the health center, then the program should address this shortage. If women are unable to reach health facilities due to lack of transport or funds, community interventions are needed.

The logic is straightforward (but often overlooked): the choice of program interventions should be grounded in the findings of the needs assessment. A case study of the use of needs assessment findings in program planning is presented in Figure 8 below.

In addition to the choice of activities, the order of implementation is also important. It is crucial not to begin community mobilization activities unless some EmOC services are already available and functioning. Obviously, if the facilities are not able to deal with obstetric emergencies, people should not be encouraged to use them. Therefore, in the following discussion we begin with improving the availability and quality of EmOC, then discuss improving transportation between health facilities, and then discuss mobilizing and educating communities. This does not mean that community activities are unimportant, it just acknowledges that they depend on a functioning health system in order to reduce maternal deaths.

The order of implementation is important for another reason, as well. If new activities are all introduced at the same time, their individual effects may be difficult to distinguish. For example, if services at the hospital are improved and community mobilization activities launched in the same month, it will not be possible to say which was responsible for any observed changes in utilization. For this reason, it may be useful to allow some time between the introduction of new activities. When activities are phased in this way, it may be possible to examine the effect of the first, and then the effect of the first combined with the second. For example, we might be able to say that after services at the hospital were improved, mean monthly utilization by women with complications increased by X%, and that after community activities were launched, an additional increase of Y% took place. Such information on the relative contributions of different activities can help set priorities for future program efforts. A method for planning for the implementation of activities will be described in Section 4.2.

## Figure 8. Case Study: Needs Assessment and Program Design in Zaria, Nigeria

### *At the Hospital*

**Needs Assessment Findings:** Interviews with doctors and nurses and a review of records at the teaching hospital revealed two main reasons for delays in treatment. First, drugs and surgical supplies needed to be purchased from pharmacies outside the hospital before treatment could begin. Second, the operating theater was not functional, primarily due to a broken anaesthetic machine. Average time from admission to treatment for women needing emergency surgery was almost 4 hours.

**Program Design:** Given these findings, the team decided to refurbish the operating theater, labor room and recovery room and to equip these facilities with the necessary supplies. Emergency obstetric supplies were pre-packaged and sold to patients at wholesale cost. In cases where relatives arrived unable to pay, treatment was started immediately, while relatives went home to collect money. The team also upgraded the hospital blood bank.

### *At the Health Center*

**Needs Assessment Findings:** A lack of drugs and materials — such as IV infusions, ergometrine, antibiotics, and antimalarials — was identified as a major constraint to providing basic emergency obstetric care at the rural health center. Moreover, patients referred to the teaching hospital were responsible for arranging their own transportation, which often contributed to substantial delay.

**Program Design:** The team equipped the health center with supplies and established a revolving fund to ensure that life-saving drugs were on hand. A used ambulance requiring a new battery was made available by the Ministry of Health for the transport of referred patients to the hospital. Finally, to upgrade the quality of service, the team organized refresher courses for health center staff in obstetric first aid and indications for referral.

### *In the Community*

**Needs Assessment Findings:** Focus group discussions in the community revealed several factors contributing to delays in seeking treatment. Women could not leave home without their husbands' consent. When the husband was not available, often no one else would give permission. Other factors contributing to delay in seeking care were the high cost of transportation, drugs and medical supplies, and the traditional custom of women laboring in solitude.

**Program Design:** Based on these findings, the team planned a public education campaign on recognition of complications and need for early referral. They also worked with community leaders to establish round-the-clock availability of local transport and a revolving fund for emergency obstetric care.

Finally, the monitoring and evaluation activities should be planned at the same time that the program is designed. This is to ensure that collection of data— and collection of the right data — begins prior to (if possible) or at the same time as program activities begin.

## **4.1 Designing Interventions**

Thinking about the various components of a program, and how they work together, is a key part of planning. It is often helpful to draw a diagram that shows the steps that make up the "causal pathway" leading from an intervention to a reduction in maternal deaths. Specifying the steps in the causal pathway is a good way to see whether any crucial steps have been forgotten. In the following sections, several key interventions to reduce maternal mortality are presented, and illustrated with examples drawn from the PMM Network. The causal pathways from these interventions to the desired outcome — a reduction in maternal deaths — are presented graphically.

### **4.1.1 Interventions to improve EmOC services**

Figure 9 presents the causal pathways for five key activities to improve the availability and quality of emergency obstetric care. Each of the interventions is discussed briefly below.

