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Achieving the Millennium Development Goal of Improving Maternal Health:

Determinants, Interventions and Challenges

Elizabeth Lule, G.N.V. Ramana, Nandini Ooman, Joanne Epp,
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Health, Nutrition and Population (HNP) Discussion Paper

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Achieving the Millennium Development Goal of Improving Maternal Health *Determinants, Interventions and Challenges*

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Abstract: This paper summarizes the importance of improving maternal and reproductive health, the progress made to date and lessons learned, and the major challenges confronting programs today. The paper highlights the progress that some countries, including very poor ones, have made in reducing maternal mortality, but cautions that progress in many countries remains slow. Relying on evidence from the most recent research and survey information, the paper also analyzes the key determinants and evidence on effective interventions for attaining the maternal health MDG. The paper finds that key interventions to improve maternal and reproductive health and reduce maternal mortality include the following mutually reinforcing strategies: (a) mobilizing political commitment and fostering an enabling policy environment; (b) investing in social and economic development such as female education, poverty reduction, and improvements in women's status; (c) providing family planning services; (d) ensuring quality antenatal care, skilled attendance during childbirth, and availability of emergency obstetric services for pregnancy complications; and (e) strengthening the health system and community involvement. The paper emphasizes that carrying out interventions remains a challenge in environments where political commitment, policies, as well as institutions and health systems, are weak. The paper concludes with guiding lessons from some of the countries that have successfully improved maternal health and with a discussion of some of the difficulties of measuring maternal mortality and morbidity outcomes.

Keywords: maternal health, reproductive health, Millennium Development Goals

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ACRONYMS AND ABBREVIATIONS

AIDS	Acquired immune deficiency syndrome
BEOC	Basic essential obstetric care
DHS	Demographic and Health Survey
CBO	Community-based organization
CDD	Community-driven development
CEOC	Comprehensive essential obstetric care
EOC	Essential obstetric care
FGM	Female genital mutilation
HIV	Human immunodeficiency virus
ICPD	International Conference on Population and Development
LTR	Lifetime risk
MDG	Millennium Development Goal
MMR	Maternal mortality ratio
NGO	Nongovernmental organization
PHM	Public health midwife
PRSP	Poverty Reduction Strategy Paper
PMDF	Proportion of maternal among deaths of females
RAMOS	Reproductive age mortality surveys
STI	Sexually transmitted infection
SWAp	Sector-wide approach
TBA	Traditional birth attendant
UNFPA	United Nations Population Fund
UNICEF	United Nations Children's Fund
WHO	World Health Organization

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PREFACE

For more than a decade and a half, the World Bank has been strongly committed to the objective of improving maternal health and reducing maternal mortality. The Bank was a founding member of the Safe Motherhood Initiative in 1987 and has backed the Program of Action of the 1994 International Conference on Population and Development (ICPD). More recently, the World Bank has embraced the Millennium Development Goals (MDGs) agreed to in September 2000 and has made the goal to improve maternal health one of its top corporate priorities.

In support of the Bank's work to scale up efforts to achieve the MDGs, the Bank's Health, Nutrition, and Population (HNP) Department supported a series of background papers on the evidence for the interventions. The background papers provide a synthesis of recent evidence and determinants of the key HNP MDG goals, including child mortality, maternal and reproductive health, HIV-AIDS, and health systems. These materials are designed to provide Bank staff members with the latest evidence on specific interventions to assist them in their dialogue with client governments on program activities to accelerate progress in achieving the MDGs. All of the HNP MDG background papers are available from the HNP Advisory Service.

This background paper focuses on interventions and determinants for improving maternal and reproductive health. It provides a framework for addressing the multisectoral issues involved and highlights the rich experience of many countries that have achieved progress in improving maternal and reproductive health.

Key interventions to improve maternal and reproductive health and reduce maternal mortality include complementary, mutually reinforcing strategies: (a) mobilizing political commitment and an enabling policy environment; (b) investing in social and economic development such as female education, poverty reduction, and improvements in women's status; (c) providing family planning services; (d) ensuring quality antenatal care, skilled attendance during childbirth, and availability of emergency obstetric services for pregnancy complications; and (e) strengthening the health system and community involvement. The challenge has been to implement these interventions in environments where political commitment, policies, as well as institutions and health systems have been weak. Some countries, including very poor ones, have been successful in reducing maternal mortality, although progress in many countries remains slow.

We hope the information in this discussion paper provides a useful synthesis of evidence about what works as we scale up efforts to achieve the MDG to improve maternal health. Our goal in producing this material is to raise the quality and effectiveness of national programs for maternal and reproductive health that are backed by developing country governments and the donor community, including the World Bank.

1. INTRODUCTION

1.1 OBJECTIVES AND OVERVIEW

The Millennium Development Goal (MDG) to improve maternal health reinforces decades of international commitment and national efforts to address the problems associated with reproductive health, safe motherhood, and family planning. It builds on past global agreements such as the Program of Action of the International Conference on Population and Development (ICPD) held in Cairo in 1994, the Platform of Action of the Fourth World Conference on Women held in Beijing 1995, and the UN International Development Targets established in 1995. The global commitment to achieving the MDGs provides a unique opportunity to reexamine, refocus, and scale up resources and program efforts by donors, governments, and civil society to improve maternal and reproductive health for individual and societal well-being.

The purpose of this paper is to synthesize key actions that can accelerate progress toward achieving the maternal health MDG. The paper begins with a summary of why improving maternal health is important, the progress made to date and lessons learned, and the major challenges confronting programs today. It continues with an analysis of the key determinants and evidence on the effective interventions for attaining the maternal health MDG. The paper relies on evidence from the most recent research and survey information. However, evidence is lacking from long-term impact studies; none were found in our review. The paper concludes with a discussion of some of the measurement difficulties and key constraints impeding achievement of this MDG and provides guiding lessons. We believe that this evidence-based review will enhance the quality and effectiveness of national programs for safe motherhood that are backed by developing country governments and the donor community.

The framing of this MDG presents at least two conceptual challenges for providing guidance on accelerated progress. First, the goal is improved maternal health, yet the target is stated in terms of reduced maternal deaths (reduce the maternal mortality ratio by three quarters between 1990 and 2015). Although health and death are related, in practice, improving the health of mothers and preventing their deaths may require quite different strategies. Efforts can improve maternal health without reducing maternal mortality, just as efforts can reduce maternal mortality without improving maternal health. Second, at an analytical level, it is impossible to disentangle maternal health from reproductive health, of which maternal health is one facet. The ICPD Program of Action clearly frames maternal health within the context of reproductive health (see Box 1). To address these conceptual challenges throughout this paper, we consciously use the phrase maternal and reproductive health.

Box 1. Reproductive Health Includes Maternal Health

Reproductive health is a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity, in all matters relating to the reproductive system and to its functions and processes. Reproductive health therefore implies that people are able to have a satisfying and safe sex life and that they have the capability to reproduce and the freedom to decide if, when and how often to do so. Implicit in this last condition is the right of men and women to be informed and to have access to safe, effective, affordable and acceptable methods of family planning of their choice, as well as other methods of their choice for regulation of fertility which are not against the law, and the right of access to appropriate health-care services that will enable women to go safely through pregnancy and childbirth and provide couples with the best chance of having a healthy infant.

A comprehensive range of basic reproductive health-care services includes: contraceptive services and supplies (family planning); abortion and treatment of post-abortion complications; voluntary sterilization services; basic infertility services; management of sexually transmitted diseases, including HIV and cancers of the reproductive system; and maternity care, including prenatal, delivery and postnatal care.

Source. Excerpted from *Program of Action*, paragraph 8.25, by the International Conference on Population and Development (ICPD), 1994, New York: United Nations; and *Reproductive Health Services and Managed Care Plans: Improving the Fit* (Issues brief), by the Alan Guttmacher Institute, 1996, New York: Alan Guttmacher Institute.

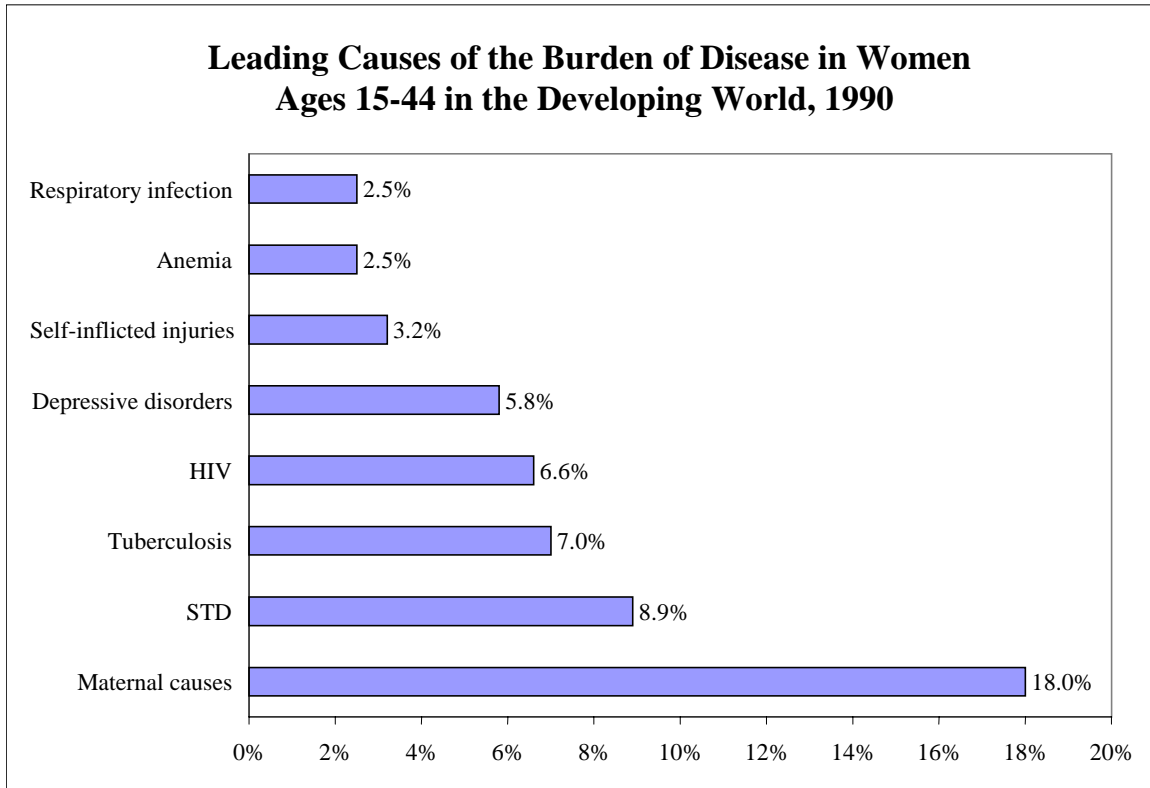
All the MDGs are, to various degrees, interrelated and mutually reinforcing. The maternal and child health MDGs have a particularly important relationship. Although the immediate causes of poor child health are markedly different from those that lead to illness and death in mothers, many of the underlying determinants—such as poorly functioning health systems—are similar. Moreover, maternal and reproductive health status has an important influence on child health outcomes. Neonatal health is inextricably linked to maternal health and is included in this paper.

1.2 THE IMPORTANCE OF IMPROVING MATERNAL AND REPRODUCTIVE HEALTH

Keeping mothers alive and healthy is good for women, their families, and society. Complications during pregnancy and childbirth as well as from STIs, HIV and AIDS are among the leading causes of death and disability among women of reproductive age in developing countries (Figure 1). Maternal mortality is not the only adverse outcome of pregnancy. Because of miscarriages, induced abortion, and other factors, more than 40% of the pregnancies in developing countries result in complications, illnesses, or permanent disability for the mother or the child (WHO, 2001). For each of the 515,000 maternal deaths that occur yearly worldwide, an estimated 30 to 50 women suffer pregnancy-related health problems such as vesico-vaginal fistulae, infertility, and depression that can be permanently debilitating (WHO, 2001). Women in the developing

world have a 1 in 48 chance of dying from pregnancy-related causes; the ratio in developed countries is 1 in 1,800 (WHO, 2001).

Figure 1. Leading causes of the burden of disease in women in the developing world.



Source. Constructed from data from *Investing in Health: World Development Report* (p. 27), World Bank, 1993, Washington, DC: The World Bank.

The implications of maternal mortality and complications it causes for the health of infants and older children are also serious. The risk of death for children under 5 years is doubled if their mothers die in childbirth. The rate of neonatal death is also highly correlated with maternal mortality ratios: every year, 4 million newborns die before they reach their first months of life and an additional 4 million are stillborn (WHO, 1999). At least 20% of the burden of disease among children less than the age of 5 years is attributable to conditions directly associated with poor maternal and reproductive health, nutrition, and quality of obstetric and newborn care (World Bank, 1999). For example, women with HIV have a 24%–40% chance of passing the infection to their fetuses either in the womb or at birth (Tinker and Koblinsky, 1993, p. 2).

The beneficial effects of reducing maternal mortality for society are equally clear. Investments in safe motherhood not only improve a woman’s health and the health of her family but also increase labor supply, productive capacity, and economic well-being of communities. The burden on women associated with frequent or too-early pregnancies, poor maternal and reproductive health, pregnancy complications, and caring for sick children and the elderly drains women’s productive energy, jeopardizes their income-

earning capacity, and contributes to their poverty. Children whose mothers die or are disabled in childbearing have vastly diminished prospects of leading a productive life (World Bank, 1999).

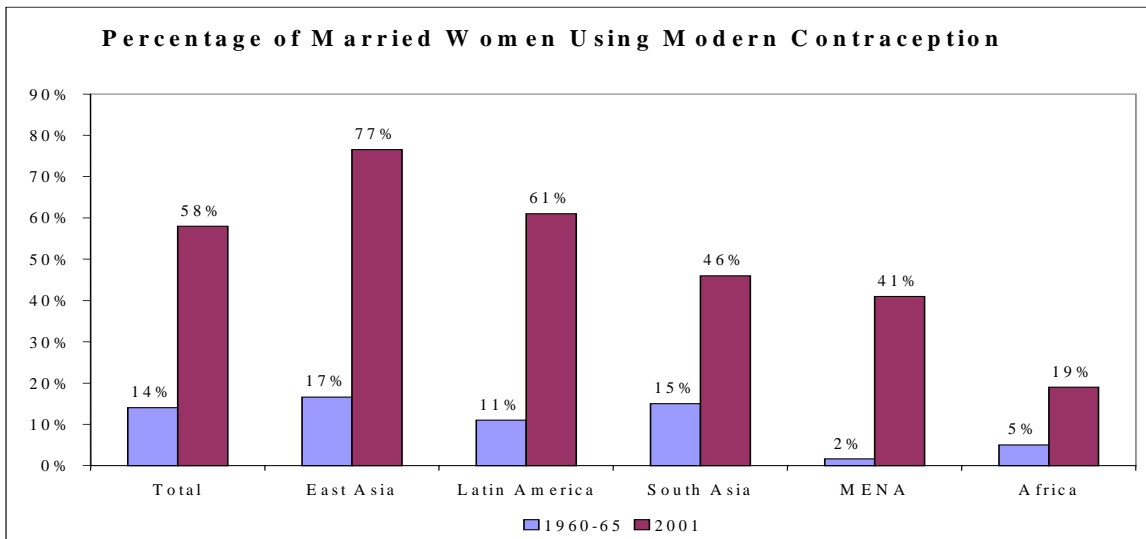
Strengthening maternal and reproductive health services also can bring benefits to the overall health system, which can enhance access and use of a broad number of reproductive health care services and can improve economic productivity for society. As this paper will show, interventions to improve maternal and reproductive health and nutrition are not only cost-effective but also clearly feasible, even in poor settings.

