

## Chapter 16 Maternal Mortality

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At the close of the last century, Sub-Saharan Africa still had high maternal morbidity and mortality rates, with the goals of safe motherhood eluding many governments. The Programme of Action of the International Conference on Population and Development of 1994 and the Fourth World Conference on Women of 1995 were created in an attempt to tackle these issues and drew unprecedented attention to reproductive health and rights as well as to gender equity and equality. The scourge of the human immunodeficiency virus and acquired immune deficiency syndrome (HIV/AIDS) has ravaged the region's population and has left in its wake untold destruction in the demographic, economic, and social spheres ([UN 2003](#)). Demographic events of the last decade are a sharp contrast to those in the 1980s, when decreasing infant, child, and adult mortality rates and maternal mortality ratios (MMRs) were leading to steadily increasing life expectancy and improved health status for women in the region.

Data sets assembled since the 1990s are the basis for the analysis of maternal mortality in Sub-Saharan Africa in this chapter. Beginning with an examination of measurement approaches and data sources of maternal mortality, the chapter continues with a description of the levels and trends in maternal mortality in the decade 1990–2000. The causes and correlates of maternal mortality, as well as priority interventions, are examined. The last section of the chapter points to what Sub-Saharan African countries could do to meet the maternal health component of the Millennium Development Goals.

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### Measurement and Data Sources

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Measuring maternal mortality remains one of the more difficult issues in maternal health, and yet an accurate picture of the scope of the problem is important to implement approaches to improve maternal health care.

#### Definitions

The World Health Organization's (WHO's) 10th revision of the *International Statistical Classification of Diseases and Related Health Problems* (ICD-10) defines *maternal mortality* as "the death of a woman while pregnant or within 42 days of termination of pregnancy irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes" ([WHO 1992](#)). Furthermore, the ICD-10 introduced a new category, namely, *late maternal death*, that is defined as "the death of a woman from direct or indirect obstetric causes more than 42 days but less than one year after termination of pregnancy." The ICD-10 defined *direct obstetric deaths* as "maternal deaths resulting from obstetric complications of the pregnant state (pregnancy, labor, and the puerperium), from interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above." *Indirect obstetric deaths*, by contrast, are "those resulting from previous existing disease or disease that developed during pregnancy

and which was not due to obstetric causes, but was aggravated by physiologic effects of pregnancy." Because accidental deaths are excluded from the definition of maternal deaths, the ICD-10 introduced the term *pregnancy-related death*, defined as "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death" ([WHO 1992](#)).

Maternal mortality is associated with neonatal mortality, but a lack of data, especially for Sub-Saharan Africa, constrains conclusive findings. A review of the literature suggests that a relationship exists between maternal mortality and perinatal mortality, including stillbirths and early neonatal deaths, and that interventions that save the lives of mothers are also effective in reducing neonatal mortality ([Bang, Bang, and Reddy 2005](#); [Darmstadt et al. 2005](#); [Jacobson 1991](#); [Kwast 1996](#); [Lompo et al. 1993](#); [Onuh and Aisien 2004](#)).

### Measures of Maternal Mortality

Three measures of maternal mortality are commonly used. First, the *maternal mortality ratio* is expressed as the number of maternal deaths during a given time period per 100,000 live births during the same period:

The MMR represents a measure of the risk of death once a woman has become pregnant. As a ratio, it is not a true risk, as it involves two different populations, pregnant women and live newborns. The ratio can be influenced by the prevalence of stillbirths as well as the prevalence of induced abortions.

Second, the *maternal mortality rate* is the number of maternal deaths in a given period per 100,000 women of reproductive age during the same period:

The maternal mortality rate is a cause-specific mortality rate for women of reproductive age in the presence of other causes of death.

Third, the *lifetime risk of maternal death* is the risk a woman has of dying during her reproductive years, given current rates of fertility and the risk of maternal mortality. Given the length of the reproductive period (about 35 years), the lifetime risk is calculated as  $[1 - (1 - \text{maternal mortality rate})^{35}]$  ([AbouZahr and Wardlaw 2003](#)).

### Data Sources

Estimation of maternal mortality indicators is difficult and subject to error because the data on which the estimates are based are frequently inaccurate. In the estimates produced jointly by the WHO, the United Nations Children's Fund (UNICEF), and the United Nations Population Fund (UNFPA) ([AbouZahr and Wardlaw 2003](#)), countries are classified into one of the following four categories:

1. countries with complete civil registration and good cause-of-death attribution

2. those with complete or nearly complete civil registration of the number of births and deaths but with poor cause-of-death attribution
3. those without a reliable system of civil registration, where maternal deaths, like other vital events, go unrecorded
4. those with estimates of maternal mortality based on household surveys, using direct or indirect sisterhood methods.