INSERT FIGURE 9 HERE

➤ **Improve availability of drugs and supplies**

Lack of drugs and supplies in health facilities contributes to delay of treatment in many developing countries. When such shortages occur, relatives of the patient are generally sent out to private pharmacies to purchase the needed items before treatment can begin.

In some situations, the problem can be remedied by improving the system of supply from the government's central storehouse to the district. In many situations, however, what is needed is a way to work around the problem.

The PMM teams in Africa have experimented with a variety of revolving fund plans. In the district hospital in Bo, Sierra Leone, there is now a 24-hour pharmacy which is independent of the country's procurement system. It sells commonly-prescribed drugs which have been bought from a commercial supplier in Europe, and the drugs are replaced with proceeds from the sales.<sup>58</sup>

The Zaria and Sokoto teams in Nigeria have established systems in which emergency obstetric "packs" that contain the drugs and supplies needed to treat serious complications are kept available in the obstetrics department at all times. Revolving fund mechanisms are in place to maintain the supplies.<sup>59,60</sup>

Other variations can be developed to fit local circumstances. The point of all of them is to decrease the delay in providing treatment by having necessary drugs and supplies in stock.

Some readers may be distressed by the idea of asking poor people to pay for supplies. Whether or not this is acceptable will depend on local circumstances.<sup>61,62,63</sup> At the moment, however, the alternative to having people pay for supplies is generally for the frantic relatives to be sent out into the town to search for the supplies. The town may be new to them, prices may be inflated, and if it happens to be night, pharmacies are likely to be closed.<sup>64</sup>

➤ **Upgrade facilities and equipment**

When the need for EmOC is pointed out, policy makers sometimes respond that providing EmOC will be very expensive. They assume that it means building new facilities and hiring new cadres of health workers. In reality, in many countries there are considerable resources already allocated to the health system that are under-utilized. For little additional cost, these can be upgraded to provide EmOC. This is not to imply that all the resources needed are available. But there are often substantial improvements that can be made largely by using existing resources.

The Freetown, Sierra Leone PMM team found an operating theater that was not being used for lack of a structure upon which to mount a lamp. The lamp itself was also sitting unused in storage. At little cost, the team installed a beam and

affixed the lamp. With the purchase of a laparotomy set and other equipment, an obstetric operating theater was put into service. The team also used low-cost equipment where possible. For example, instead of buying expensive sterilizing equipment, they purchased a kerosene stove and several large pots in which equipment is boiled.<sup>65</sup>

The Accra PMM team renovated an abandoned warehouse and converted it into a functioning village health post with a trained midwife on staff. By mobilizing resources from the community, the Ministry of Health, and private charitable organizations, the team only needed to contribute 10% of the US \$12,000 required.<sup>66</sup>

### ➤ **Improve staff capabilities**

Upgrading the skills of staff — physicians, midwives or nurses — is an important part of extending EmOC out toward the people who need it. For example, in many countries there are district hospitals staffed by general practice physicians who do not perform cesarean sections. Instead, they refer all women who need surgery to the nearest teaching hospital (which is often in the country's capital). Similarly, in many countries midwives are not trained or authorized to do such life-saving procedures as manual removal of retained placenta. There is no technical reason for such policies, and they result in many deaths.<sup>67</sup>

In Sokoto, the PMM team arranged for obstetrician specialists to come for periodic visits. During their stay, they trained local general physicians in emergency obstetric procedures while also treating women with complications.<sup>68</sup>

The Kumasi PMM team in Ghana arranged training for midwives at the Juaben Health Center. They noted that a substantial proportion of manual removals of placenta, vacuum extractions and episiotomy repairs were subsequently performed by the midwives.<sup>69</sup>

The Enugu, Nigeria PMM team found that privately-owned facilities were important providers of EmOC in their area, but that much of the care in these facilities was provided by relatively unskilled auxiliaries. Working with the proprietors, the team arranged EmOC training courses for the auxiliaries, including a clinical rotation at nearby hospitals.<sup>70</sup>

Of course, the lessons learned about training in other fields should be applied here, whenever possible. For example, it is preferable to train the whole surgical team together (physician, nurse, anesthetist). Also, phased training — which allows people to use a few new skills before learning more — is preferable to one long training course.<sup>71,72</sup>

### ➤ **Increase staff coverage at facilities**

As with the problem of drugs and supplies, lack of 24-hour availability of key staff is endemic in developing countries. The district hospitals and health centers in many countries function for only a fraction of the day (often morning), and are virtually inactive the rest of the day and all of the night. This may be true even when there are a number of doctors on staff.