In addition to the health and economic rationale for ensuring maternal and reproductive health is a compelling human rights dimension to reducing death and illness associated with pregnancy and childbirth. Maternal and reproductive health has been codified in multiple international covenants (Cook, Dickens, Wilson and Scarrow, 2001). Improved access to reproductive health was agreed as a key goal at the Cairo International Conference on Population and Development in 1994. The international development community has endorsed a fundamental conceptual shift from population control and fertility regulation to the reproductive health approach that addresses reproductive health rights and ways to enhance people's choices. It recommends that primary health-care programs provide a package of services that include family planning, safe pregnancy and delivery, and the prevention and treatment of reproductive tract infections and sexually transmitted diseases, including HIV-AIDS. It also recognizes the broader dimensions of reproductive health and the important linkages between reproductive health and rights and other development issues, particularly those related to gender inequality.

1.3 MATERNAL AND REPRODUCTIVE HEALTH: CURRENT STATUS

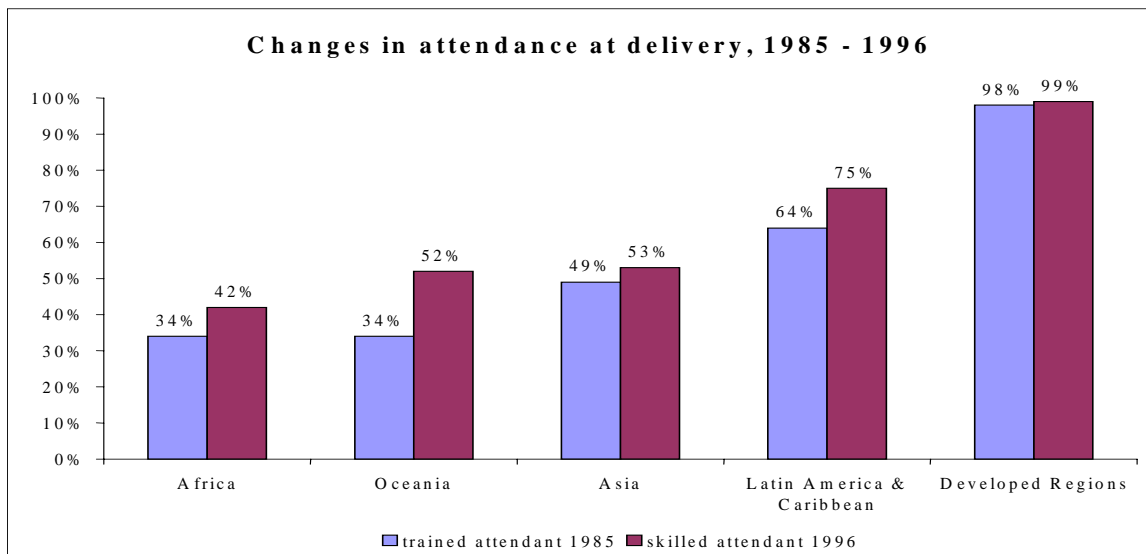
Progress on maternal and reproductive health in recent decades has been somewhat mixed in developing countries. Although great progress has been made in some countries and for selected programs, the availability of comprehensive and high-quality reproductive health services remains an unrealized goal in many settings. Key among the success stories is family planning. Contraceptive use among women has increased steadily (see Figure 2), rising from about 14% of married women of reproductive age in 1965 to more than 50% today (UN Population Division, 2000a, 2000b). Family size has fallen from 5.5 on average in 1970 to about 3 today (UN Population Division, 2002a, 2000b), and the rate of high-risk births to girls aged 15 to 19 has also fallen steadily. The percentage of births attended by a trained health worker has risen (see Figure 3), albeit slowly, from 48% in 1985 to 55% in 1996 (WHO, 1998a).

Figure 2. Contraceptive prevalence trends in the developing world, by region



Source. Constructed from data from *Findings From Two Decades of Family Planning Research* by J. Ross and E. Frankenberg, 1993, p. 2, New York: The Population Council; and *World Population Data Sheet* by the Population Reference Bureau, 2002, Washington, DC: Population Reference Bureau.

Figure 3. Global trends in skilled attendance at delivery



Source. Constructed from data from *Ensure Skilled Attendance at Delivery* by the World Health Organization, 1998a. Retrieved March 12, 2003, from the World Wide Web: http://www.who.int/archives/whday/en/pages1998/whd98_06.html

By contrast, maternal mortality ratios (MMR) remain high in many countries (Table 1 and Figure 4), with wide variations within regions. For example, the MMR for all of Africa is 1,000, subregional MMRs range from 1,300 in Eastern Africa to 360 in Southern Africa. Even in Europe, subregional variation exists: MMR is 50 in Eastern Europe, and averages 13 in the other European subregions. Relatively little recent improvement has occurred in the global level of maternal deaths notwithstanding the success of a few countries such as Sri Lanka, Malaysia, China, Egypt, Honduras, and Tunisia in reducing death rates (Koblinsky 2003; Pathmanathan et al., 2003).

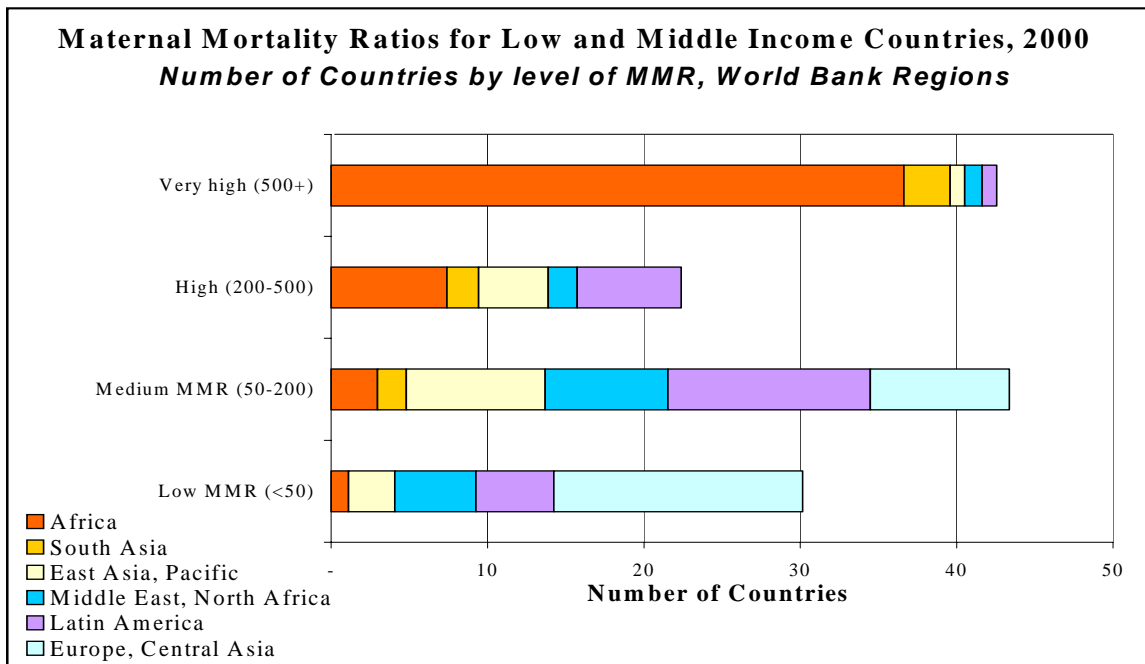
Table 1. Low- and Middle-Income Countries by Level of Maternal Mortality

Region	Very High (500+)	High (200–500)	Medium (50–200)	Low (< 50)
Africa	Central African Republic Mozambique Eritrea Guinea-Bissau Chad Nigeria Guinea Zambia Malawi Gabon Kenya Niger Mali Senegal Mauritania Tanzania Uganda Benin Sudan	Madagascar Togo Cameroon Zimbabwe Botswana Namibia Ghana	Mauritius	
South Asia		Bangladesh India	Sri Lanka	
East Asia and Pacific	Lao PDR	Cambodia Indonesia Papua New Guinea Myanmar	Philippines Vietnam Mongolia Korea, Dem. Rep. China	Thailand Malaysia Korea, Rep.
Middle East and North Africa		Yemen, Rep. Morocco Algeria	Egypt, Arab Rep. Syrian Arab Republic Lebanon Libya Tunisia	Jordan Iran, Islamic Rep. Oman
Latin American and the Caribbean		Bolivia Peru Dominican Republic	Guatemala Paraguay Brazil Ecuador Nicaragua El Salvador Jamaica Honduras Colombia Panama Venezuela, RB México	Argentina Costa Rica Cuba Uruguay Chile
Eastern Europe and Central Asia			Turkey Georgia Kazakhstan Kyrgyz Republic Tajikistan Turkmenistan Estonia Russian Federation	Latvia Azerbaijan Moldova Romania Armenia Belarus Ukraine Uzbekistan Lithuania Bulgaria Hungary Bosnia Herzegovina Czech Republic Slovak Republic Poland Croatia Macedonia, FYR

Source. Constructed from data from *World Development Indicators Report* by the World Bank, 2002, Washington, DC: The World Bank.

In addition to differentials in maternal mortality across and within regions, large gaps also remain for other reproductive health indicators. Despite gains in family planning, a large unmet need for contraception exists. An estimated 120 million women who wish to space or limit further childbearing are not using contraception mainly because they lack access to information and family planning services (WHO, 1998b). Too often, the result is unsafe abortion—defined as the termination of an unwanted pregnancy by a person lacking the necessary skills, in an environment lacking the minimal medical standards, or both (WHO, 1993). Among the 20 million unsafe abortions that occur worldwide annually, an estimated 70,000 result in death, yielding a case fatality ratio of 0.4 deaths per 100 unsafe abortions and contributing 13% to the overall maternal mortality rate (WHO, 1997a). Some 340 million new and curable cases of sexually transmitted infections (STIs) occur each year worldwide in addition to many millions of incurable (yet preventable) viral STIs, including an estimated 5 million HIV infections (WHO, 2003). STIs enhance the transmission of HIV-AIDS, which is rapidly spreading in women of reproductive age, a group that represents 40% of all new HIV infections worldwide (Tinker, Finn, and Epp, 2000). Maternal health problems are particularly acute for adolescent girls and young women, who have the highest levels of unmet need for contraception and who are the most vulnerable to unwanted pregnancy and HIV infection (FOCUS, 2001).

Figure 4. Current levels of maternal mortality in developing countries



Source. Constructed from data from *World Development Indicators*, World Bank, 2002, Washington, DC: The World Bank.

Gender-based violence underlies some of the most intractable reproductive health issues of our times—unwanted pregnancies, HIV, and other sexually transmitted infections. Globally, about 30% of women are coerced into sex or physically assaulted or otherwise abused at least once in their lives. Gender-based violence can affect women’s autonomy, productivity, quality of life, and physical and mental well-being (Tinker et al., 2000).

Female genital mutilation (FGM) is experienced by more than 2 million girls every year (Toubia, 1993) and can have devastating consequences. FGM is the partial or total removal of the external female genitalia and is strongly influenced by cultural norms surrounding female sexuality. The immediate consequences of FGM on a woman’s physical health can include tetanus, infection, and hemorrhage, and the lifelong consequences of this practice include long-term pain, scarring, urinary tract infections, urinary incontinence, complications in childbirth, and painful intercourse; often, the consequences lead to death (Tinker et al., 2000).

In spite of global and national efforts to improve women’s health, millions of women live in poor reproductive health, and many die in the process of fulfilling their reproductive roles as mothers. The following section examines the evidence with respect to the causes of poor health and high mortality. This kind of analysis is central to developing appropriate and effective interventions that will accelerate progress toward achieving the MDG relating to maternal health.

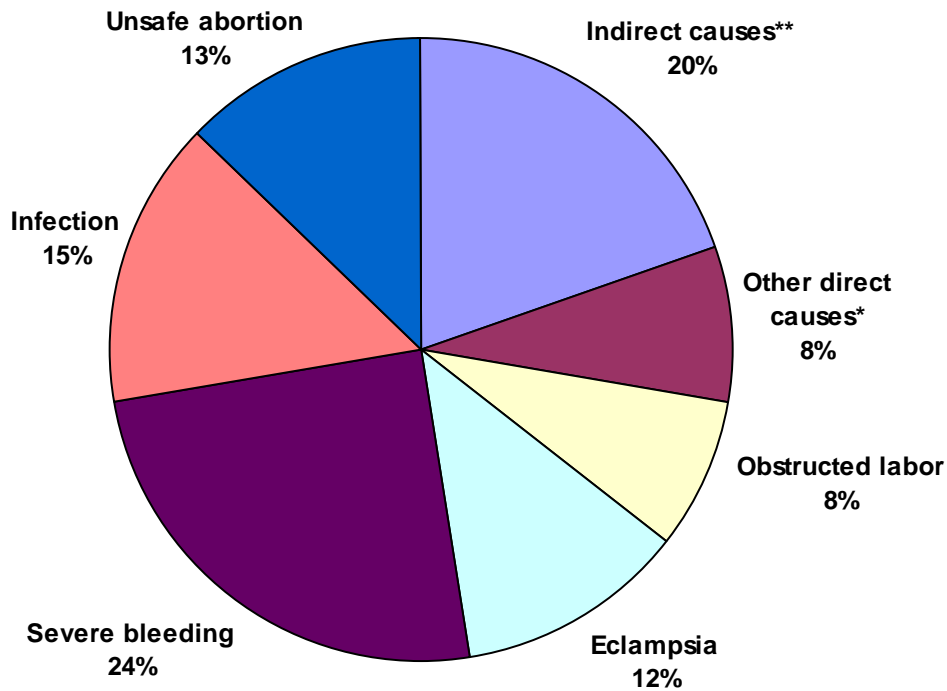
2. EVIDENCE ON DETERMINANTS

This section briefly reviews the direct and indirect determinants of maternal death and presents what we know about the underlying determinants of maternal health (See Appendix A for a summary table).

2.1 DIRECT AND INDIRECT DETERMINANTS OF MATERNAL DEATH

The principal direct determinants of maternal mortality are well established (Figure 5). More than 70% of maternal deaths are due to five major complications: hemorrhage (25%), infection (15%), complications of unsafe abortion (13%), hypertension (12%), and obstructed labor (8%). These complications can occur at any time during pregnancy and childbirth, often without forewarning and often requiring immediate access to emergency obstetric care for their management (Safe Motherhood Technical Consultation Report, 1997). Indirect determinants are defined as preexisting diseases or diseases that develop during pregnancy (not related to direct obstetric determinants) that are aggravated by the physiological effects of pregnancy; the principal indirect determinants in many settings include anemia, malaria, hepatitis and diabetes (Gelband et al., 2001).