Most Sub-Saharan African countries fall into the last two categories. This implies that estimates of maternal mortality in Sub-Saharan Africa are derived from the methods mentioned in category 4 above. When estimating maternal mortality for these countries, the WHO, UNICEF, and the UNFPA use an approach that includes adjusting country data to account for underreporting and misclassification and a statistical model to generate estimates. Maternal deaths are generally identified by medical certification when vital registration exists; in household surveys, censuses, and Reproductive Age Mortality Studies (RAMOS), a time of death definition is used, making these "pregnancy-related deaths" rather than "maternal deaths." Several sources of data on which estimates of maternal mortality rely are described briefly below.

### **Vital Registration**

This source is generally used in developed countries, where maternal mortality is estimated from deaths registered by cause of death. It permits calculation of period-specific maternal mortality ratios in which the numerator is registered maternal deaths and the denominator is the registered live births (see equation 16.1). Where the degree of underreporting of maternal deaths is almost similar to that of live births, the resulting maternal mortality ratio will give a reasonable population-based estimate. In Sub-Saharan Africa, vital registration is lacking in all countries, with the exception of Mauritius. In the rest of Sub-Saharan Africa, vital registration-based maternal mortality estimates are inadequate because of the failure to register vital events, as well as the misclassification of causes of death, due to the absence of medical personnel and for social, religious, and emotional reasons ([Graham 1991](#)). In view of these shortcomings, the vital registration system is ruled out as a reliable source of measuring maternal mortality in the region.

### **Population-Based Data**

In the absence of complete vital registration, the main sources of population-based data are censuses and surveys, which use one of the following approaches to estimate maternal mortality: RAMOS, sisterhood method, sibling-history method, and household deaths methods. The key characteristics of each of them in the context of Sub-Saharan Africa follow.

Decennial census counts can generate both national and subnational data with questions on deaths in the household in a defined reference period (one or two years before the census), followed by detailed questions that permit identification of maternal deaths according to time of death relative to pregnancy. Estimates of maternal mortality derived from censuses in this way are believed to be fairly accurate ([Stanton et al. 2001](#)). A problem is that censuses of Sub-

Saharan African countries ask questions that are often not useful for identification of maternal deaths, which, in addition, are often not fully reported.

A RAMOS study seeks to identify all deaths of females of reproductive age in a defined population by investigating all relevant sources of information, namely, household interviews, hospital and health center records, vital registration, or word of mouth. Generally, a team of physicians studies the information collected by the study team to determine maternal mortality ([Stanton, Abderrahim, and Hill 1997](#)).

Investigation of maternal mortality by the sisterhood method, an indirect approach, entails asking respondents about ever-married sisters: how many have died, and how many died while they were pregnant or during childbirth or six weeks following the end of the pregnancy ([Stanton, Abderrahim, and Hill 2000](#)). This method has been used frequently in population-based approaches, such as household surveys. Originated by W. J. Graham and W. Brass ([Graham 1991](#)) in a field trial in The Gambia in 1987, it is a simple and low-cost technique with considerable appeal in maternal mortality studies. The method provides a retrospective rather than a current estimate, averaging experience over a lengthy time period, 35 years, with a midpoint of about 12 years before the survey. The estimates have wide confidence intervals, making short-term monitoring of maternal mortality trends difficult ([AbouZahr and Wardlaw 2003](#)).

The direct sibling-history method has been employed by the Demographic and Health Surveys (DHSs), and permits the calculation of a maternal mortality ratio for a more recent period of time; results are typically calculated for a reference period of seven years before the survey, with a point estimate some three to four years before the survey ([AbouZahr and Wardlaw 2003](#)). The data requirements for this method are more demanding than for the indirect approach because respondents are asked three sets of questions. First, they are asked how many children the mother has given birth to and how many of the children were born before the respondent. The second set of questions asks about the siblings' sex, age, and survival, or how many years ago she or he died and age at death. Finally, three questions are asked about dead sisters to determine maternal mortality: whether she was pregnant when she died, whether she died during childbirth, and whether she died within two months after the end of pregnancy or childbirth ([Stanton, Abderrahim, and Hill 2000](#)).

The final method entails undertaking a survey of households to ascertain maternal deaths. Unlike the sibling-history method, in which a sibling reports on the deaths of female siblings, the direct household method involves reporting by household heads or any other persons volunteering such information. When household information is screened, maternal and nonmaternal deaths can be distinguished. Although useful in direct estimation of maternal mortality, this type of household survey is expensive and often too complex to implement in many countries because it requires large sample sizes. An alternative approach is provided by demographic surveillance systems (DSSs) that exist in selected districts in a few Sub-Saharan African countries, notably the Navrongo DSS in Ghana and the Nouna DSS in Burkina Faso ([http://www.indepth-network.org/dss\\_site\\_profiles/dss\\_sites.htm](http://www.indepth-network.org/dss_site_profiles/dss_sites.htm)). DSSs continually collect births and deaths in households in the populations in the sites. Unfortunately, the DSSs generally cover small areas, typically a district in a country, so that the maternal mortality

estimates based on them do not permit generalization; they can be treated as estimates based on case studies.