The reality of the situation is that government salaries in many places have not kept up with inflation (or currency devaluation), and therefore staff supplement their salaries by having private practices. Perhaps it is not possible to change this situation, but in many places a rotation roster could be put in place so that the hospital would always be adequately staffed.

Another cause of inadequate coverage, even in teaching hospitals, is the practice of doctors being "on call" but off the premises. In such situations, when an emergency cesarean section is needed in the middle of the night, then a car must be found (often the ambulance) to go collect the doctor. Such delays can be fatal to the woman.

The Calabar, Nigeria PMM team has created an "on-call room" in the obstetrics ward where doctors are expected to stay when on duty. In this way, the expenditure of a small amount of money (for paint, bed, air-conditioner, etc.), in conjunction with improved supervision and management, can make better use of existing staff.<sup>73</sup>

➤ **Improve availability of blood at facilities**

Improving access to blood for transfusions can expand the range of emergency services performed in a facility. Many district hospitals, at present, have no blood supply. In teaching hospitals, getting blood from the hospital's central blood bank sometimes wastes precious time. A blood bank need not be a very complicated or sophisticated arrangement. Technical advice can be obtained from the WHO or other organizations. Once the blood bank is functioning, it may then be appropriate to make blood donation part of the community mobilization drive.

The Bo PMM team found an unused but functional large-capacity blood bank in the Ministry of Health storehouse, and arranged to have it transported to the district hospital in Bo. After using it for a while, they found that many units of blood were being wasted due to the irregularity of the electrical supply. They responded by purchasing a smaller, simpler kerosene/electric refrigerator, and storing smaller quantities of blood which they would replace immediately upon using.<sup>74</sup> The Freetown team established a functional blood storage system using a UNICEF cold chain box.<sup>75</sup>

**The causal pathway for improving EmOC services (see Figure 9)**

<b>Step 1</b>	The first step of the hypothesized causal pathway is the intervention itself — improving the availability and quality of services. This could be any of a number of activities (Steps 1a-1e).
<b>Step 2</b>	The interventions in Steps 1a-1e are expected to lead to the second step in the pathway — improved treatment of complications.
<b>Step 3</b>	Improved treatment is expected to lead to improved outcomes — i.e., fewer deaths among women with obstetric complications treated.
<b>Steps 4 &amp; 5</b>	Improved treatment is also expected to reduce maternal deaths by another route. Improved services can improve the reputation of the health system in the community (Step 4), which can in turn, lead to increased utilization of emergency obstetric services (Step 5).
<b>Impact</b>	If the changes envisioned in steps 1 - 5 take place, then maternal deaths should be reduced in the population.

### 4.1.2 Interventions to improve transport

Interventions to improve transport of women with complications can be divided into two types: those aimed at transporting women between health facilities (e.g., from health center to hospital), and those aimed at transporting women from the community to the health system. The former generally entails some form of ambulance operated by the health system. The latter is more likely to be a part of community mobilization activities. Therefore the two are treated separately here.

Figure 10 shows the causal pathway for an intervention to improve transportation between health facilities. Depending on the situation, it may or may not be feasible to have an ambulance at every health center. While ambulances may seem like a relatively simple solution, in fact they are often not working or not around when they are needed. So, again, management and supervision are crucial. Where it is not possible to have an ambulance at every facility, it may be possible to have some way to call for the ambulance, as shown in the example below.

The Bo team posted a single 4-wheel drive vehicle to the district hospital and motorbikes at surrounding government health centers. In the event of an emergency, health center staff would travel by motorbike to the hospital to summon the vehicle. This system was vulnerable to breakdowns and road accidents, and the travel time it took was substantial. Later, shortwave radios were installed in the health centers, at the hospital, and in the vehicle, which proved to be a more satisfactory system.<sup>76</sup>

INSERT FIGURE 10

**The causal pathway for improving transport between facilities** (see Figure 10)

- Step 1** The intervention is the first step — refurbishing or purchasing an ambulance (or other suitable vehicle) to transport women with complications from lower to higher level facilities, e.g., health centers to hospitals.
- Step 2** Awareness of the improved transportation to the hospital is expected to increase the number of women with complications seeking care at the health center.
- Step 3** Improvement in transportation between health facilities is also expected to affect the staff's decision to refer for further treatment those women whose complications cannot be treated at the health center. Factors affecting referral of patients could be assessed by interviews with staff at the referring facilities.
- Step 4a** Changes in the decision to refer are expected to have two important results in the fourth step. First, the availability of improved transportation should result in more referrals being completed.
- Step 4b** Second, the improved transportation is expected to reduce the time it takes for women to get from the health center to the hospital.
- Step 5** Step 5 is the provision of treatment to women with complications at the hospital. The reduction in delay due to transport problems is expected to lead to improved outcomes among women who are referred for treatment.
- Impact** If all of these changes happen as planned, this should reduce the number of maternal deaths in the population.