Figure 5. Determinants of maternal death



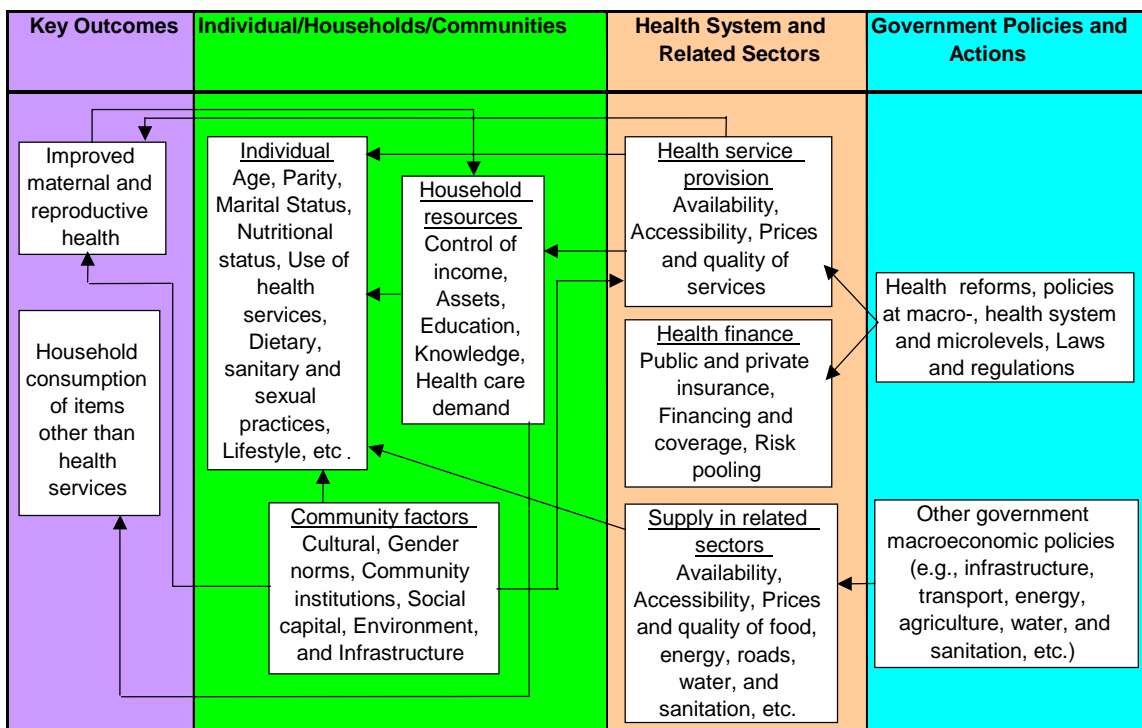
* Other direct causes include ectopic pregnancy, embolism, anesthesia-related
** Indirect causes include anemia, malaria, heart disease

Source. From *The Safe Motherhood Action Agenda: Priorities for the Next Decade* by Safe Motherhood Technical Consultation Report, 1997, New York: Family Care International in collaboration with Safe Motherhood Inter-Agency Group (SMIAG).

2.2 UNDERLYING DETERMINANTS OF MATERNAL HEALTH

In addition to direct and indirect determinants of maternal mortality, a range of underlying determinants, including social, cultural, health system, and economic factors, have a profound effect on maternal health and, ultimately, on maternal mortality. The indirect and underlying determinants are best examined from both a demand and supply perspective, organized into pathways at the following levels: individual, household and community, health system and related sectors, and government policies and action (see Figure 6). The following sections describe various aspects of these levels.

Figure 6. Determinants of reproductive health-sector outcomes



Source. Adapted from “A Framework for Analyzing the Determinants of Maternal Mortality,” by J. McCarthy and D. Maine, 1992, *Studies in Family Planning*, 23, pp. 23–33; and “Poverty Reduction and the Health Sector,” by M. Claeson, C. Griffin, T. Johnston, M. McLachlan, A. Soucat, A. Wagstaff, and A. Yazbeck, 2001, page 6 in *Poverty Reduction Strategy Sourcebook*, Washington, DC: The World Bank.

2.2.1 Individual-Level

As suggested, several health and non-health-related factors contribute to poor maternal health and mortality. On an individual level, one can discern effects associated with a woman’s age, her ability to use reproductive health-care services effectively, and her general health status (including nutrition).

Age

The age below which giving birth is physically risky for a woman varies significantly depending on general health conditions and access to prenatal care (Islam, 1999). Although the physical risk of giving birth during adolescence is not high for women in countries with good nutritional levels and extensive access to prenatal care (Makinson, 1985), this circumstance is not the case for societies where anemia and malnutrition are widely prevalent and where access to health care is generally poor. In these societies, women who are too young or too old or who have babies too closely spaced face increased risks of complications not only during and after pregnancy but also at childbirth. Very young and nulliparous women are also more likely to experience prolonged labor as a result of immature pelvises, a circumstance that can lead to complications such as vesico-vaginal fistulae (Hoestermann, Ogbaselassie, Wacker, and Baster, 1996; Tahzib, 1989). Older women face risks of other sequelae. A study in Egypt

showed that every 1 year increase in age increased the risk of prolapse by 7% (Younis et al., 1993).

Limited and Spaced Births

Although family planning programs have made tremendous achievements in expanding access and use of contraceptive methods, in many settings, informed choice is limited by a narrow range of temporary methods that are available, especially for adolescent girls. In addition, evidence indicates persistent rates of discontinuation of contraceptive use and a high number of unplanned pregnancies (Ali and Cleland, 1995). The effects of multiple births on maternal health are well understood. Higher parity increases risks for maternal health, including uterine prolapse and other gynecological morbidities.

Although some evidence from Matlab, Bangladesh indicated that the length of the preceding birth-to-conception interval did not affect the risk of maternal mortality (Ronsmans and Campbell, 1998), allowing an insufficient amount of time between births can have serious effects on women and their children. Recent evidence from Latin America shows that women who experience birth intervals of less than 15 months have 2.54 times increased risk of maternal death. They also experience an increased risk of third-trimester bleeding, premature rupture of the membranes, and anemia compared with women who experience 27–32 months between births (Conde-Agudelo and Belizan, 2000). Additionally, children born 3 years or more after a previous birth are healthier at birth and are more likely to survive at all the developmental stages of infancy and childhood through the age of 5 years (Rutstein, 2002).

Health Status

The following subsections describe health conditions that can affect women in their reproductive lifetime.

Nutrition and anemia: Malnutrition in women contributes to complications and death during pregnancy and childbirth. Women who are stunted from malnutrition during childhood are at greater risk of needing an assisted delivery than taller women (Kelly, Kevany, de Onis, and Shah, 1996; WHO, 1995). Anemia is a life-threatening complication for women during pregnancy and puts them at risk of dying from even small amounts of blood loss during the delivery and postpartum periods. Women with severe anemia are particularly at risk and have a 3.5 times greater chance of dying than women without anemia (Brabin, Hakimi, and Pelletier, 2001). More than 50% of pregnant women are anemic in developing countries. South Asia has the greatest number of anemic women, and in India alone, estimates approximate that 130 million women are anemic (Galloway, 2003, calculated from the NFHS-2 for India 1998–1999).

Malaria: Infection due to malaria during pregnancy is a major public health problem in tropical and subtropical regions throughout the world, and pregnant women are the most vulnerable adult group in endemic areas of the world. Africa bears 90% of the global malaria burden, and every year, at least 24 million pregnancies occur among women in malaria-infested areas of Africa. Unfortunately, less than 5% of pregnant women have

access to effective interventions (WHO, 2002). *Plasmodium falciparum* infection during pregnancy increases the chance of maternal anemia, spontaneous abortion, stillbirth, prematurity, intrauterine growth retardation, and infant low birth weight (Steketee, 2003; WHO, 2002).

Hookworm: Because intestinal worm infestations are common worldwide and often thrive in poor communities in tropical countries with poor water supply and sanitation, pregnant women in these environments face increased risks of hookworm infestation and its effects on their infants. Although low birth weight in infants and decreased child growth cannot be directly attributed to hookworm infestations, recent intervention trials using effective drugs against intestinal worm infestations showed significant improvements in child weight, weight for age, and weight for height (Beach et al., 1999).

HIV-AIDS: Of the estimated 39.4 million people living with HIV-AIDS, 17.6 million are women. In 2004, it was estimated that 4.9 million adults were newly infected and that 3.1 million had died of AIDS (UNAIDS, 2004). Furthermore, 57% of adult infections in sub-Saharan Africa are in women, 30% in Southeast Asia, and 36% in Latin America (UNAIDS, 2004). Women are more vulnerable to HIV infection biologically, economically, and socially, and the infection's effects can be exacerbated during pregnancy. Transmission of HIV from an infected mother to a child can occur during pregnancy, during labor, or after delivery through breast milk. In the absence of any intervention, an estimated 15%–30% of mothers with HIV infection will transmit the infection during pregnancy and delivery, and 10%–20% through breast milk (WHO, 2003).

The synergistic effects of the indirect determinants of maternal mortality are significant because a woman will often exhibit more than one symptom. These multiple effects are aggravated by pregnancy and place a woman at an even higher risk of maternal death from direct determinants. Severe malaria may contribute to severe anemia, which could decrease the chances of survival from hemorrhage. An analysis of anemia- and pregnancy-related maternal mortality indicates that, in holoendemic malaria-infested areas with a 5% severe anemia prevalence ($Hb < 70$ g/L), approximately 9 deaths per 100,000 live births would be related to severe malarial anemia and 41 deaths per 100,000 live births would be related to non-malarial anemia (Brabin et al., 2001). With hookworm infestations, the gastrointestinal blood loss, malabsorption, and appetite inhibition may further aggravate the iron, zinc, and protein-energy deficiencies as well as the anemia of pregnancy (Steketee, 2003). Women infected with HIV (before or during their pregnancies) tend to become vulnerable to other infections that are detrimental to their unborn children and to their own health. Recent evidence suggests links between AIDS-associated tuberculosis and maternal death in Zambia, indicating the emerging role of nonobstetric causes of maternal death (Ahmed et al., 1999).

2.2.2 Household-Level

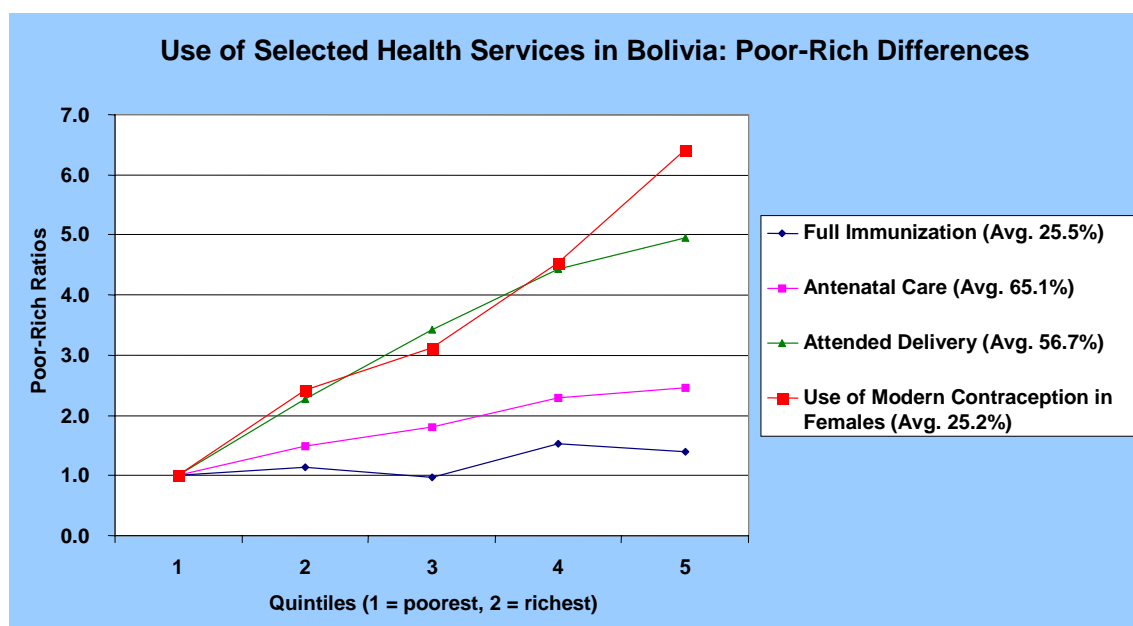
A woman's decision to seek health care is shaped by several factors, including the influence of her spouse or other family members, social norms, her education, her status in society, the severity of her illness, the distance she lives from the health facility, the financial and opportunity costs of seeking care, and her previous experiences with the health system and perceived quality of care (Thaddeus and Maine, 1994). These factors are in turn influenced by household- and community-level variables, and the following sections describe the influence of these variables on maternal health and mortality.

Inequalities in Socioeconomic Status

Being poor limits access to information and appropriate care, which poses major challenges to improving maternal health outcomes. Evidence from literature suggests that socioeconomic inequalities in the utilization of health services persist even after controlling for potential confounders such as age, religion, ethnicity, or place of residence (Ragupathy, 1996). The differentials between the rich and the poor are great not only among countries, as mentioned before, but also within countries. Data from Demographic and Health Surveys (DHS) indicate a consistent relationship between asset quintiles and the use of health services. For example, in Bolivia, differences between the poor and the rich in the proportion of clients using health services are large for all services, but they are the greatest for the use of modern contraception and skilled attendance at delivery: the rich-poor ratio is 6.4 for contraceptive prevalence and 4.9 for skilled attendance at delivery (Figure 7). Relatively less inequity occurs for immunization (rich-poor ratio: 1.4) and antenatal care (rich-poor ratio: 2.5). Although averages for the use of safe motherhood health services (antenatal care and skilled attendance at delivery) are above 50%, they mask the low levels of health-care utilization by the poorest people (Gwatkin, Rustein, Johnson, Pande, and Wagstaff, 2000).

Socioeconomic inequality and discrimination make poor women more vulnerable to physical and sexual abuse; to unwanted pregnancy; and to sexually transmitted diseases, including HIV-AIDS. Although socioeconomic status and the use of maternal health services are consistently related, the underlying determinant of household poverty clearly operates through other intermediate determinants such as women's position in the household, to affect maternal mortality and morbidity.

Figure 7. Differences in the use of selected health services among the rich and poor in Bolivia, 1998



Source. Compiled from data in *Socio-economic Differences in Health, Nutrition and Population in Bolivia* by D. Gwatkin, S. Rustein, K. Johnson, R. Pande, and A. Wagstaff, 2000, Washington, DC: The World Bank, HNP/Poverty Thematic Group. Adapted with permission.