### Health Services Data

Hospitals generally collect data on causes of deaths, including maternal deaths. But lower-level facilities, such as clinics, dispensaries, or health posts, are sometimes omitted in inquiries about maternal mortality. As a result, health services data in Sub-Saharan Africa are often incomplete and misclassified, especially because deaths related to ectopic pregnancy and abortion are recorded in female wards rather than maternity wards. In addition, deaths outside health facilities are generally excluded from the health services data. In Sub-Saharan Africa, where 58 percent of deliveries take place outside of health facilities, maternal mortality using health services data is underestimated ([WHO 2005](#)).

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### Levels and Trends in Maternal Mortality

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Estimates of maternal mortality based on survey data and models have been compiled at the WHO for 1990, 1995, and 2000. [Table 16.1](#) presents estimates of MMR and the total deaths relating to maternal mortality in the years 1990, 1995, and 2000, but trends should be interpreted with caution, as the estimates are based on different models. Among regions, Sub-Saharan Africa had the highest MMR over the period 1990–2000. The wide margins of error (not shown in [table 16.1](#)) of the MMR estimates, and the methodological approaches employed in the three years, limit analysis of trends over the period ([AbouZahr and Wardlaw 2003](#)).

#### [Table 16.1](#)

Maternal Mortality Measures, 1990, 1995, and 2000.

[Table 16.2](#) shows maternal mortality measures (number of maternal deaths, MMR, and lifetime risk of maternal death) in Sub-Saharan Africa over the period 1990–2000. MMRs of 1,000 or more per 100,000 live births were recorded in 16 of the Sub-Saharan Africa countries in 1990; that level of MMR was recorded in 21 countries in 1995, and 17 countries in 2000 ([table 16.2](#)). Many of the countries with civil war or unstable governments—including Angola, Burundi, Central African Republic (since 1995), Chad, Eritrea, Ethiopia, Mozambique (except for 1995), Niger, Nigeria, Rwanda, Sierra Leone, and Somalia—fell into that category in the 1990s. Kenya and Tanzania, although not having suffered a conflict, are notable for maintaining maternal mortality ratios above 1,000 maternal deaths per 100,000 live births since 1995. Mauritius and Reunion in the Indian Ocean, and Cape Verde in the Atlantic Ocean, and the landlocked country of Botswana have low maternal mortality ratios, atypical of Sub-Saharan Africa.

#### [Table 16.2](#)

Maternal Mortality Measures in Sub-Saharan Africa, by Country, 1990–2000.

## Causes and Correlates of Maternal Mortality

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Understanding the causes and correlates of maternal mortality is crucial in confronting the challenge of unyielding high rates in Sub-Saharan Africa. Abraham Lilienfeld, a prominent epidemiologist, very appropriately remarked, "the better we know about the root cause of a problem, the better we are in a position to address the problem," and in his book, *Foundations of Epidemiology*, cites Benjamin Disraeli's statement, "The more extensive a man's knowledge of what has been done, the greater will be his power of knowing what to do" ([Lilienfeld 1980](#)). Despite the 1978 Alma Ata Declaration and the 1987 Safe Motherhood Initiative, the reduction of maternal mortality has been minimal worldwide. The slow improvement in the MMR in the developing world is due not only to the trend in Sub-Saharan Africa but also to stagnating declines in the regions of Latin America and the Caribbean and South Central Asia. In other regions, notably North Africa and Southeast Asia, the MMR is estimated to have declined substantially during the 1990s. Such divergent trends call for a closer examination of the factors correlated with the MMR.

Different interactive factors contribute to maternal morbidity and mortality. The range is wide and includes the behavior of families and communities, social status, education, income, nutritional status, age, parity, and availability of health services. It is important to note that non-health sector activities, such as education, water and sanitation, roads and communication, agriculture, and internal security, also influence maternal outcome. In Sub-Saharan Africa, some of the highest MMRs have been recorded in countries that are in conflict or have large refugee populations, such as Angola and Sierra Leone.

### Causes of Maternal Deaths

About 60 percent of the maternal deaths occur during childbirth and the immediate postpartum period, with 50 percent of these deaths occurring within the first 24 hours of delivery. In a recent study in Eritrea, 16 percent of maternal deaths occurred during pregnancy, 48 percent during childbirth, and 36 percent postpartum ([Ghebrehiwot 2004](#)). These findings imply that the causes of the deaths in this critical period are either the result of labor or worsened by labor and delivery.