### 4.1.3 Interventions to mobilize communities

#### ➤ Educate communities

Community members need to be able to identify complications and seek care promptly. Educating people in the community — including traditional birth attendants (TBAs) — is one of the most important community-level interventions. The major obstetric complications are usually not difficult to recognize (see Figure 11). Certainly, discussing the signs and symptoms should be part of antenatal consultations and training for traditional healers. This information should be spread widely in the community — not just to pregnant women and traditional birth attendants. The TBA may not be there when a woman starts to bleed, and husbands and mothers-in-law may be the ones to decide whether to seek care, and from whom.

#### **Figure 11. Community Education on Recognition of Complications**

*Seek emergency obstetric care if any of these occur:*

- Any vaginal bleeding before labor
- Heavy bleeding during or after labor
- Severe headaches and/or fits
- Swollen hands and feet
- Fever
- Smelly vaginal discharge
- Labor from morning till nightfall or vice versa
- Any part of the baby showing except the head

After upgrading services in facilities, the Sokoto team launched a community education campaign to encourage greater utilization of services. Their messages focussed on recognition of complications and the need for prompt treatment. They used various means to disseminate these messages, including weekly meetings with community leaders, video shows, posters and flyers.<sup>77</sup>

The Kumasi PMM team disseminated similar messages, spreading word of the improved services at facilities. They made use of existing channels of communication — Ministry of Health outreach and village health workers, public health nurses and midwives, and village health committees — and addressed a variety of audiences, including women's and church groups.<sup>78</sup>

The Calabar PMM team adopted a different approach, training a group of community educators to disseminate key messages.<sup>79</sup>

➤ **Improve community transport**

Even if there were an ambulance at every health center, women would still need to be able to reach the health center. This is where community mobilization is key.

The Freetown PMM team organized "action groups" of village men prepared to transport women by hammock to the nearest road in the event of a complication.<sup>80</sup>

The Sokoto team worked with the local transport unions, conducting sensitization and awareness workshops and establishing an emergency fuel fund for drivers who transport women with complications.<sup>81</sup>

The Zaria team motivated local drivers to agree to transport women with complications for a predetermined and reasonable fee.<sup>82</sup>

➤ **Establish emergency loan funds**

The cost of transport, hospital fees and supplies may add up to more money than most families have available on short notice. Emergency loan funds, run by community leaders, are a way to deal with this problem. In some societies — including various groups in West Africa — there are traditional savings clubs. In such societies, programs can build on this local expertise. Establishing an emergency fund presents opportunities to emphasize to community leaders the importance of prompt medical care for women who develop complications. It can also provide a forum for community education, e.g., at a ceremony to inaugurate the fund.

The Benin, Nigeria PMM team worked with the traditional clan leadership in their area to set up emergency loan funds for women with complications. With a small amount of seed money from the team, community members contributed several hundred dollars to establish the funds. The funds were managed entirely by the community, which decided upon a 6-month grace period with nominal interest charged thereafter. In the first year of operation, several hundred small loans were granted, and almost all were repaid in full.<sup>83</sup>

The Zaria team in Nigeria and the Bo team in Sierra Leone also worked with communities to set up loan funds. Again, the funds were managed entirely by the community.<sup>84,85</sup>

Figure 12 depicts the causal pathways for the three key community-level interventions described above.