Women's Status

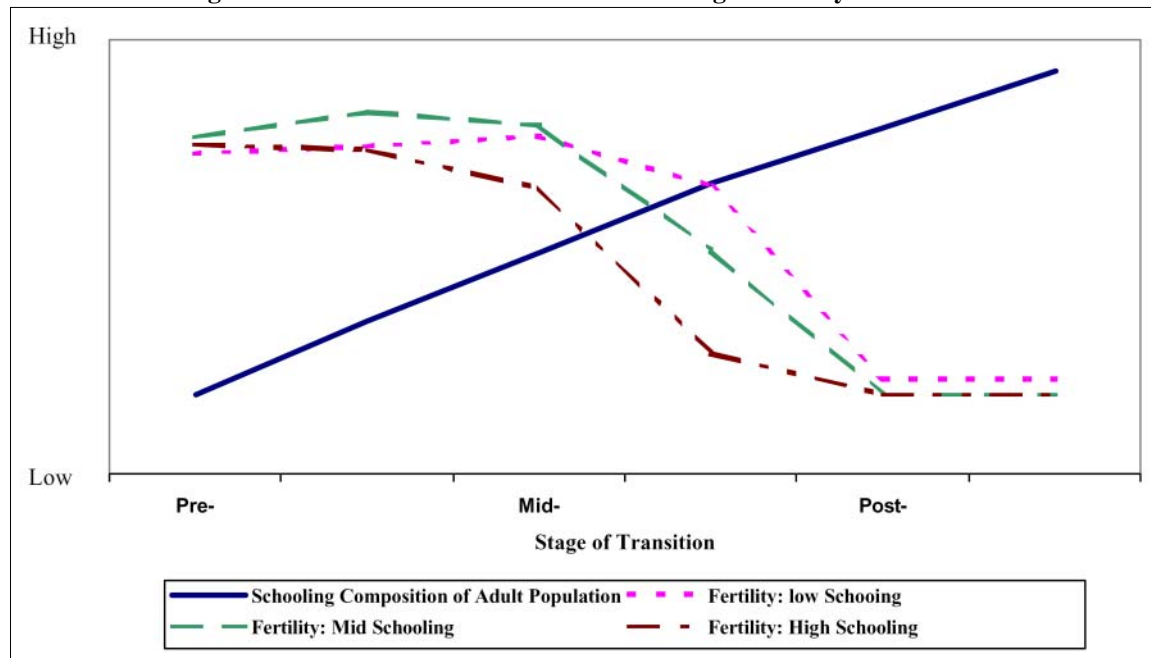
In many settings, restrictions on women's access to resources such as land, credit, and education limit their engagement in productive work, constrain their ability to seek health care, and deny them the power to make decisions that affect their lives. Even when women do seek health care, they face high opportunity costs. They must give up time that they would normally spend on household chores such as caring for children, collecting water and fuel, cooking, cleaning, doing agricultural work, and engaging in trade or other employment. These restrictions and other human rights abuses are pervasive, and they relate, in part, to gender inequities and can impede progress in improving maternal health outcomes among the poor.

A strong association exists between women's education or literacy levels and use of reproductive and maternal health services. For example, a descriptive study in Turkey reports that educational attainment and lower parity levels were significantly associated with the choice of a modern home delivery as opposed to a traditional home delivery (Celik and Hotchkiss, 2000). Poor, rural women are more likely to have lower education and are less likely to make use of available services. Evidence from Punjab, India, shows that education contributes to women's self-confidence and improved maternal skills, increases their exposure to information and alters the way others respond to them (Das Gupta, 1990).

The relationship between female education and fertility holds for a large number of countries, even after controlling for socioeconomic factors. However, the strength of the relationship across countries is not uniform (United Nations, 1995) and depends on the

stage of fertility transition of a particular country (Figure 8). In the early phase of fertility transition, childbearing declines first among the better educated and last among the least educated. In the later phases of fertility transition, these differentials begin to narrow until convergence is reached at the end of transition (Cleland, 2002). Additionally, the effect of education on fertility preferences is largely conditioned by other community-level influences such as gender norms, geographical location, social structure, and cultural perceptions within a specific context (Basu, 1996; Jejeebhoy, 1995).

Figure 8. An illustration of the role of schooling in fertility transition



Source. From Education and Future Fertility Trends, With Special Reference to Mid-Transitional Countries, by J. Cleland, 2002, New York: United Nations. Available on the World Wide Web: <http://www.un.org/esa/population/publications/completingfertility/CLELANDpaper.pdf>

2.2.3 Community-Level

As suggested previously, local cultural norms that govern women’s reproductive lives have a profound effect on their health and mortality. In some settings, men’s decision-making authority over women can impede their use of reproductive health-care services. Social isolation of women often exists in settings where male peer groups condone and legitimize violence, which contributes to high rates of gender-based violence (Koenig, Hossain, Ahmed, and Haaga, 1999). Other evidence from Bangladesh indicates that poor households tend to rely on free and low-cost services for women; husbands are unwilling to spend their household income on preventive care and treatment for women and, especially, for family planning (Schuler, Bates, and Islam, 2002).

Beliefs about health risks and health problems during pregnancy, at birth, and during the postpartum period strongly influence both health-seeking behavior and attitudes to available medical services for both the mother and infant. For example, pregnant women

may substantially reduce their food intake during pregnancy because of the belief that eating too much during pregnancy will result in a larger baby and, thus, a more difficult delivery (SEWA-Rural Research Team, 1994).

Cultural norms that operate on a community level penetrate household dynamics and may affect a woman's ability to regulate her fertility. Expectations of high fertility and large families as well as early marriage and early childbearing are encouraged in many settings, particularly among poor families where use of services is low and maternal mortality is still high. In some cultures, son preference influences fertility choices and behavior to seek health care for infants (Johansson, Lap, Hoa, Diwan and Eriksson, 1998). A woman may feel pressured to reproduce until she has at least one son, increasing her risk of pregnancy-related morbidity and mortality. For example, a study in North India found that one out of every six women who had an abortion (in the last 18 months) did so with the knowledge that they were carrying a female child (Ganatra, Hirve and Rao, 2001). In a study in rural China, 36% of the 301 women who reported induced abortions acknowledged them to be sex-selective abortions (Junhong, 2001).

2.2.4 Health Systems

Even if women and their families are in the ideal situation of recognizing their health problems, making decisions to seek care, and feeling financially secure to make that expenditure, several obstacles remain to obtaining good quality health care. These usually emerge at the levels of the health system and of government policies and actions.

Women must have access to comprehensive health care to improve their overall health and mortality outcomes as envisaged by the MDGs. This comprehensive care requires health systems that can and do make high-quality services accessible, available, and affordable at both the primary care and referral levels.

Quality of Care

Poor quality of care and unacceptable services (or providers) are common reasons that women and their families give for not using available health services. Accountability for performance (for the delivery of health services) as measured by responsiveness to the client's needs has been shown to have an explanatory power that is significantly greater than female literacy rates and wealth (Gross National Product–Purchasing Power Parity, or GNP-PPP) for maternal mortality (Van Lerberghe and De Brouwere, 2001). Formal health services can be inappropriate for cultural settings in which they are delivered. For example, Saraguro Indians in Ecuador perceive hospital-based deliveries as an invasion of their privacy. They are uncomfortable with male providers and with childbirth positions that health providers recommend. As a result, accessible and affordable maternal health services are underutilized (Leslie and Gupta, 1989).

Accessibility

The geographic coverage of health facilities, usually reported as distance or time required to reach the nearest health center, is an important barrier for large segments of societies in most countries, particularly in rural areas and urban slums. Women in rural areas often

walk more than an hour to the nearest health facility. Poor road infrastructure and lack of reliable public transport or access to emergency transportation make access difficult, especially when obstetric complications occur. As a result, women are obliged to seek health care from less-trained providers who are more accessible but who are neither competent nor equipped to deal with pregnancy complications. A study in Turkey found that urban women were more likely than rural women to choose a facility delivery over a traditional home delivery (Celik and Hotchkiss, 2000). In Malawi, 90% of women in a study wanted to deliver in a health-care facility, but only 25% of them did, those who did not citing distance and time as major obstacles (Lule and Ssembatya, 1996)

Availability

Even when women reach a health center, they may not be able to receive the health-care services they require. Public facilities, especially those serving poor and geographically remote areas, commonly face limited human resources and a shortage of skilled providers to provide emergency obstetric care. In Asia and sub-Saharan Africa, only one skilled attendant is available for every 300,000 people, resulting in a ratio of one skilled attendant for every 15,000 births (MacDonald and Starrs, 2002). In addition, few incentives exist for skilled workers to work and live in rural areas, small urban areas and remote regions. Moreover, in some developing countries, skilled medical professionals are lured by higher incomes in western countries, contributing to the overall “brain drain” of medical professionals from developing countries (Heller and Mills, 2002).

In countries with high maternal mortality, referral systems are not systematic, and the availability of emergency health-care services is uncertain. A referral system is an essential component of a health-care system and plays an important role in reducing maternal mortality (as will be apparent in the discussion of effective interventions). Yet even in settings where a referral site is nearby, delays in seeking care are often a problem. A study from Pakistan shows that, in a large referral hospital in Karachi, 118 mothers who had been brought dead to the hospital lived within an 8 km range of the hospital. Social and cultural factors (of patients and first-line providers) played the most significant role in preventing timely referral to the hospital (Jafarey and Korejo, 1993).

Affordability

A low level of public expenditure for health services and, particularly, maternal health services is a major problem for many developing countries. Pressure to achieve financial sustainability of health services often translates into increasing a household’s financial burden through user fees, out-of-pocket payments, and other cost-recovery mechanisms (McPake, 1993). Families that are already too poor to pay for normal childbirth procedures are overwhelmed and suffer catastrophic financial consequences as they try to support the costs of emergency medical care. The cost of a normal birth with a skilled attendant can be as low as \$2 but usually ranges from \$7 to \$15 at health centers in Africa and Latin America. The cost of a normal delivery at a hospital ranges from \$10 to \$35, and a cesarean section or a complicated delivery can escalate to costs from \$50 to \$100 (Gelband et al., 2001). In addition to fees for services, other informal or hidden costs that women are required to pay also arise. Several studies have reported out-of-pocket costs for maternity care supplies such as gloves, syringes, and drugs (Nahar and

Costello, 1998). In Uganda, a study showed that the costs for medical supplies were significantly higher than the actual user fees (15,000 shillings compared to 3,000 shillings) and that, if the pregnant woman and her family cannot cover these hidden costs, she is likely to receive poor quality care during her delivery (Konde-Lule and Okello, 1998).

Supply in Related Sectors

The supply of other goods such as transport and commodities will affect the use of maternal health services, particularly for emergency obstetric care that is provided only in referral hospitals for women in rural areas. Both the lack of transport and the high cost of transport can be barriers to accessing maternal health services. Frequently, community-based health workers have no access to phones and transport, even in emergency situations (Jahn, Dar Iang, Shah and Diesfeld, 2002), so effective referral of the obstetric case is blocked.

Government Policies and Implementation

The medical interventions for specific maternal complications that are needed to address maternal mortality are well understood; however, less clear is how to create the enabling health systems and policy environments to implement these interventions (Koblinsky, Campbell and Heichelheim, 1999). Even when technical interventions are available and in place, maternal mortality levels may not fall proportionately, indicating the influence of the broader environment of health systems and policy on the delivery of health services. Many countries with high maternal mortality lack appropriate policies to improve education, health, transport, and energy sectors. Political will to reach poor regions and provide safety nets, health insurance, and risk pooling or to provide free maternal and child services for poor women is often lacking. Policies to address human resource issues and increase skilled provider coverage in rural areas are weak. The poor are disproportionately affected by inadequate health systems and policies, resulting in low levels of investment in maternal and child health services. Countries face a pressing need for national-level policies that improve the functioning of health systems as a whole and that foster multisectoral linkages among the ministries of health, education, social protection, and transport.

2.3 COMPLEXITY OF THE DETERMINANTS OF MATERNAL HEALTH AND MORTALITY

The determinants of maternal health and mortality interact to produce a complex set of circumstances that involve clients, communities, the health system, and the government. These dynamics become urgent when a life-threatening obstetric emergency occurs. The Delay Model (Thaddeus and Maine, 1994) outlines the three delays in obtaining emergency obstetric care and provides an elegant example of these interactions:

- **Delay One:** *Recognizing Danger Signs and Deciding to Seek Care* are influenced by a woman's knowledge of pregnancy-related health risks and by her ability to access the resources of her family and community. Poor families in communities with limited information and resources tend to delay decision making or make inappropriate choices when complications arise.

- **Delay Two:** *Reaching Appropriate Care* is exacerbated for poor rural women and their families, who tend to face higher and less predictable costs of emergency transportation because of distance and poor infrastructure.
- **Delay Three:** *Receiving Care at Health Facilities* is influenced by economic status, discrimination based on gender or ethnic prejudice, and availability of providers. Poor families often have to borrow money to pay up front when complications arise. Frequently, households do not have ready access to sufficient cash in time, and often, credit is withheld for needed supplies, medications, and services.

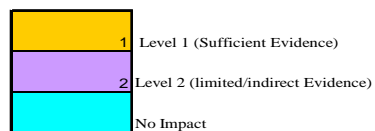
3. EVIDENCE ON INTERVENTIONS

The challenges of measuring maternal mortality and morbidity discouraged rigorous research far too long. The time has come to evaluate safe motherhood interventions that show promise of being effective under real-life conditions (Miller, Sloan, Winikoff, Langer and Fikree, 2003). Most of the evidence on the determinants of maternal mortality shows that improving maternal health requires health and non-health interventions. Key interventions to improve maternal health and reduce maternal mortality are well known. They include complementary and mutually reinforcing strategies: (a) mobilizing political commitment and an enabling policy environment; (b) investing in social and economic development such as female education, poverty reduction, and improvements in women's status; (c) providing family planning services; (d) ensuring quality antenatal care, skilled attendance during childbirth, and the availability of emergency obstetric services for pregnancy complications; and (e) strengthening health systems and community involvement. The challenge has been to implement these interventions in environments where political commitment, policies, institutions, and health systems have been weak. Strengthening the fragile health-care system in many developing countries remains the principal challenge to reducing maternal mortality. Available evidence also suggests that, within the health sector, a more integrated systems approach is required to improve maternal health for health sector interventions while coordination with non-health investments assumes macro-level priority.

Figure 9 summarizes evidence based interventions directly or indirectly impacting maternal mortality extracted from the Cochrane database (2003). The evidence presented in the table is limited because prospective trials comparing existing maternal health interventions such as antenatal care with no intervention are out of the question, for ethical or other reasons discussed above. Though there are no randomized trials assessing the impact of family planning, we have assumed level 1 association based on the impact of reduced fertility on lifetime risk of maternal death.