As noted earlier, the causes of maternal mortality have traditionally been classified as direct and indirect, although the distinction is not always easy to discern (both were grouped under pathogenic causes in the previous edition of this book). Pathogenic causes are purely medical and therefore best determined by health professionals. Most of the information on pathogenic causes is derived from hospital studies; thus, data from health institutions will continue to be an important source of information for direct and indirect causes of maternal deaths. Implicit is the need to educate health professionals on the ICD and provide updates whenever the ICD definition changes. As an example, the 10th revision of ICD has introduced a much broader definition of maternal death and has expanded on the categorization of the causes ([WHO 1992](#)). This will make analysis of trends increasingly more difficult because past data will need to be adjusted to accommodate the new definition in order to make them comparable with more recent data.

Availability and accuracy of data sources influence the study of causes and correlates. For instance, data from hospitals or health institutions are limited in that medically certified deaths at these institutions involve only a small and selective fraction of total deaths. This limitation is greatest in Sub-Saharan Africa, where a large proportion of deliveries take place at home ([WHO 2005](#)).

The main direct causes of maternal deaths, accounting for up to 80 percent of cases in Africa, are obstetric hemorrhage, puerperal sepsis, pregnancy-induced hypertension (including eclampsia), obstructed labor and ruptured uterus, and complications of unsafe abortion (see [figure 16.1](#)). Three causes—hemorrhage, sepsis, and eclampsia—account for a vast majority of deaths, considering that even some cases of abortion or obstructed labor eventually succumb to either bleeding or sepsis.

### **Figure 16.1**

Major Causes of Maternal Mortality in Sub-Saharan Africa *Source:* WHO 1992.

Indirect causes account for 20 to 25 percent of maternal deaths and are attributable to illnesses aggravated by pregnancy ([WHO 2005](#)). They include anemia; malaria; HIV/AIDS; diseases of the heart, lung, liver, or kidneys; and ectopic pregnancies. Physical violence and accidents are not included in this group.

As documented by several DHS surveys, many African women enter pregnancy in a state of nutritional deficit and therefore are unprepared to cope with the extra physiological demands of pregnancy. In Eritrea, for example, 37.3 percent of women have a low body mass index, which is an indicator of chronic energy deficiency (Eritrea National Statistics and Evaluation Office and ORC Macro 2002). The nutritional deficit, macro- or micronutrient, predisposes these women to anemia in pregnancy, among other problems. Anemia is highly prevalent in Africa, with up to three-fifths of pregnant women in Africa having some degree of anemia, and about one-third classified as having severe anemia ([Isah et al. 1985](#); [Massawe et al. 1996](#); [Massawe et al. 1999](#); [Van den Broek and Letsky 2000](#)). Anemia may cause death on its own or predispose a woman to severe postpartum hemorrhage leading to death ([Harrison 1997](#)).

The growing HIV/AIDS pandemic is also having a severe impact on women's health. It is estimated that there were 5 million new HIV infections in 2003, of which 40 percent were among women and 20 percent among children ([United Nations 2003](#)). In eastern and southern Africa, between 20 and 30 percent of pregnant women are infected with HIV, and available evidence indicates that HIV/AIDS currently accounts for at least 18 percent of maternal deaths. Death in this case results from opportunistic infections, puerperal sepsis, meningitis, tuberculosis, pneumonia, postabortion sepsis, encephalitis, and probably malaria ([Mbaruku 2005](#); [Pattinson et al. 2005](#)).

Unsafe abortion deserves special mention in Africa, the only region where complications of abortion are the most common cause of maternal mortality. Globally, unsafe abortion accounts for about 13 percent of maternal deaths compared with 30 to 50 percent in Sub-Saharan Africa ([AGI 1999](#); [Henshaw, Singh, and Haas 1999](#)). Of the estimated 46 million induced abortions

globally every year, about 20 million are considered unsafe. It is estimated that 95 percent of unsafe abortions occur in the developing world ([Henshaw, Singh, and Haas 1999](#)). The [WHO \(1998\)](#) estimated that there were about 5 million induced abortions in Africa annually, whereas [Rogo \(1993\)](#), using the results of several DHS surveys, estimated that there were 1.5 million induced abortions, most of which were unsafe. The tragedy of abortion-related mortality in Africa is that most of the victims are teenagers.

The unsafe abortion conundrum in Africa begins with unprotected sex among teenagers who are ill-informed about their sexuality; an unwanted or ill-timed pregnancy follows. Living in countries where induced abortions are legally restricted, the young victims resort to back street abortionists or quacks. Crude methods used in the pregnancy termination, delay in seeking medical attention when and if there is a problem, and the poor quality of postabortion care lead to a significant proportion of the victims sustaining serious injuries with life-threatening complications, resulting in either death or disability. For survivors the psychological impact is immense and lifelong ([Rogo 2004](#)). Postabortal sepsis is worse in HIV/AIDS-infected women ([Mbaruku 2005](#)).