INSERT FIGURE 12

**The causal pathway for mobilizing communities** (see Figure 12)

- |                |  |
|----------------|--|
| <b>Step 1</b>  | The first step is to carry out the community activities.   |
| <b>Step 2</b>  | Each of the community activities is expected to affect the decision to seek care, either by helping people recognize the need for medical care more quickly, or by improving their access to money and transportation.                                   |
| <b>Step 3a</b> | Community interventions are expected to have two important results. First, they should increase the number of women seeking care.  |
| <b>Step 3b</b> | Second, all of these interventions are expected to reduce the time it takes women to get to facilities.  |
| <b>Step 4</b>  | Step 4 is treatment provided at the facility. The number of women receiving treatment at the facility should be increased. The reduction in delay is expected to lead to improved outcomes among women with complications who reach the health facility. |
| <b>Impact</b>  | If steps 1 - 4 are accomplished, then maternal deaths in the population should be reduced.   |

## 4.2 The Implementation Plan

The implementation plan specifies the timing and order of program activities. It often takes the form of a timetable, and serves as an overall work plan for the program. The implementation plan can also include the timing of monitoring and evaluation activities, as a reminder that data collection procedures need to be in place before program activities begin. This will also help managers plan for periodic review of data collected and the writing of interim evaluation reports. For this reason, the implementation plan should be written at the same time as the monitoring and evaluation plan (section 5.2). An example of an implementation plan is provided in Appendix A.11.

## 5. Monitoring and Evaluation

It is hardly possible to overemphasize the importance of monitoring and evaluation of health programs. It is not enough to design and implement apparently worthwhile activities. We have to make sure they work on the ground. Process and output indicators are especially useful in this regard because they provide information not only for the final evaluation, but also for ongoing management and improvement of program components.

In this chapter, we will return to the causal pathway diagrams presented in Chapter 4, and use them to derive a set of process and output indicators for each intervention. The general idea is to use the diagrams to develop indicators for steps at several points along the hypothesized pathway between an intervention and the reduction in maternal deaths. Then by watching for changes in these indicators, it is possible to make inferences about program effect. Once you are familiar with this approach, you can use it to develop indicators for any program.

There is a growing recognition in the field of international health that not all projects can be expected to measure impact. Instead, what is important is that the indicators used have an established connection with the goal of the program. This is the idea behind using process and output indicators.

Using process and output indicators differs from using impact indicators in that a number of kinds of information is usually required. By gathering information on several process and output indicators along a pathway, we are better equipped to make inferences about the effect of program activities on the desired outcome. Several of the interventions share common pathways, and hence indicators. This greatly simplifies data collection.

You will notice that the monitoring and evaluation indicators derived below correspond to the needs assessment questions outlined in Chapter 3. This should come as no surprise. The information needed to design a sensible program is the same information needed to assess how it is working — information on the availability, utilization, and quality of emergency obstetric services. Ideally, the information collected during the needs assessment should serve as the baseline information against which progress is measured.

OJO Insert Figure 13 (version with pages 1 and 2, condensed onto 1 page)

Note: For each of the following figures and text description, the figure should be on the left hand pages (even-numbered pages), and the text description facing it on the right (odd-numbered pages).

## 5.1 Deriving Indicators

### 5.1.1 Indicators of improving services

Figure 13 shows again the causal pathways for five key interventions to improve the availability and quality of emergency obstetric care: improving availability of drugs and supplies; upgrading facilities and equipment; improving staff capabilities; increasing staff coverage; and improving availability of blood. It also shows the process and output indicator(s) that derive from each step in the pathway, as well as the sources for gathering data on these indicators. The derivation of indicators is discussed step-by-step below.

- Step 1** The first step of the hypothesized causal pathway is the intervention itself (see Figure 13). The evaluation indicators for this step are direct measures of program process or output (e.g., availability of drugs and supplies, utilization of drugs and supplies, etc.).
- Step 2** All of the interventions in Figure 13 can be expected to lead to the second step in the pathway — improved treatment of complications. A number of indicators can be developed to measure this, including a reduction in time from arrival to definitive treatment and an increase in the number of cesarean sections (or other life-saving procedures) performed.
- Step 3** Improved treatment can be expected to result in improved outcomes among women treated. The indicator for this step would be a reduction in case fatality rate (CFR) — the proportion of women admitted with obstetric complications who die.
- Step 4** Improved treatment can also be expected to reduce maternal deaths by improving the reputation of the health system in the community (Step 4), which should, in turn, lead to increased utilization of emergency obstetric services (Step 5). The indicator for Step 4 would be the reputation of the health system in the community, as measured by opinion survey, for example.
- Step 5** The indicator for Step 5 would be the number of women with obstetric complications admitted to the facility.
- Impact** Because we are using process and output indicators, this step is not measured. Impact is inferred from changes in the process indicators.

INSERT FIGURE 14

### 5.1.2 Indicators of improving transport

Figure 14 shows the causal pathway for an intervention to improve transportation between health facilities.