Figure 9 Interventions for reducing maternal mortality

Interventions		Causes of Maternal Death								
		Hemorrhage	Puerperal Infection	Eclampsia	Obstructed Labour	Abortion Complications	Malaria	Anemia	Tetanus	Other....
Preventive	Iron Supplementation in pregnancy							2		
	Folate supplementation in pregnancy							2		
	Balanced protein/energy supplements in pregnancy									2
	Treatment for iron deficiency in pregnancy							2		
	Calcium supplementation during pregnancy for preventing			2						
	Vitamin A supplementation during pregnancy	2	2	2						
	Use of Insecticide Treated Nets for prevention of Malaria						2	2		
	Intermittent Malaria Prophylaxis						1	1		
	Family Planning	1	1	1	1	1				
	Continuity of caregivers during pregnancy and child birth									2
Primary clinical care	Antibiotics for preterm (before 37 weeks) rupture of membranes		1							
	Antibiotics for prelabour (36 weeks or beyond) rupture of membranes		1							
	Antibiotics for treating bacterial vaginosis in pregnancy		2							
	Antihypertensive drug therapy for mild to moderate hypertension			2						
Basic Essential Obstetric care	Professional delivery services (Skilled attendant)	2	2	2	2					
	Active versus expectant management in the third stage of	1								
	Management of Primary PPH with rectal Misoprestol administration	1								
	Magnesium Sulphate and other anticonvulsants for women with pre-			2						
Comprehensive Essential Obsteric Care	1	1	1	1						



Source: From “The Millennium Development Goals for Health: Rising to the Challenge”, The World Bank, page 51, by Wagstaff, A., and Claeson, M., 2004, Washington, DC: The World Bank, Human Development Network; The Cochrane Library Issue 3, 2003. Oxford

Box 2. Investing in Maternal Health: Learning from Sri Lanka

Sri Lanka's achievement in maternal mortality reduction is one of the spectacular success stories in human development. Multisectoral public sector investments led to a steep decline in maternal mortality ratios (deaths per 100,000 live births) during the 1930s and early 1950s and a continuation of this decline to a current MMR level of 60 estimated for 1995. Several studies have attributed the early decline of MMR to Sri Lanka's focus on communicable disease reduction (malaria and hookworm), general improvements in sanitation, and the introduction of modern medical advances (antibiotics). General improvement also occurred in living standards, including food supplies, which improved women's nutrition. In addition, specific factors acted on improving MMR.

The initial scheme to expand delivery of maternal and child health services to the broader population started in 1926 with the health unit system. Each health unit is subdivided into public health midwife (PHM) areas. A PHM is responsible for all pregnant women in her jurisdiction—covering a population of 4,000–5,000. By 1948, the whole island was covered by the health unit system. This system remains the cornerstone of field health services in Sri Lanka today. With the increase in the number of health units, the number of health centers rose rapidly. These centers provided an integrated package of maternal and child health services with an emphasis on improving antenatal coverage, detection, and early referral of delivery complications. Access to these and other primary services was free.

During the 1950s, Sri Lanka increased investments in midwife training and expansion of PHM positions, increased the number of hospitals providing obstetric services, and increased investments in an ambulance service throughout the country. The effect of these investments resulted in an increase in the percentage of births delivered by a skilled attendant. Before 1940, 30% of live births in Sri Lanka had skilled attendance, with most of these births taking place at the mother's home with a trained public health midwife. By the late 1950s, skilled attendance had increased to 50%, with PHMs conducting half of these deliveries at home. Today, 95% of births are attended by a skilled practitioner, with the majority taking place in a hospital.

The success of women's health promotion in Sri Lanka is attributable to other sectoral investments—including investments in girl's education, promotion of women's rights, and empowerment of women through the electoral process. These elements also provided an environment that sustained political and managerial commitment to improved maternal health.

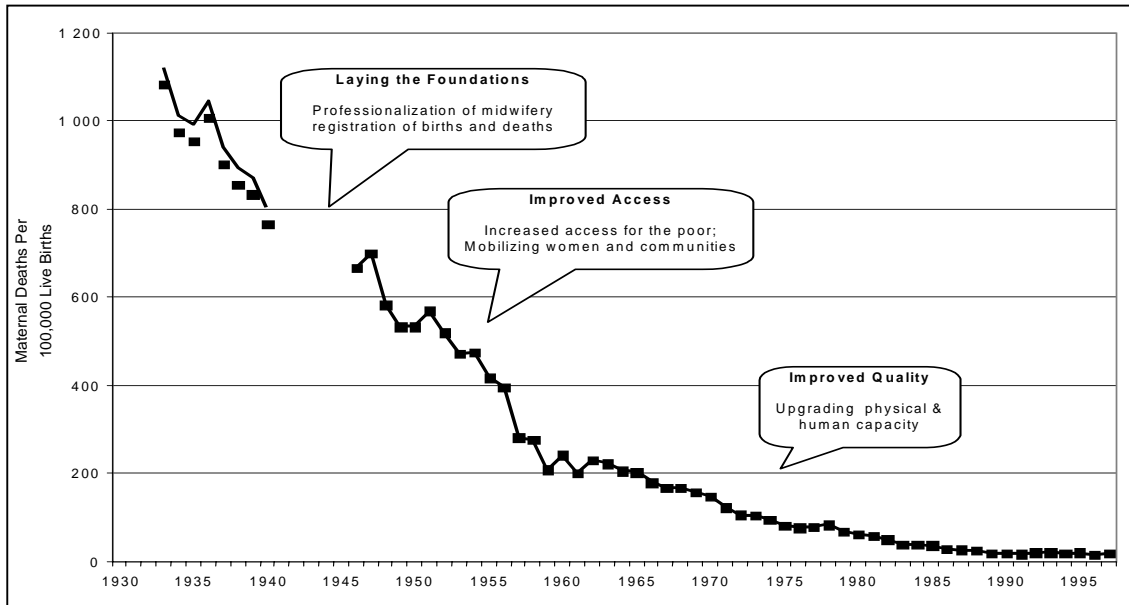
With good access to basic health care established, Sri Lanka then focused during the 1960s and 1970s on family planning, improving quality of care, and introducing advances in obstetric care. Monitoring systems were continually strengthened, and maternal death investigations were used to fuel improved clinical and organizational management.

Although Sri Lanka faces many challenges today in maintaining its system of high quality, accessible maternal and child health services, its past efforts are commended for demonstrating that, when human development investments focus on improving women's health, maternal mortality can be reduced in a resource-poor setting.

Source. Abstracted from information presented in *Investing in Maternal Health: Learning From Malaysia and Sri Lanka* (Health, Nutrition and Population Series), pages 112–151, by I. Pathmanathan, J. Liljestrand, J. M. Martins, L. C. Rajapaksa, C. Lissner, A. de Silva, S. Selvaraju, P. J. Singh, 2003, Washington, DC: The World Bank, Human Development Network.

Sri Lanka and Malaysia are examples of success in reducing maternal mortality. Box 2 describes some of the particular successes that have been achieved in Sri Lanka. However, global success will require a much steeper rate of decline in maternal mortality than Sri Lanka and Malaysia experienced (see Figure 10). For this amount of change to occur, maternal health programs need to be developed using the most effective interventions (Figure 11).

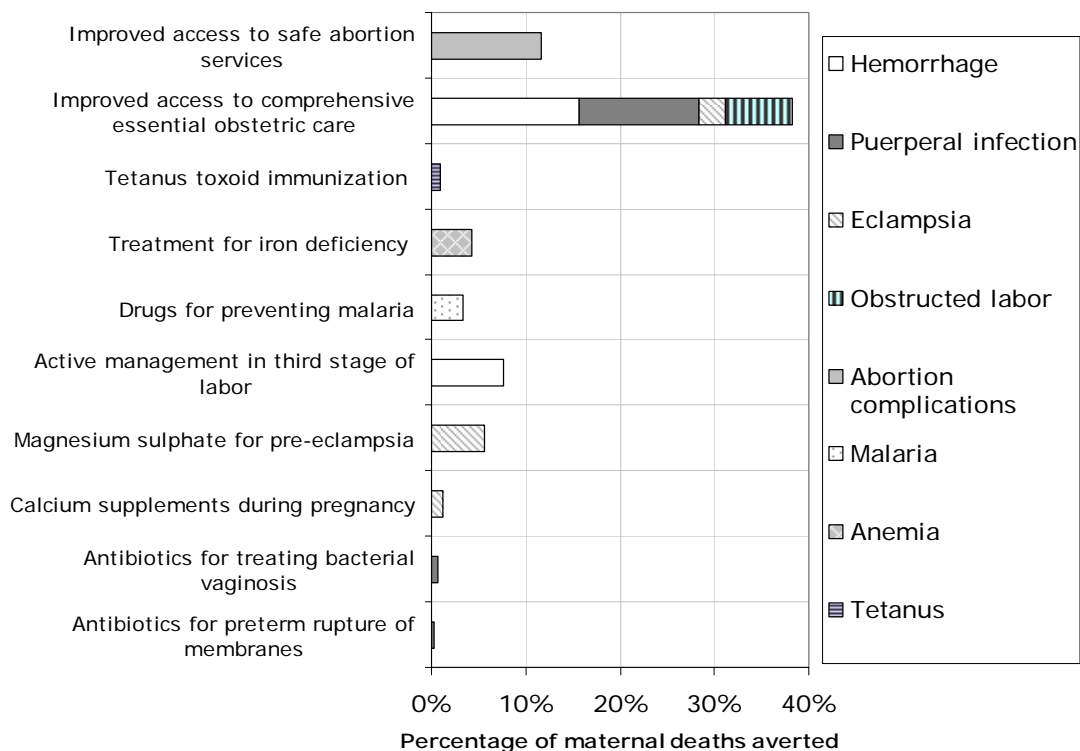
Figure 10. Maternal mortality ratio in Sri Lanka, 1930–1996



Source. From “Investing in Maternal Health: Learning From Malaysia and Sri Lanka” (Health, Nutrition and Population Series), page 46, by I. Pathmanathan, J. Liljestrand, J. M. Martins, L. C. Rajapaksa, C. Lissner, A. de Silva, S. Selvaraju, P. J. Singh, 2003, Washington, DC: The World Bank, Human Development Network.

This section of the paper discusses the evidence on these core interventions across sectors that affect maternal health at the household, community, health facility, and policy levels. First, interventions within the health sector are examined, and then actions required from outside of the health sector that can influence maternal health outcomes are addressed.

Figure 11. Full use of existing interventions would dramatically cut maternal deaths

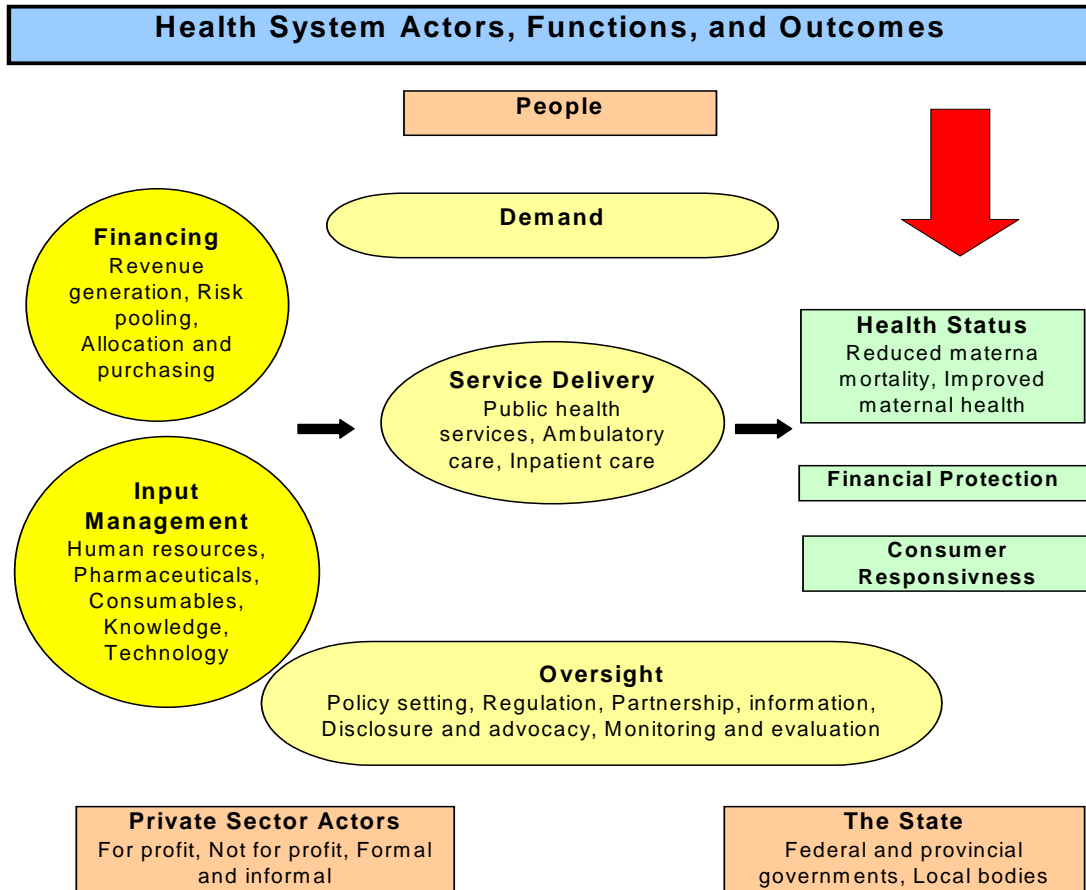


Source: World Bank staff estimates.

3.1 HEALTH SECTOR INTERVENTIONS FOR IMPROVING MATERNAL HEALTH

Health sector interventions for reducing maternal mortality and for promoting maternal health need to work through a system-wide approach to deliver needed services. As Figure 12 shows, the key actors for health systems include the people, the state, and the private sector. An efficient health system should improve health outcomes and ensure financial protection to the poor, especially during catastrophic illness. Responsiveness to the client is another important health system outcome, which involves providing culturally appropriate services with adequate clinical quality. The latter is determined by the quality and availability of human resources as well as by the adequacy and regularity in supply of essential commodities such as pharmaceuticals, contraceptives, and consumables. To ensure these outcomes, the health systems need to provide adequate financing through revenue generation, risk pooling, and efforts to enhance efficiency through competitive purchasing of services from the private sector. An overarching function of public health systems is their stewardship or oversight role, which among other things involves setting policy, regulating quality and price of services, partnering with the private sector, and regularly collecting and disseminating information to the communities.

Figure 12. Health system actors, functions, and outcomes



Source. From *Better Health Systems for India's Poor: Findings, Analysis, and Options* (Health, Nutrition and Population Series), p. 152, by D.H. Peters, A. S. Yazbeck, R. R. Sharma, G. N. V. Ramana, L. H. Pintchett, and A. Wagstaff, 2002, Washington, DC: The World Bank, Human Development Network.

Health systems deliver comprehensive care to women, including preventive and curative services for a broad range of health-care needs. Countries need to engage national health systems fully at all levels to develop a culture of quality and professional accountability (Van Lerberghe and De Brouwere, 2001). The following sections summarize specific health system interventions for improving women's health.

3.1.1 Increasing Access to Family Planning Information and Services

Access to voluntary, safe, affordable, and appropriate family planning knowledge and services is fundamental to improving maternal and child health and to reducing maternal mortality. A women's lifetime risk of dying due to pregnancy-related causes is influenced by both fertility and maternal mortality. Consequently, the maternal mortality rate can be lowered either by making childbirth safer or by reducing the fertility rate in the population (UNICEF, WHO, and UNFPA, 1997). In addition, family planning helps to reduce high-risk pregnancies associated with increased parity and helps women to avoid

unwanted and unsafe abortions. Family planning programs were responsible for approximately 43% of the decline in fertility in the developing world between 1960s and the 1980s (Bongaarts, 1995).