### **Determinants of Maternal Mortality and Morbidity**

Available evidence indicates that there are several factors that predispose a woman to greater risk of maternal death. The common biomedical approach to the determinants of maternal morbidity and mortality usually divides them into distal and proximal factors.

The seminal work by [McCarthy and Maine \(1992\)](#) is credited with the conceptual model of analyzing determinants of maternal mortality that could be applied to research as well as programs. The concept grouped the determinants as:

- distant, or socioeconomic, factors;
- intermediate factors (health behavior and status, access to services, and unknown factors);
- outcomes (pregnancy, morbidity, and mortality).

The McCarthy and Maine concept has since been modified, most notably by [UNICEF \(1999\)](#), to facilitate strategic programming for maternal health. From the pediatric perspective, the [Mosley and Chen \(1984\)](#) framework for the study of child survival in developing countries has also found, with various modifications, utility in the analysis of determinants of maternal morbidity and mortality. The original model proposed three levels of determinants of child mortality (socioeconomic determinants, proximate and biological determinants, and outcomes expressed in terms of growth and death), but subsequent modifications have expanded the levels to five: household characteristics (behavioral), intermediate variables (behavioral and biological), risk factors (biological), malnutrition-infection syndrome, and demographic outcome ([van Norren and van Viannen 1986](#)). The Poverty Reduction Strategy approach developed by the World Bank and sector-wide approaches to the health sector have generated new interest for incorporating government policies and actions, within or outside the health sector, that focus on health outcomes. [Edwards \(2001\)](#), by expanding on previous models, introduced the macroeconomic evaluation of non–health sector policies that influence health.

These developments are relevant to maternal health and can be applied to generating a more comprehensive understanding of determinants and correlates of maternal health in Africa. The following modified framework is proposed as appropriate for discussing the correlates of maternal mortality in Africa:

- household and community characteristics (behavior, cultural-religious values, and income poverty)
- biological-demographic variables and risk factors
- malnutrition-infection syndrome (including protein-energy malnutrition [PEM], micronutrient deficiencies, anemia, malaria, and HIV/AIDS)
- health systems
- national policies and related investments (health and nonhealth).

### **Household and Community Characteristics**

Pregnancy outcome and maternal survival have strong correlations with household behavior and decision making. Enlightened communities value their mothers and seek prompt attention at the earliest indication of problems. Low status of women in the household and society as a whole, as exemplified by inequality in education, employment, property ownership, participation, and decision making, is another important correlate ([Wall 1998](#)). Gender-based violence is common in situations in which the status of women is low and legal protection inadequate, and in turn it is correlated with high rates of maternal mortality.

Harmful traditional practices and religious beliefs also adversely affect maternal health. They vary from one ethnic group to another and cover a wide range of activities and practices; from the sexual or genitally linked ones, such as female genital cutting, to feeding and nutritional practices. In addition, a plethora of harmful beliefs and practices around pregnancy and childbirth affect health-seeking behavior during pregnancy and parturition. The disproportionately low use of health facilities for delivery care is testimony to the strength of these beliefs ([Ghebrehiwot 2004](#)).

Household poverty, allocation of resources, and the control of those resources also influence maternal mortality. Delivery of infants is not free of charge in many African countries. Indeed, it was never without cost in traditional societies either. Even in countries where delivery is declared to be free in public facilities, the cost of accessing care, both direct and indirect, can be prohibitive, quality notwithstanding. The relationship to poverty is bi-directional; complications of pregnancy were cited as one of the most common causes of household poverty ([Borghi et al. 2003](#); [Claeson et al. 2001](#)).

### **Biological-Demographic Variables and Risk Factors**

Standard biological variables, such as age, height, and parity, apply to maternal mortality in Africa as elsewhere. In many countries of Sub-Saharan Africa, at least 50 percent or more of women will have started childbearing by age 19. Adolescents comprise about 20 percent of

maternal deaths, most of which are due to complications of unsafe abortion. Early marriage and childbearing are associated with high parity and therefore higher risk of maternal death ([Ghebrehiwot 2004](#)). Various indicators of maternal status during pregnancy and childbirth may also be predictors of maternal outcome, including edema, hypertension, and history of previous complications ([Garenne et al. 1997](#)). Sociodemographic factors are correlates of maternal mortality. Marital status, first pregnancy, and level of education are commonly cited ([Garenne et al. 1997](#)).

### **Malnutrition-Infection Syndrome**

Malaria remains a major killer of women in pregnancy and a leading indirect cause of maternal mortality. There are effective interventions, such as intermittent preventive treatment and insecticide-treated bednets that are affordable but often not available where they are most needed. The changing complexities of malaria chemotherapy and the rising cost of newer, more effective combinations pose new challenges, including safety in pregnancy ([Heymann et al. 1990](#); [Shulman et al. 1999](#)).