- Step 1** First there is the intervention step, with its immediate process and output indicators (e.g., the existence, functioning and/or utilization of an ambulance).
- Step 2** Improved availability of transportation between facilities is expected to increase the number of women with complications seeking care at the health center. The indicator for this step is the number of women with complications admitted to this facility.
- Step 3** Improvement in transportation between health facilities is also expected to affect the staff's decision to refer a woman for further treatment. The indicator for this step is the number of women with complications referred from the health center. Interviews with staff at the referring facilities may indicate how the intervention has changed their behavior.
- Step 4a** Changes in the decision to refer are expected to have two important results. First, the availability of improved transportation should result in more referrals being completed. The indicator for this step is the number of completed referrals — i.e., women with complications admitted to the hospital who were referred from the health center.
- Step 4b** Second, the improved transportation is expected to reduce the time it takes for women to get from the health center to the hospital. There are at least two possible indicators here: the woman's physical condition on arrival at the referral facility; and time from decision to refer to arrival at the referral facility. We would recommend using condition on arrival, for several reasons. First, the data to measure this (e.g., blood pressure, temperature, etc.) can be gathered at the hospital, whereas data for tracking the interval from decision to refer to admission need to be gathered at both the health center and the hospital, which is more complicated. Secondly, it is easier to objectively define "condition on arrival" than to define "decision to refer."
- Step 5** Improved outcomes among women with complications is expected to result from earlier arrival at the referral facility. Case fatality rate among women referred can be used as an indicator of this. However, caution must be taken in interpreting this indicator, since it will reflect improvements in services at the facility as well.
- Impact** As before, this step is not measured. Impact is inferred from changes in the process and output indicators.

INSERT FIGURE 15

### 5.1.3 Indicators of mobilizing communities

Figure 15 depicts the causal pathways for the 3 key community-level interventions: educating communities (including TBAs); improving community transport; and establishing emergency loan funds.

**Step 1** Immediate process and output indicators might be: the number of community education sessions held; the number of people participating in community education sessions; knowledge of signs of complications among participants in education sessions; the number of transport owners mobilized; the number of women transported; the number of loan funds established; the number of loans granted or repaid; etc.

**Step 2** Each of these community-level interventions may affect the decision to seek care. Information on barriers to seeking care are best assessed qualitatively, through interviews and focus groups with members of the community, community leaders and TBAs. Mini-surveys<sup>c</sup> can be used to measure people's views about factors affecting the decision to seek care, and to assess change over time.

**Step 3a** Community interventions can have two important results in the third step. First, they should increase the number of women seeking care. The indicator for this step is the number of women with complications admitted to the facility.

**Step 3b** Second, all of these interventions are expected to reduce the time it takes women to get to facilities. For this step, the indicator is condition on arrival at the facility.

Another indicator for this step — time from onset of complication to arrival at facility — is generally not recommended. However, it may be useful in some situations. For example, since the determination of “time of onset” varies depending on the particular complications (e.g., for hemorrhage it would be the time bleeding began, for obstructed labor it would be onset of labor), this indicator is better suited to for use with a single type of complication. It is difficult to gather reliable data on this time interval, as it depends on asking the patient or her relatives when the complication began and they may not be able to give a precise time. Rough measures — e.g. days — can be used for some complications. Also, it is advisable to gather information on distance as well, so that time intervals can be validly compared.

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<sup>c</sup> A mini-survey contains a small number of questions, and responses for 10-12 people fit onto one page, making it easy to tabulate the data.

**Step 4** The reduction in delay is expected to lead to improved outcomes among women with complications who reach the health facility. The case fatality rate can be used to monitor this. Again, caution should be used in interpreting CFR, as it will also reflect changes in services at the health facility.

**Impact** From the process and output indicators, the impact of these community interventions on maternal deaths in the population can be inferred. If the number of women with complications reaching a health facility increases, and the case fatality rate decreases, we can be reasonably sure maternal deaths in the population are being reduced.

## **5.2 Planning Monitoring and Evaluation Activities**

The monitoring and evaluation plan specifies the indicators which will be used for each activity, where data will come from, how often data will be collected (or summarized if it is routinely collected information), and who will collect the data. Development of a monitoring and evaluation plan before beginning new activities serves a number of purposes. First, it enables the planners to think through what they expect to happen. A second function is to define which data will need to be collected and when. A third purpose is to determine in advance what resources will be necessary for conducting monitoring and evaluation activities.