Family planning programs also have achieved additional gains. A study in Bolivia, Egypt, and Thailand found that women who had previously used modern contraception were more likely to have used prenatal care and to continue modern contraception after the index birth (Zerai and Tsia, 2001). If the unmet need for contraception were addressed and women had only the number of pregnancies at the interval they wanted, then the overall maternal mortality would drop by 20%–35% (Doulaire, 2002; Maine, 1991).

3.1.2 Improving Coverage and Quality of Prenatal Care

Although prenatal services are considered an essential element of obstetric care (WHO, 1994), evidence suggests that there is wide variation in coverage and quality (Eseko 1998; WHO, 1993). Although an accepted goal of prenatal care is to assess the risk of complications in later pregnancy, most of the complications that lead to maternal mortality cannot be predicted.

This finding does not obviate the need for good quality antenatal care. Antenatal care can provide women familiarity with the health system and can offer other essential health services as well as information on birth preparedness (Ross, 1998). An evaluation of a safe motherhood information, education, and communication program in Pakistan found that participants showed a marked improvement in knowledge about preventive measures that women should take during pregnancy (Fikree, Jafarey and Kureshy, 1999). After a comprehensive review of available evidence, Rooney (1992) also concluded that antenatal care is not an academic luxury. Some women at greater risk can be identified with good prenatal care and can be cared for if the women and their families appreciate the seriousness of the complications and if the referral health systems are functional and responsive. The prenatal interventions known to be effective include the following:

- *Prevention of malaria (chemo prophylaxis)*. Fifteen studies found that malaria chemo prophylaxis, when given regularly and routinely in endemic countries, was associated with fewer episodes of fever, reduced antenatal anemia, and increased birth weight in infants (Garner and Gulmezoglu, 2000). In countries where the malaria parasite was not resistant to chloroquine and proguanil, intermittent chemo prophylaxis with these drugs was also found to be effective (Mnyika, Kabalimu, Rukinisha and Mpanju-Shumbusho, 2000).
- *Detection and management of anemia (oral or injectable iron)*. Anemia is an important underlying cause of maternal mortality and low birth weight outcomes. Treating iron-deficiency anemia with supplementation of iron and folate during pregnancy has been shown to reduce the prevalence of anemia (Macky, 2000). Fortification of foods with iron has been found effective where there is a bio-available iron source that is compatible with a suitable food vehicle (e.g., fortification

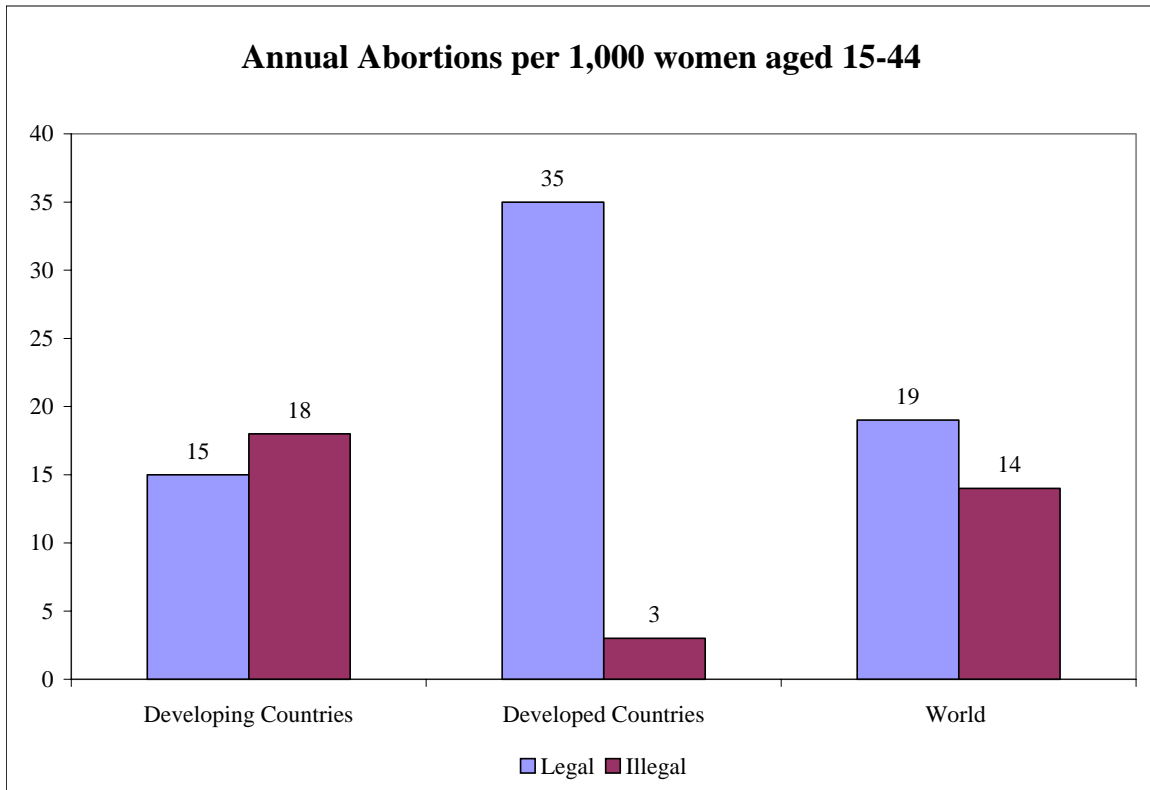
of salt in India). A study in Indonesia demonstrated that traditional birth attendants (TBAs) and village health workers are effective in distributing and monitoring the intake of iron and folate tablets with increased compliance of uptake and reduction in anemia (Robinson, 2000).

- *Treatment of hookworm infestation.* In South Asia and other areas of the world, hookworm infestation is very common. Decreasing the hookworm load in pregnant women enhances the effect of iron supplementation (Atukorala, de Silva, Dechering, Dassenacike and Perera, 1994, cited in Robinson, 2000) and improves the quality of their lives.
- *Early detection and management of pregnancy-induced hypertension* through regular blood pressure recording, urine testing, a specific referral system for attention to pregnancy-induced hypertension, and use of magnesium sulfate in cases of eclampsia (McCaw-Binns, Ashley, Knight, MacGillivray and Golding, 2000).
- *Screening for sexually transmitted infections and HIV through serology for syphilis and microbiology for gonorrhoea, especially in countries with high STI prevalence.* Providing voluntary HIV testing and counseling has proved to be effective (Berer, 1999; WHO and UNAIDS, 1999). A comprehensive review of randomized trials provides evidence that short-course Zidovudine and single-dose Nevirapine are effective therapies for reducing mother-to-child transmission of HIV. Zidovudine also appears to reduce the risk of maternal death (Brocklehurst and Volmink, 2003).
- *Immunization for primary prevention of neonatal and maternal tetanus.* The effectiveness of tetanus toxoid immunization on neonatal health is well established, with a large body of evidence demonstrating a large reduction in neonatal tetanus (Gupta and Keyl, 1998).

Recently, 25,000 pregnant women from four countries participated in an effort to develop a new model consisting of four prenatal visits (Villar et al., 2001). The results suggest that, in low-risk pregnancies, no significant additional health gains result from a greater number of prenatal visits. In economic terms, the new model of focused antenatal care was cheaper; however, the clients were less satisfied with fewer visits, even though they were more satisfied with the better information on labor, delivery, and pregnancy complications provided to them in the new model (Villar et al., 2001).

About 13% of maternal mortality is attributed to unsafe abortions (WHO, 1997b). Of an estimated 20 million unsafe abortions that take place worldwide each year, 95% are performed in developing countries (WHO, 1998b). In a nationally representative study in Egypt, one out of every five OB/GYN admissions was for treatment of an incomplete abortion (Huntington, Nawar, Hassan, Youssef, and Abdel-Tawab, 1998). The delivery of good quality post-abortion services and family planning services to avoid unwanted pregnancy is an essential element of a program to reduce maternal mortality and morbidity. Figure 13 compares the number legal and illegal abortions globally.

Figure 13. Annual abortions per 1,000 women ages 15–44



Source. From *Maternal Mortality and Unsafe Abortion: A Heavy Burden for Developing Countries* by P. Thonneau, 2001, page 154, in V. De Brouwere and W. Van Lerberghe (Eds.), *Studies in Health Organization and Policy: Vol. 17. Safe Motherhood Strategies: A Review of the Evidence*, Antwerp, Belgium: ITG Press.

3.1.3 Improving Management of Delivery, Immediate Postdelivery, and Neonatal Complications

Interventions during labor and delivery are the most critical for reducing maternal mortality (Starrs, 1997). Nearly half of all maternal deaths in developing countries occur during labor, during delivery, or in the immediate postpartum period. Essential interventions for delivery also contribute to saving newborn lives. Of the 13 million deaths among children under 5 years in the developing world, 3 million occur in the first week after delivery. In addition, WHO estimates that some 4 million stillbirths or late fetal deaths occur every year. These 7 million deaths are associated with maternal complications, with poor management of labor and delivery, and with women's general health and nutrition status before and during pregnancy (Tinker and Koblinsky, 1993).

3.1.4 Improving Delivery at Home by a Nonprofessionally Trained Provider

About two-thirds of all births worldwide occur outside health facilities (WHO, 1997a), and the majority of these (about 60 million deliveries per year) are attended by a traditional birth attendant (TBA), a relative, or (in some settings) by no one at all (Alto,

Albu and Irabo 1991). TBAs are commonly respected members of their communities and provide essential social support to women during childbirth (Campero et al., 1998; Chalmers and Mayor, 1993; Chen, 1981).

When TBAs are more formally linked with the health system, they can play an important role in increasing awareness of maternal health issues and strengthening community-based referral practices. The main benefits of training TBAs are improved referrals and links with the formal health-care system when essential obstetric services are available. Malaysia used this strategy effectively by encouraging TBAs to continue their traditional services such as accompanying mothers to hospitals, being present during the delivery to attend to customary rituals, and providing care for the mother and newborn. Health workers were trained to value the role of TBAs in these services and to work with them as full partners (Rizzuto and Rashid, 2002). In rural China where fertility is low and referral services are good, the skills of rural doctors and TBAs have been used for normal delivery and for recognizing problems and stabilizing the patient rather than for managing complications (Koblinsky, 2003).

In communities where a high proportion of deliveries occur outside facilities, a bridge connecting the family, community, and referral facilities is required. For example, China and Honduras have used a trained frontline provider or community worker to refer and liaise with the health system (Koblinsky, 2003). Local organizations outside the health system, for example, nongovernmental organizations or women's groups, may also be effective in these liaison tasks, as has been reported from Kenya (Macintyre and Hotchkiss, 1999) and Guatemala (Bailey, Bocaletti, and Holland, 2001). In countries where TBAs are an important source of delivery care, policymakers need to make the best use of TBAs while planning to expand the number of more skilled attendants.

3.1.5 Promoting Skilled Attendance at Home and in Facilities

A key characteristic of countries that have lowered maternal mortality to a level of fewer than 100 maternal deaths per 100,000 deliveries is that large numbers of births are delivered by professional skilled birth attendants (Campbell, 2000). The Safe Motherhood Initiative defines a *skilled birth attendant* as a health worker with midwifery skills who is proficient in managing a normal delivery and who is able to recognize the onset of complications, provide essential obstetric care, and supervise the referral of mothers and their babies for interventions that are either beyond the attendant's competency or not possible in a particular setting.

Appropriate management by skilled attendants of labor, delivery, and the immediate postpartum period can avert complications such as retained placenta, even without modern obstetric techniques that include surgery and blood transfusion (MacDonald and Starrs, 2002). A skilled attendant can reduce maternal mortality in two ways. First, by using safe and hygienic techniques, approximately one-half of infection-related deaths can be averted (Gelband et al., 2001). Second, skilled attendants can reduce mortality through active management of the third stage of labor (the period after the baby is born during which the placenta is being expelled) when the risk of postpartum hemorrhage is

highest (McCormick, Sanghvi, Kinzie and McIntosh, 2002). Several large clinical trials suggest that use of manually performed techniques (controlled cord traction and uterine massage) as well as a single dose of an oxytocic drug immediately after the delivery of the child can significantly reduce postpartum hemorrhage (WHO, 2000a, 2001). An estimated 47% of hemorrhage-related deaths were averted by skilled attendants using these techniques (Gelband et al., 2001).

However, a skilled attendant who does not have access to supplies, equipment, drugs and a referral system will have less effect on maternal mortality. The support provided by the health-care system to the skilled attendants is essential. *Skilled attendance* refers to the process wherein the attendant with the necessary skills is supported by an enabling environment that ensures adequate supplies, equipment, and infrastructure as well as an efficient and effective system of communication, referral, and transport (SMIAG, 2000). Other features of a supportive health-care system include in-service and on-the-job training, supervision, accountability, and equitable distribution and deployment of skilled attendants.

Historical evidence from Sweden suggests that significant reduction in maternal mortality is possible by providing competent midwifery services. The Swedish success was partially a result of scientific and technical advances (Hogbern, Wall, and Brostorm, 1986) and partially a result of social changes empowered by public authorities. Countries that adopt this recipe could reduce maternal mortality successfully. Model-based estimates suggest that between 16% and 33% of the maternal deaths might be avoided through primary or secondary prevention of four common pregnancy-related complications (obstructed labor, eclampsia, puerperal sepsis, and hemorrhage) by skilled attendance (Graham, Bell and Bullough, 2001). Yet a correlational analysis highlights the inconsistencies in the link between maternal mortality and skilled attendants and emphasizes the importance of timely access to quality maternal care (Graham et al., 2001).

The ideal population size served by a skilled birth attendant and the skills needed to manage complications will be context specific and will depend on several factors, including the birth rate, cultural practices on birthing, and government commitment to provide skilled maternal assistance close to the community. The International Confederation of Midwives (ICM) and the International Federation of Gynecologists and Obstetricians (FIGO) propose at least one person with midwifery skills for 5,000 population. Assuming a crude birth rate of 40 births per 1,000 population in a year, a skilled attendant would manage about 200 births per year.

Achieving skilled attendance for the 60 million deliveries in the developing world therefore requires approximately 400,000 trained and supported personnel (Walraven and Weeks, 1999), which makes ensuring safe home delivery a daunting challenge. In addition to training and start-up costs will be expenses for ensuring an enabling environment.

3.1.6 Improving Availability of Health Facilities Providing Emergency Obstetric Care

Approximately 15% of pregnant women will require medical care above the minimum level (Koblinsky, 1995; Maine, McCarthy and Ward, 1992; WHO, 1994, cited in Campbell and Pittrof, 2000). Essential obstetric care (EOC) services save women from most of the potentially fatal obstetric complications. EOC is generally categorized as either basic (BEOC) or comprehensive (CEOC). Table 2 summarizes the services to be provided for each.