HIV/AIDS and its effect on maternal outcomes in Africa is grossly underreported. HIV is not regarded as a primary cause of death unless AIDS is diagnosed. A study in South Africa reported a 25 percent increase in seropositivity, from 50 to 75 percent between 1997–99 and 2000, in maternal deaths due to non–pregnancy-related sepsis in Pretoria ([Pattinson and Moodley 2002](#)). HIV infection in pregnancy is also associated with anemia and severe malaria infections ([Antelman et al. 2000](#)).

As previously mentioned, both PEM and micronutrient deficiencies are prevalent in African women. Pregnancy aggravates the situation and increases vulnerability to any concurrent condition or opportunistic infection. [Paul \(1993\)](#), in analyzing maternal mortality in Africa from 1980 to 1987 found a strong correlation with calorie supply as a percentage of requirements. Maternal anemia, however mild, also increases several-fold the risk of life-threatening postpartum hemorrhage.

### **Health Systems**

Poorly financed and unaccountable health systems, including weak referral systems, are a key determinant of maternal outcome. Another determinant is poor access to quality maternal health care services because of geographical terrain and poor roads. Maternal health care services are deemed to be of poor quality if, for example, they lack skilled health providers, the providers have negative attitudes, treatment guidelines and protocols are inappropriate, and they lack essential drugs, equipment, and supplies. A low health personnel-to-population ratio is a chronic issue in Sub-Saharan Africa. For instance, the health personnel-to-population ratio in Sub-Saharan Africa is reported as 1:23,540, ranging from 1:750 in South Africa to 1:72,000 in Rwanda. For nurses, the Sub-Saharan African health personnel-to-population ratio is 1:3,460, ranging from 1:600 in Zambia to 1:5,470 in Tanzania ([Howson, Harrison, and Law 1996](#)).

Given that skilled birth attendants working within a supportive health system are the most important factor in keeping women healthy and safe in pregnancy, inadequate numbers and distribution of human resources are a major underlying cause of maternal mortality in Sub-

Saharan Africa. Although the use of skilled attendants at delivery increased significantly in the developing world as a whole, from 41 percent in 1990 to 57 percent in 2003, the greatest improvements were in Southeast Asia and North Africa and the least in Sub-Saharan Africa ([http://unstats.un.org/unsd/mi/goals\\_2005/goal\\_5.pdf](http://unstats.un.org/unsd/mi/goals_2005/goal_5.pdf)). A recent WHO report indicates an average of 42 percent in the Africa Region, implying no change from the 1990 global average (WHO 2005).

Although there is no specific comparative rate, in its global estimates on births attended by skilled personnel the WHO (2005) reported 46.2 percent for Africa with the lowest rates in East Africa (32.5 percent) and West Africa (39.7 percent) ([http://www.who.int/reproductive-health/global\\_monitoring/skilled\\_attendant.html](http://www.who.int/reproductive-health/global_monitoring/skilled_attendant.html)).

Figure 16.2 shows that the higher the proportion of deliveries with a skilled attendant in a country, the lower the country's MMR. Furthermore, most of the Sub-Saharan Africa countries (not labeled) are above the regression line. Lack of or poorly functioning health management information systems with an effective feedback loop as well as weak supervision are further challenges influencing the quality of maternal services and MMRs.

### **Figure 16.2**

Relation between Skilled Attendant at Delivery and MMR for All Countries, 1995 Source: *Safe Motherhood Initiative and Maternal Mortality in 1995*. Estimates developed by WHO, UNICEF, and UNFPA 2001.

### **National Policies and Investments**

For any program or strategy on maternal health and safe motherhood to succeed, it must have the support of the highest level of national authority. Such support facilitates the allocation of adequate financial and human resources; improves the infrastructure and communications; and puts in place effective and implementable standards, policies, and protocols. Most countries in Sub-Saharan Africa have not addressed policy issues, even where the policies have been shown to have significant influence on maternal mortality. Romania provides the best example for the developing world of the impact of changes in policy. Figure 16.3 clearly demonstrates the trends of maternal mortality that occurred with the change in the country's abortion law in 1966 and 1989 ([http://www.who.int/docstore/world-health-day/en/pages1998/whd98\\_10.html](http://www.who.int/docstore/world-health-day/en/pages1998/whd98_10.html)). In the 1950s and early 1960s, the law provided for access to abortion and was associated with relatively low mortality ratios. The restrictions on abortion that followed was associated with significant increase in the MMR in the 1980s. Immediately after the December 1989 revolution that overthrew President Nicolae Ceau<sup>o</sup>escu, restrictions on contraceptives were removed and abortion legalized. Subsequently, with the precipitous drop in abortion-related mortality, the MMR dropped.