One way of thinking about the kinds of information you are going to need is to outline the final report which will be presented, and develop mock-ups of tables or charts which would illustrate the program's effects. These tables or charts can be used to cross-check that all of the necessary information is being collected.

A sample monitoring and evaluation plan is provided in Appendix A.12. The monitoring and evaluation plan should be developed at the same time the implementation plan is written. As noted earlier, this is to help ensure that the necessary data are collected right from the start of program activities. Moreover, funding agencies are increasingly requiring that proposals specify how monitoring and evaluation will take place.

Keep the monitoring and evaluation simple. Collect information on as few indicators as possible and limit the number of research methods used. A simple monitoring and evaluation plan has several advantages. First, it is more likely to be carried out than one which places heavy demands upon the time of the service providers and program managers. A related advantage is that a simple plan will require fewer resources. Since the overall goal of programs is to improve health, monitoring and evaluation efforts should not unnecessarily shift resources away from service provision.

## **5.3 Using Results for Program Management**

In order to ensure that data are useful, it is important that they be available on a timely basis. They also need to be easy to use. It may be helpful to develop a standard reporting format which the people collecting the data can use to summarize data. Service providers or other personnel can construct simple charts or graphs to show changes in key indicators over time. Periodic meetings to discuss the trends shown on the graphs are useful for discussing the possible reasons behind any changes. Periodic review of the data collected should be built into the program's implementation plan. These times should be used as "decision points" — opportunities to assess how program activities are progressing and to make decisions on what modifications are required. In this way, program components that are identified early on as ineffective can be discontinued, while others can be modified or strengthened.

One way to encourage the timely use of information is to make sure that it is available to people in the program. For example, if program staff are just asked to report "raw" data on their activities to the district or national level, they are unlikely to use these data themselves. But if the program staff are responsible not only for collecting the data but also for calculating some of the key performance indicators, they are more likely to make use of them to guide their activities. Supervisors should be trained to include review of data in their supervisory tasks, but program staff are more likely to be diligent in collecting data when they use them in managing the program.

It should be noted that using results for program management implies some decentralization of decision-making. Data at the district or health center level will not be very useful if the manager does not have any power to make decisions based on the findings.

When interpreting the data you have collected, a **program diary** can be tremendously helpful. A program diary can be a simple notebook in which the program manager records, by date, any events or changes which may have an effect on the program. Entries should be made on a weekly basis and include both program and non-program events. For example, the dates of the posting of a new doctor, the arrival of a shipment of drugs and supplies, or an interruption of electrical service for the operating theater should all be recorded. Equally important, however, would be a transport strike, a sharp downturn in the economy, the closing of a nearby health facility, or the opening of a new road, because each of these factors may be expected to have an effect on utilization. Suppose that the number of women with complications coming to the hospital increases sharply in a short period. This type of information can be invaluable in considering what factors were responsible.

Even with a project diary, however, sometimes the reasons for a change (or lack of change) in an indicator will remain unclear. In these situations, a quick qualitative investigation into the matter can be useful. For example, suppose after conducting a careful needs assessment, surgical capacity and blood storage capabilities at the hospital are improved, but the expected reduction in case fatality is not seen. A more detailed investigation of the functioning of the hospital using interviews with key staff, case reviews, and/or direct observation might reveal constraints that were missed at the outset, or new problems that had not been anticipated.

Similarly, if hospital utilization does not increase as expected, focus groups in the community may be helpful in identifying barriers that need to be addressed.

In the interests of conserving space, we do not discuss how to use each individual indicator, but a few general principles apply. For most of the program indicators described below, changes can be reported in either absolute numbers or proportions. For example, in Figure 13, the availability of drugs and supplies is the first indicator listed. This can be measured either in absolute terms (using counts) or relative terms (using proportions). An example of reporting a change in absolute terms is: "Before the project there was no refrigerator in which blood could be stored, but the team purchased one." In this example, the previous "count" was 0, and this increased to 1. An example of using a proportion to report change is the following: "During the situation analysis, only 30 percent of the drugs and supplies on the checklist were present in the hospital's obstetric ward. During the last year of the project, monthly supervision visits found that 85-97 percent of items on the list were available." While program personnel can construct checklists themselves, it is good to use standard lists if these exist. Using standard lists helps promote comparability of results from different studies. Often, government agencies have standard lists of drugs and supplies that can be used in checklist, or international agencies have produced them.<sup>86,87</sup>