Table 2. Composition of Basic and Comprehensive Essential Obstetric Care Services

Basic EOC Services	Comprehensive EOC Services
<p>(1) Administer parenteral* antibiotics</p> <p>(2) Administer parenteral oxytocic drugs</p> <p>(3) Administer parenteral anticonvulsants for pre-eclampsia and eclampsia, including magnesium sulfate</p> <p>(4) Perform manual removal of placenta</p> <p>(5) Perform removal of retained products (e.g., manual vacuum aspiration)</p> <p>(6) Perform assisted vaginal delivery</p>	<p>(1–6) All those included in Basic EOC</p> <p>(7) Perform Surgery (Cesarean section)</p> <p>(8) Perform blood transfusion</p>
<p>* Parenteral administration of drugs include injections or intravenous fluids</p>	

Source: From *Guidelines for Monitoring the Availability and Use of Obstetric Services*, p. 16, 1997, by UNICEF, WHO, and UNFPA, New York: UNICEF.

WHO and UNICEF recommend one comprehensive and four basic EOC facilities for every 500,000 population (WHO, 1994). Successful programs have gone far beyond this minimum ratio: Yunnan, China, for example, has one BEOC facility for every 30,000 people and nearly half of these facilities can provide the higher-level CEOC. In addition, one CEOC facility is provided for every 100,000 population. Similarly, Egypt has one hospital for every 32,000–42,000 population, with most of these facilities providing BEOC (Koblinsky, 2003). Considering access barriers such as a lack of roads and transport, time taken to reach a facility would be a more precise indicator for physical access than number of facilities per population. Evidence suggests that obstetric hemorrhage requires attention within 2 hours. Most of the obstetric emergencies (except postpartum hemorrhage) can be managed if CEOC is reached within 12 hours (WHO, 1989).

Countries that have been successful in reducing maternal mortality also have used facilities beyond public hospitals and clinics, for example, birthing homes, private providers, and maternity waiting centers to improve geographic access to EOC for populations residing in remote and rural areas. Between 1980 and 1997, Honduras reduced the number of maternal deaths from 182 to 108 per 100,000 by targeting specific

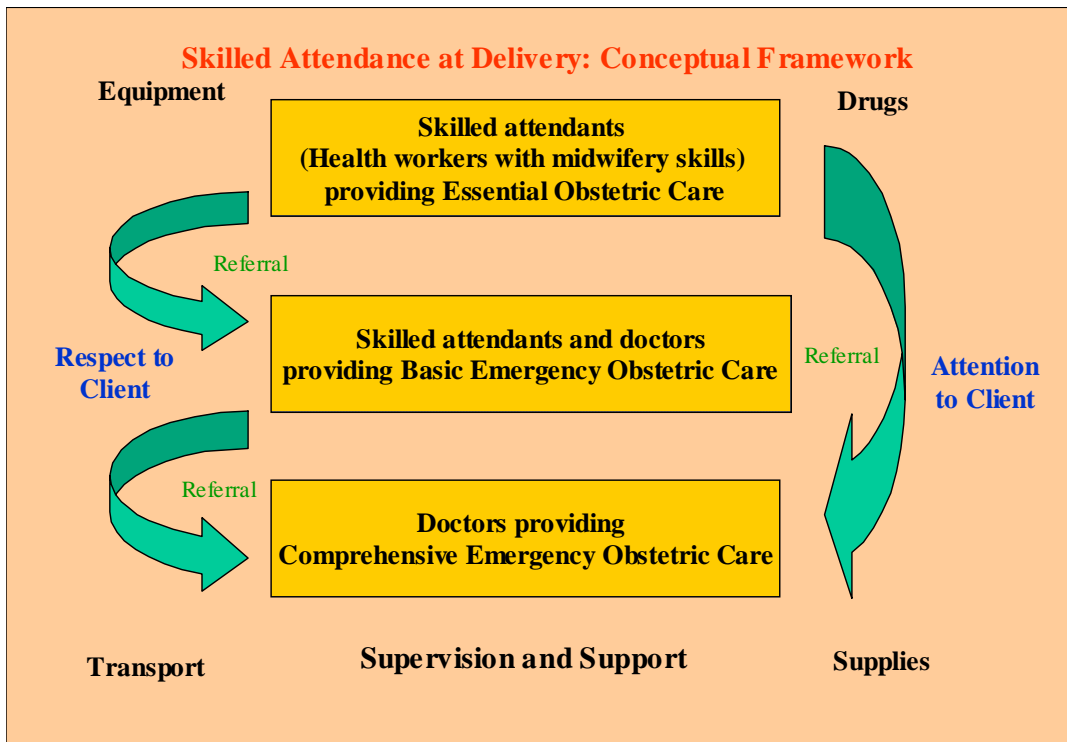
areas; for example, one strategy was to set up 13 birthing centers in remote areas known for high maternal mortality (Danel and Rivera in Koblinsky, 2003). Egypt had similar and impressive gains with MMR reduction from 174 to 84 between 1992 and 2000; one contributing factor was an increase in the use of facilities for deliveries, including those in the private sector. However, because the location of these private clinics was determined by market forces, these services were not available in areas with greatest need. Cuba started maternity waiting homes as early as 1962, which, between 1963 and 1984, helped to increase institutional deliveries from 63% to 99% and led to a decline in MMR from 118 to 31 per 100,000.

Although infrastructure creation is relatively easy, ensuring adequate staffing and essential supplies at these facilities remains a major challenge. In many developing countries, human resources to provide quality maternity care are scarce, and the available staff members prefer to stay only in main cities (Solanke, 1997) or work abroad. Many EOC procedures can be performed effectively by health personnel other than specialists if they are adequately trained and work in equipped and supported conditions. Several Asian and African countries (e.g., Ethiopia, Malawi, South Africa and Indonesia) have provided upgrading training for “general practitioners” in rural areas. Some other countries have trained paraprofessional health staff members to provide a set of surgical and obstetric interventions and anesthesia. Examples include medical assistants in Tanzania, assistant anesthetists in Burkina Faso and Malawi (Adeloye, 1993) and nurses in Democratic Republic of Congo/Zaire (Duale, 1992; Rosenfield, 1992). In Mozambique, medical assistants with 3 years of training and an internship in a provincial hospital performed surgical procedures, including cesarean sections (da Luz and Bergstrom, 1992).

3.1.7 Strengthening Referral Services

Referral services typically focus on improving access, quality, and use of emergency obstetric care for women who develop complications rather than on having contact with all pregnant women (Maine, 1997). An essential part of the process is to ensure that the referral starts at the earliest sign of an unmanageable complication (see Figure 14). This ability to refer early requires raising awareness of complications and danger signs at the community level, using appropriate “triggers” for referral and accessing the locally available resources for transport and communication.

Figure 14. Conceptual framework for skilled attendance at delivery



Source. Adapted from Can Skilled Attendance at Delivery Reduce Maternal Mortality in Developing Countries? by W. Graham, J. Bell, and C. Bullough, 2001, page 106, in V. De Brouwere and W. Van Lerberghe (Eds.), *Studies in Health Organization and Policy: Vol. 17. Safe Motherhood Strategies: A Review of the Evidence*, Antwerp, Belgium: ITG Press.

Triggers for referrals were used effectively to reduce maternal mortality in Honduras, Brazil, Jamaica, and China. Honduras was able to increase referrals through a “risk focus” strategy that effectively worked with TBAs for identifying and referring women at higher risk. In Jamaica, where eclampsia was a leading cause of maternal mortality, midwives were specifically trained in blood pressure recording and urine testing to identify women with hypertension and refer them to specially set up high-risk clinics. An evaluation suggests that a 50% reduction in hospital admissions and a comparable decline in bed occupancy rates due to eclampsia occurred as a result of the program intervention (McCaw-Binns in Koblinsky, 2003). In China, a referral system linking rural birth attendants to health centers and hospitals providing EOC contributed to a significant reduction in MMR (Koblinsky et al., 1999).

Speedy referral was ensured in Malaysia by cutting the referral chain across administrative state boundaries and by complementing the health sector’s ambulance fleet with alternative transport mechanisms (such as police and marine boats), especially in remote and island regions. Sri Lanka started ambulance services as early as 1926, and most health facilities had ambulances by 1950. In addition, if alternative transport is used, the government reimburses the cost to the health staff (Rizzuto and Rashid, 2002). Several local initiatives of this kind have been documented, including arrangements with

local owners of transport and emergency loan schemes (Essien, Ifenne, and Sabitu, 1997).

3.1.8 Coordinating Reproductive Health Services and Management of STIs, HIV, and AIDS

Ensuring access to more effective reproductive health services is an important means to improve maternal health. Effective interventions for improving reproductive health are well defined and include the following: family planning; prevention of abortion and management of the consequences of abortion; cervical cancer screening; education and services for prenatal care; delivery by trained and skilled birth attendants; emergency obstetric interventions and treatment for reproductive tract infections; and STI-HIV counseling, prevention, and treatment. The ICPD Program of Action challenges countries and development partners to ensure that these types of interventions are accessible through primary health care to all people, including the most vulnerable and hard-to-reach groups such as adolescents, and are provided as an integrated package ensuring high quality of care (WHO, 1999). Implementation of effective reproductive health programs continues to be a challenge amid the tensions between those who advocate for an integrated comprehensive approach and those who support a vertical and selective approach.

Everyday, more than 1 million people are infected with curable sexually transmitted infections (STIs) that are known to enhance transmission of HIV. Single-purpose STI control programs often fail to reach women because the women are asymptomatic and reluctant to seek treatment. Also, social factors and economic dependency on males make it difficult for women to insist on mutual fidelity or condom use. By offering counseling, barrier contraceptives, and STI diagnosis and treatment as an integrated package with family planning and maternal health service, access can be improved. In developing countries where incidence of STI is high, rapid serologic tests (e.g., Rapid Plasma Reagin) that provide immediate results followed by treatment with penicillin have shown up to 60% reduction in incidence of syphilis (Hira et al., 1990; Schulz, Schutle and Berman, 1992).

Various interventions that have had demonstrable effects include information and education and counseling, STI treatment, and condom distribution directed at commercial sex workers and truck drivers. Evidence from Thailand suggests that education and vocational training hold the most promise for reducing the number of girls entering the sex industry. Child prostitution in Southeast Asia increases the vulnerability of children and adolescents to HIV and STIs. Thailand successfully addressed this vulnerability through an aggressive prevention program supported by strong government commitment and financing. The proportion of commercial sex workers who became HIV-positive declined to less than a half of previous totals (to 13% from 30%) between 1990 and 1999. Condom promotion and improved treatment of STIs reduced the incidence of STIs by more than 80% in 5 years (Lampthey, 2002).

Among other important reproductive health concerns are Female Genital Mutilation (FGM) in Africa and sex-selective abortions in South Asia. Although laws and clear

policy declarations may help to reduce these practices, more broad-based efforts that are directed at educating the public and changing social norms are critical. Media approaches that widely publicize the harmful effects of genital mutilation and address its cultural roots are necessary along with efforts to enhance women's rights as equal and responsible members of society. These programs need to use mass media and local folklore effectively to spread coherent messages. In Senegal, women from several villages found that they could collectively abandon FGM by organizing pledging ceremonies and by establishing a national committee to educate the population on the consequences of the practice and to encourage the population to pledge against FGM (World Bank, 2000).

3.2 INTERVENTIONS OUTSIDE THE HEALTH SECTOR FOR IMPROVING MATERNAL HEALTH

Experiences from countries that improved maternal health suggest that traditional health system interventions need to be complimented by those outside the health system. The following sections summarize some of the experiences from these countries.

3.2.1 Enabling Policies and Political Commitment

Many of the developing countries that have successfully improved maternal health had strong political commitment and enabling policies to ensure equal rights for women in education, voting, and employment; in addition, these countries enacted health-care programs that explicitly targeted maternal mortality reduction. Some countries have accelerated reductions in maternal mortality by focusing resources and policies on critically important health service delivery issues and by concentrating nonhealth resources in specific geographic areas of high MMR. The following sections describe successful interventions.

Identifying and targeting needy groups. The Honduras Ministry of Health strategically planned to reduce maternal mortality in 1990 through well-targeted infrastructure development and donor support to the most needy areas with high MMR; these efforts were complemented by reforms in personnel and improvements in the quality of health-care services. This initiative occurred within the context of a decentralization that reportedly enhanced local community participation to the point that local groups built and maintained birthing centers and maternity waiting rooms. Within 7 years, Honduras achieved a significant reduction in MMR from 182 to 108 deaths per 100,000 women (Danel and Rivera, 2002).

Enhancing provider accountability. Another important policy intervention is to enhance provider accountability. Some Chinese provinces are implementing innovative service delivery contracts with the providers. Yunnan province, for example, has a quantitative indicator, the "systematic management of pregnant women," that includes: at least five prenatal checks, a minimum of three postnatal visits, and indicators relating to providing a clean home delivery or the percentage of women who deliver in a hospital. Service delivery performance at each level of care is measured using these indicators, and the

results are used to determine facility subsidies, continuation of employment for rural doctors, and promotions for managers. Malaysia introduced a quality assurance approach, using hospital care indicators in consultation with obstetricians as part of its maternal health program. These indicators are compiled every year, and outliers are obliged to investigate the reasons for their poor performance.

Developing financing systems that are equitable. The effect of fees on use of obstetric services, especially on use of emergency obstetric care, is increasingly being recognized as an important barrier to care (Ekwempu, Maine, Olorukoba, Essien and Kisseka, 1990). In the 1990s, several countries began experimenting with innovative policy options to reduce financial barriers to maternal health-care services. Bolivia's Basic Health Insurance program augmented earlier Maternal and Child National Insurance by explicitly including complications during the maternity period, post-abortion care, and costs of transport. This augmentation helped to improve women's access to skilled attendance (from 24% to 34%) between 1994 and 1998. This increase was more marked among the women in the poorest asset quintile (11% to 20%). However, because of a very low level of overall utilization by the poorest quintile, the bulk of insurance funds still cover the costs of those who are better off. Inadequate information to families, essential drugs that are frequently out of stock, and delays in insurance reimbursements have been identified as important constraints.

3.2.2 Enhancing Community Participation

Community involvement can enhance the saliency of behavioral change initiatives and health education messages by creating a supportive environment for their adoption, particularly in understanding the health needs of women. A community-based health program in Bangladesh that included both TBAs and primary care providers functioning as a team—in addition to a continuing education program and the availability of a referral hospital—was associated with declines in birth rates and infant death rates and with increases in contraceptive prevalence and immunization coverage (Chowdhury, 1998).

Community-driven development (CDD) initiatives hold promise for improving the position of women and, consequently, women's health. Operating through the organization of self-help groups, women in many settings have been able to access community health insurance and other social development schemes (Wilson, 2002). Evidence suggests that, for CDD initiatives to work, they must be transparent and have broad participation. Other evidence suggests that women who participate in microcredit programs exhibit higher levels of knowledge about health care (Hadi, 2001) and have children who are more likely to be completely immunized (Amin and Li, 1997); women who have participated for a longer time in these programs are more likely to be using contraceptives (Schuler, Hashemi and Riley, 1997). Nanda (1999) found that women who participated in microcredit programs in Bangladesh had a greater demand for formal health-care services, suggesting that, after participation, they had greater control over their own resources.