### **Figure 16.3**

Effects of the Introduction in Romania of an Anti-Abortion Law in 1966 and Legalization of Abortion in 1989 *Source: WHO 1998.*

Changing the abortion policy reduced maternal mortality by more than half in less than 10 years. Therefore, by changing the underlying policy-related causes, Sub-Saharan African countries have the potential of achieving reductions in maternal mortality. In most Sub-Saharan African countries, despite many international pronouncements, high-level support for maternal health and measures to reduce maternal mortality and unsafe abortion is weak or nonexistent.

Inadequate financing and sustainability of the health sector in general and of reproductive health in particular, are other barriers. In most African countries, health expenditures have not increased substantially while major problems in allocation efficiency and inequities exist ([World Bank 2005](#)). With various competing priorities for a dwindling financial resource base, the health sector needs to do a better job in reclaiming its rightful share. Moreover, given the inadequate investment, the number of health personnel trained is often small, and once trained, many open private clinics or emigrate to developed countries to earn a better living.

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## **Reducing Maternal Mortality: Priority Interventions and Lessons**

Many lessons have been learned on what works in maternal health. These have led to the identification of key interventions for the reduction of maternal morbidity and mortality in the developing world.

### **Priority Interventions**

The past two decades have witnessed significant shifts in thinking about effective interventions for improving maternal outcomes in poor countries, from the Maternal and Child Health program to the Safe Motherhood Initiative, with its "Pillars," and the Making Pregnancy Safer program ([Starrs 1998](#); <http://w3.whosea.org/pregnancy/chap1f.htm>). More recently, the case for identifying and investing in the most effective interventions for safe motherhood has dominated the debates ([AbouZahr, Wardlaw, and Hill 2001](#)). There is evidence of effective clinical interventions that save lives, but less is known about the best strategies for accelerating reduction of maternal mortality in developing countries, especially in Africa and South Asia ([De Brouwere and Van Lerberghe 2002](#); [Donnay 2002](#); [Koblinski, Campbell, and Heichelheim 1999](#); [Liljestrand 2000](#)). The findings of the World Bank's analysis for the decline in maternal mortality in Malaysia and Sri Lanka in the past 50 to 60 years and the magnitude of health system expenditures on maternal health are relevant to Africa ([World Bank 2003](#)).

Malaysia and Sri Lanka have succeeded in reducing maternal mortality to levels comparable to those in industrial countries in the last few decades. Expanded female literacy in Sri Lanka and strong economic performance by Malaysia helped promote these gains. The World Bank analysis confirmed that maternal mortality can be halved in developing countries every 7 to 10 years and is affordable, regardless of income level and economic growth rate; steady, modest investment in poverty reduction and in maternal health services to improve access to and quality of emergency obstetric care are required.

Removal of financial barriers to maternal care was an important step in both countries, as was increased access to skilled birth attendance and emergency obstetric care. Recording and reporting of maternal deaths was a prerequisite to addressing the challenges of reducing maternal mortality in both countries. Other important lessons were that governments can afford to provide the critical elements of maternal care free of charge to clients and that different tactics are needed at different stages of the development of health systems. The transition from high to low MMR passes through several phases characterized by the following:

- high MMR: low levels of skilled attendance and emergency obstetric care (EmOC)
- declining MMR: medium levels of skilled attendance and EmOC
- low MMR: high levels of skilled attendance and EmOC.

Except for South Africa and Botswana, most of Sub-Saharan Africa falls in the first category, "high MMR—low levels of skilled attendance and EmOC." This status calls for establishing a solid foundation for effective maternity care, increasing access to care, and ensuring appropriate use of available services through community mobilization and improved quality. Elements of the foundation to support effective maternal care in Malaysia and Sri Lanka included professionalization of midwifery, civil registration of births, compilation of data on maternal deaths, and replication of local success. These elements do not always need additional resources but require focused leadership and effective management.

### **Improving Emergency Obstetric Care: The Three Levels of Delay**

It is clear from the foregoing that accelerating the decline of maternal mortality in Sub-Saharan Africa and realization of the Millennium Development Goals will require the provision of a synergistic package of health and social services that reaches everyone, especially deprived populations.

The framework model of three delays has been applied to analyze the constraints, opportunities, and systems required at different levels of a safe motherhood program ([box 16.1](#)). This framework serves as a useful planning tool for the actions required at every level of health care while emphasizing the need to link these levels through transport and communication, supervision, and community outreaches. Thus, community awareness and trust and better access to and quality of emergency transport reinforce each other to improve maternal outcome. In an integrated essential health care package, this network enhances provision of other services, such as family planning and immunization, while promoting emphasis on skilled attendance.