Some indicators are best reported using categories. This is especially true of some of the newer indicators, such as admission-to-treatment interval, and condition on arrival among women admitted with obstetric complications. For example, one might report the proportions of admission-to-treatment intervals that fell into the following categories: less than 1 hour, 1-6 hours, more than 6 hours. Categories should reflect meaningful differences. For example, for the woman waiting for life-saving care, the difference between 1 hour and 4 hours is much greater than that between 21 and 24 hours. For some indicators, considerable thought will be required to construct categories. For example, to group women with complications based on condition on arrival, it will be necessary to define categories in terms of ranges of blood pressure, temperature, etc. Often, 3 categories will be sufficient — e.g., poor, fair, good.

### **Figure 16. Summary: Key Features of the Strategy for Program Design and Evaluation**

**Use of existing data for initial assessment and as baseline data.** The strategy emphasizes using facility-based data, many of which are already being collected, to guide program design, and then using these data as a baseline against which to measure progress.

**Integration of program design and evaluation.** This is recommended for all public health programs, but it is especially important for maternal mortality and other reproductive health programs which rely heavily on process and output indicators.

**Use of process and output indicators.** We make inferences about program impact and the contributions of program components based on careful monitoring of process and output indicators, as well as attention to external factors which could affect the project.

**Use of output data based on service utilization.** The strategy for design and evaluation of maternal mortality programs relies heavily on the collection of service utilization data. This is because utilization of prompt emergency medical care is key to the reduction of maternal mortality.

**Collection of cost data.** Data on cost of interventions is useful for informing decision-makers about the replicability and sustainability of programs.

**Use of both quantitative and qualitative data.** Quantitative data are used to assess the availability, utilization and quality of services. They answer the questions “how much?” or “how many?”. Qualitative data provide insight into the reasons for observed patterns in the availability, utilization and quality of services. They answer the question “why?”. Qualitative data are useful at various stages of the program, but especially in program design.

**Periodic review of data for program management.** An advantage of using process and output indicators is that they provide information that is useful to program managers over the course of the program. The indicators respond rapidly to changes and are meant to be reviewed on an ongoing basis.

## 6. Disseminating Information

The best-laid monitoring and evaluation plans and most carefully conducted evaluation research will have little impact unless the right people receive the information. People who should have access to the monitoring and evaluation information include the following: service providers; program managers; local policy makers; national policy makers; funding agencies.

The strategies for making information available and useful to these groups will vary. The report for policy makers will not be the same as the information required by program managers responsible for day-to-day activities. Consider publicizing the research results in a number of different ways. Think about who the different audiences are, and what each needs to know about the program. The best way to reach some audiences (e.g., Ministry personnel) is to hold a national workshop. Media coverage of such events is a great way to spread the message even more widely. Other audiences are best reached through newsletters, and still others through international journals. Some general guidelines are the following:

**Involve people who could use the information as early as possible.** Results from monitoring and evaluation activities are more likely to be used if the program planners or service providers feel that they have been involved in the decision-making process. Having them collect data is usually not perceived as involvement enough. To make them feel a part of the process it is a good idea early on to discuss with them issues such as the indicators and methods which will be used. Officials from public and private agencies should also be kept informed in a timely manner. These people may provide good ideas and help in solving potential obstacles the program may face.

**Provide information as early as possible.** This can take the form of periodic updates on the program and should start early. Program planners and service providers are more likely to use the results of monitoring and evaluation activities if they have been kept informed.

**Present important information verbally as well as in written reports.** Whenever possible, small workshops, meetings or other occasions should be used to present important information. A set of guidelines for making clear charts, graphs and visual aids for presentations is included in Appendix A.13.

**Keep reports simple and concise.** The more concise and easy-to-read reports are, the more likely they are to be read. Periodic monitoring reports might consist of two or three simple tables or charts, and a couple of pages of text which describes and analyzes the data and includes recommendations. Suggested sections for a more extensive report required at the end of a project cycle, and recommended page lengths, are listed in Figure 17 below.

**Figure 17. Outline of Interim or Final Reports**

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|----|--|----------------|
| 1. | Executive Summary                          | (2 pages)      |
| 2. | Background/Introduction                    | (2 pages)      |
| 3. | Methods used                               | (3 pages)      |
| 4. | Results                                    | (8-10 pages)   |
| 5. | Conclusions and Recommendations            | (4 pages)      |
| 6. | Appendices: Maps, tables, instruments used | (if necessary) |

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