#### **Box 16.1**

Model of Three Levels of Delay. Level 1 delay: decision making at community level—examines decision-making process on pregnancy and childbirth at household and community level, including birth preparedness Level 2 delay: accessibility, transport, ([more...](#))

The model is advocated by the Regional Prevention of Maternal Mortality Network ([PMMN 1995](#)) and is rapidly gaining ground in Africa. Using a modified "Four Levels of Delay" approach to analyze maternal mortality in Eritrea, [Ghebrehiwot \(2004\)](#) attributed the causes of death to the following processes:

- Delay One: failure or delay in recognition of danger signs—33 percent of maternal deaths
- Delay Two: delay in deciding to seek care—40 percent of the cases
- Delay Three: delay in reaching appropriate care—19 percent of cases
- Delay Four: delay in receiving appropriate care—52 percent of cases.

This simple framework appears ideal for Sub-Saharan Africa. It works well and supports local partners in finding tailor-made solutions to challenges posed in each specific setting and making service more responsive to local community needs. It can also be used to improve data collection and use at the local level.

The first level involves a primary health care bottoms-up approach with active community involvement (men and women) and focused comprehensive development programs wherein reproductive health and safe motherhood are appropriately integrated into the district health system. The second level entails expanding access to quality services, including functional linkages between communities and health facilities in regard to transport and communication. This leads to the final level, where appropriate quality of services is provided to clients on arrival at the health facility.

A Tanzania case study ([Urassa et al. 1997](#)) depicts a typical finding from most maternal mortality reviews in Africa. A large proportion of women die because of delayed decision making at home, lack of transport, and inappropriate care if they make it alive to a health facility. This confirms the observation that reduction of high maternal mortality demands a strong focus on each level of delay through creation of an effective system providing EmOC. Links between the different levels of the health care system, from community through the basic health center (basic EmOC) to the referral hospital (comprehensive EmOC) are critical.

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## Conclusion

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Countries in Sub-Saharan Africa face the challenge of identifying the base MMR to be reduced by the prescribed proportion in view of the conflicting MMR statistics from country-based studies and global estimates. Because of the difficulties in assessing MMR, different methodologies have been used. The use of different approaches complicates the comparison and study of trends and causes of maternal mortality, owing to variations in coverage, reference dates, and data presentation.

Two Millennium Development Goals are of direct relevance to maternal and newborn health: goal 4, to reduce child mortality, and goal 5, to improve maternal health. The latter goal is aimed at reducing the 1990 MMRs by 75 percent by 2015. The probability of reaching this goal in most

Sub-Saharan Africa countries is highly questionable given that most countries have shown little or no change in their MMRs and in a few countries they have even increased ([World Bank 2004](#)). Evidence from Sri Lanka and Malaysia shows that maternal mortality reduction can be accelerated through joint government and community action. For Sub-Saharan Africa, this calls for the establishment of a solid foundation for effective maternity care and increasing access and use of services. Monitoring of maternal care services and audits of maternal deaths are crucial to this effort.

Further exploration into maternal mortality, especially the underlying factors in Sub-Saharan Africa, is necessary, as are improved data collection systems, credibility in dissemination of data, and realistic estimates where information is deficient. Without good sources of data, Sub-Saharan Africa will continue to rely on model estimates, which could be misleading and demotivating. For instance, the WHO, UNICEF, and UNFPA estimates, the best and most quoted, vary significantly from those obtained from country-based studies ([AbouZahr and Wardlaw 2003](#)). In some countries, the estimates are double those reported from country-based studies, and underreporting was presented as the main factor. For instance, WHO, UNFPA, and UNICEF estimates reflect Kenya's MMR of 1,300 maternal deaths per 100,000 live births against the 590 maternal deaths per 100,000 live births reported by the DHS ([AbouZahr and Wardlaw 2003](#)). Also, the WHO, UNFPA, and UNICEF estimate for Tanzania was 1,500 maternal deaths per 100,000 live births, compared with the DHS estimate of 529 maternal deaths per 100,000 live births ([AbouZahr and Wardlaw 2003](#)). These discrepancies are enormous and have significant implications in regard to the Millennium Development Goals.

Increasing interest in the "near-miss population" provides an opportunity to explore the underlying causes and correlates of maternal morbidity and mortality. *Near-miss population* is defined as individuals who present to the health facilities with life-threatening conditions or develop life-threatening complications while under management ([Filippi et al. 2000](#); [Kaye et al. 2003](#); [Mantel et al. 1998](#)). This is a special category of survivors, whose stories provide unique insights and valuable information on maternal mortality. In the absence of accurate and detailed information on maternal deaths in Sub-Saharan Africa, increased use of studies on the near-miss population could provide useful lessons. Such studies could provide information on the sequence of events leading to complications and describe critical life-saving interventions. Comparative studies between the near misses and deaths occurring in the same institution or communities could further clarify the factors contributing to or averting deaths.

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