3.2.3 Promoting Cross-Sectoral Linkages

Because many of the determinants of maternal health are multisectoral, programs need to be broad based and go beyond the health sector. Policies and strategies that support cross-sector investments in women’s education, roads, power, and telecommunications as well as community-driven development programs (mentioned above) are crucial in improving access and utilization of maternal health services.

Women’s education. Investing in the education of young girls and women is recognized as the single most far-reaching intervention that carries multiple benefits for society, including being associated with improved maternal health and reduced mortality (De Brouwere, Tonglet and Van Lerberghe, 1997). Table 3 summarizes the relationship of women’s education to maternal health outcomes. The importance of this intervention has been amply demonstrated in Sri Lanka and Malaysia as well as in China where conscious policies were implemented to promote female literacy (Koblinsky et al., 1999; Pathmanathan et al., 2003). Evidence from India indicates the strong influence of education on women’s nutrition status, and awareness and use of health services as well as child survival.

Table 3. Association between Education and Key Maternal Health and Nutrition Outcomes

	Illiterate	Literate, less than middle school complete	Middle school complete	High school complete and above
Percentage of women with fewer than 3 children, aware of ORS packets	51.2	72.3	77.2	86.5
Percentage of ever married women shorter than 145 cm	15.4	12.2	9.8	7.7
Percentage of ever married women with BMI below 18.5 kg/m ²	42.6	32.6	28.0	17.8
Percentage of ever married women with moderate to severe anemia	19.1	15.7	13.9	10.6
Percentage of ever married women currently using contraceptive methods	42.9	55.5	55.2	57.0
Percentage of women who had births during past 3 years with no antenatal checkup	48.4	19.3	13.5	5.8
Percentage of births during past 3 years with skilled attendance	25.4	53.1	66.9	83.4
Infant Mortality Rate	86.5	58.5	48.1	32.8
Child mortality (4 ql)	39.7	18.4	10.5	4.4

Source. Adapted from *National Family Health Survey 1998–99* by International Institute for Population Studies, 1999, Mumbai, India: International Institute for Population Studies.

Roads and infrastructure. Better transportation can increase access to health facilities (Samai and Sengh, 1997). Good roads and communication foster timely access to lifesaving emergency obstetric care. Several community-driven development programs

have successfully demonstrated that women's geographic access to health services can be improved by making arrangements with local transporters and by organizing emergency, interest-free loans that are managed and financed by the communities (Essien et al., 1997). Preliminary experiences in Mali, where referral funds are managed by local health communities with a system of radio communication and ambulances, increased the emergency referral rates from 1% to 3% (De Brouwere et al., 1997).

Water and sanitation. Use of safe drinking water and improved sanitary practices are known to enhance maternal health. In addition to reducing the burden of waterborne diseases, improved access to water saves precious time and physical energy spent by women in fetching water for the entire family. Promotion of hand-washing and hygienic practices is key to preventing infection during delivery.

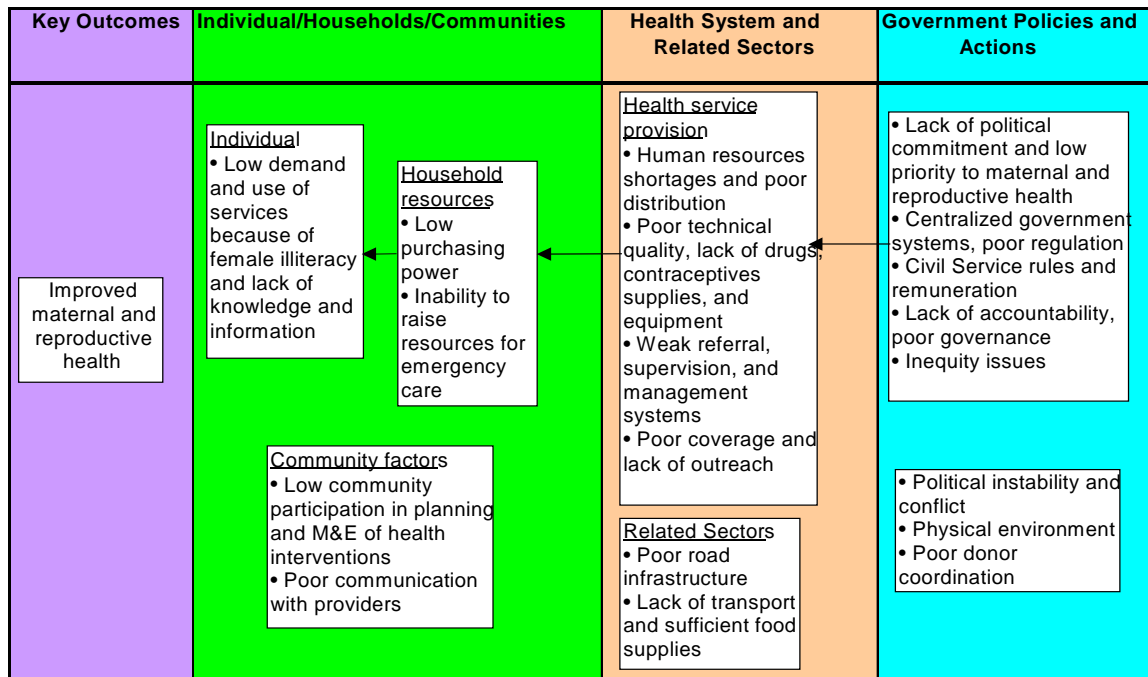
Improved the nutritional status of women. Improving the nutritional status of women only during pregnancy is not the ideal solution, compared to improving women's general nutritional status. Hope of achieving an improvement lies in a two-pronged strategy. The first effort focuses on decreasing energy loss by reducing unwanted fertility, which prevents infections and lessens a heavy physical workload. The second effort focuses on increasing nutritional intake by improving the diet, reducing inhibitors that limit the efficiency of food absorption (such as intestinal worms), and providing food and micronutrient supplements before and after pregnancy (Tinker et al., 2000). If properly targeted and tailored to market conditions, food supplementation programs can enhance nutritional status, especially for extremely poor women. However, experiences suggest that, generally, food supplementation programs are costly and difficult to maintain.

4. IMPLEMENTATION CHALLENGES AND OPPORTUNITIES

This section presents challenges and constraints to achieving an adequate supply and demand of maternal and reproductive health at the individual, household, and community level, within health system and related sectors, and through support by government policies and actions (Figure 15).

Effective interventions to save women's lives, reduce maternal morbidities, and improve maternal health are well known. Progress is slow because of poor access, low demand, and underutilization of services. In poor countries where maternal mortality and morbidity is high, the majority of women lack knowledge and information about effective interventions and available services. Even when women have the relevant knowledge and information, gender inequalities and low status exclude them from decision-making processes and limit their access to household resources and education. Physical access remains a challenge, especially for poor women who live in rural areas, in the sprawling urban slums, and in hard-to-reach geographical areas and for hard-to-reach groups such as adolescents, men, and displaced women. Although communities—as custodians of social norms—play a critical role in influencing behavior of individuals and households, communities are often excluded from planning, monitoring, and evaluation of health services.

Figure 15. Constraints and challenges to achieving maternal and reproductive health



Source: Adapted from Claeson M., Griffin C., Johnston T., McLachlan M., Soucat A., Wagstaff A., and Yazbeck A. 2001. *Poverty Reduction Strategy Sourcebook*. Washington: The World Bank.

Dysfunctional health systems are failing to save women’s lives and meet their health needs, and these inadequate systems are slowing progress. Shortages in human resources; poorly trained providers; poor quality of care; lack of drugs, contraceptives, supplies, and equipment; and ineffective referral systems are responsible for the lack of progress in reducing maternal mortality and in providing basic reproductive and maternal health services. Even when services are available, transport and skilled care are unaffordable for the majority of women when pregnancy complications arise. In countries with high maternal morbidity, poor commitment to improving maternal health prevails, and large gaps between policy and implementation persist. In addition, centralized government, weak management systems, poor governance, lack of accountability, and political instability in many settings have contributed to the lack of substantial progress to reduce maternal mortality and improve maternal health.

As the largest-ever generation of young women enter their reproductive years, the most critical challenge remains declining political commitment as well as declining and inefficient use of financial resources to address the growing demand for maternal and reproductive health, especially as countries struggle to deal with the HIV-AIDS catastrophe and other emerging communicable and noncommunicable diseases and epidemics. Some of the most critical challenges and opportunities are described in more detail in the following sections.

4.1 PROVIDING KNOWLEDGE AND INFORMATION AND PROMOTING BEHAVIOR CHANGE

In addition to cultural and social factors, demand at the individual and community levels is constrained by lack of knowledge and information about effective interventions, by perceptions about quality, and by poor communication between communities and providers. Low participation and involvement of communities in planning, monitoring and evaluation of health services results in low demand for quality services. Countries such as Malaysia and Sri Lanka that have reduced maternal mortality have improved utilization of maternal and reproductive health services through the following interventions: initiating participatory approaches that engage community leaders and men to address cultural and social barriers, supporting community health workers to provide health education and assist women with birth preparedness, establishing outreach services to take services to the communities, and forming community village committees to monitor quality and participate in decisions on cost-recovery mechanisms. In other countries, communication programs that function through mass media and person-to-person contact have proved effective in promoting behavior change and improving health-seeking behavior of women.

4.2 REMOVING INEQUITIES AND REACHING THE POOR

Poor women are at higher risk of maternal mortality and experience poor reproductive health but often face multiple barriers to using maternal health services. The differences between rich and poor people's access to skilled attendance is greater than it is for access to other basic health services (Figure 16).

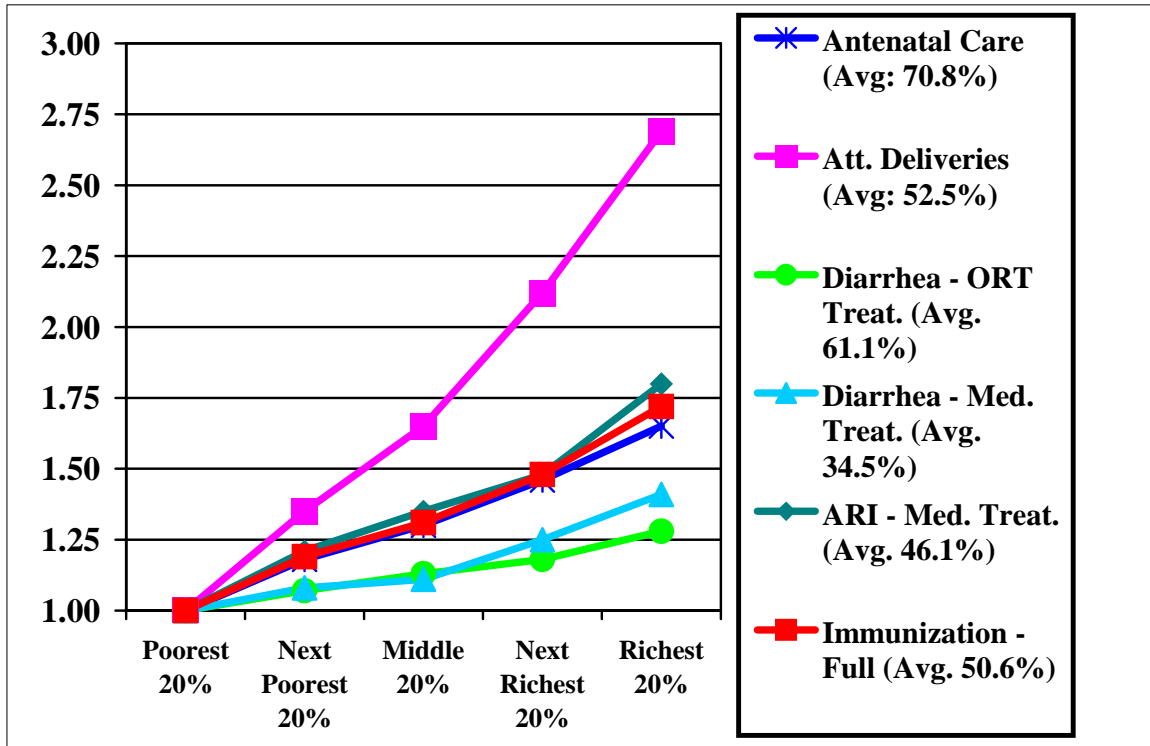
However, poor women do use child health services (i.e., the differences between rich and poor people's use of child health services are less than the differences for maternal health care). Unfortunately, because of the way services are organized, poor women may not be provided information and maternal health services, even when they use child health services. The public sector often provides free or subsidized services to middle- and lower-income groups who actually can afford to pay. The private-commercial sector lacks incentives to reach low-income groups and remains underutilized as a channel to deliver quality service to the poor. The nongovernmental (NGO) sector has comparative advantage in reaching and mobilizing the poorest groups but often lacks resources and technical skills and has limited coverage.

Although technical interventions for improving maternal health-care services are well understood, expertise in implementing these interventions in ways that promote use among the poor remains elusive. In part, this lack of expertise persists because, while progress can be made in reducing maternal mortality and improving maternal health on a macro-level, persistent differentials across income groups remain hidden.

Alternative targeting and outreach strategies, mobile services, and community-based approaches are required to overcome the formidable combination of social, economic, and cultural barriers that prevent poor women from utilizing services, even when they are available. Other effective interventions include establishing emergency funds to cover transport costs, instituting user fee waivers and voucher systems, coordinating social

investment funds, and allocating geographic resources to reach poor underserved groups and regions.

Figure 16. Socioeconomic inequalities in access to maternal health care



Source. From *Socio-Economic Inequalities in the Use of Safe Motherhood Services in Developing Countries* by D. Gwatkin, 2002, a presentation to the Interagency Safe Motherhood Meeting, February 6, London.

4.3 INCREASING ACCESS AND COVERAGE TO REACH OTHER UNDERSERVED GROUPS

Underserved groups such as adolescents are particularly likely to have a high level of unmet need. Pregnancy-related complications are among the major causes of death for girls aged 15–19. The public sector is often ineffective in reaching young adults—the most vulnerable group. Yet the number of adolescents and young adults is very large, their needs are great, and the benefits to them—and society—from access to information and use of maternal and reproductive health services are high. Existing adolescent programs are small pilot projects with limited coverage, especially in rural areas. Involvement of young people in the design, management, and evaluation of youth-friendly services remains weak. Efforts to scale up adolescent programs are urgently required. More investments in adolescent health programs, in meeting the special needs of married adolescents, and in increasing access to youth-friendly services are a prerequisite to progress.

Men also have neither been involved in nor even reached by maternal and reproductive health services. Male participation and involvement in family planning and reproductive health services would enhance women’s use of services and potentially would improve

public health greatly. Promoting male responsibility and innovative interventions for reaching men are required.

4.4 BUILDING CAPACITY AND ADDRESSING HUMAN RESOURCE SHORTAGES

At the health system level, human resource shortages and poor distribution of trained providers is the biggest challenge to achieving the MDG goal of improving maternal health. Worldwide, fewer than 50% of women deliver with medical care and skilled attendance. Even though global progress has been slow in increasing the use of medical care during deliveries, most parts of the world, with the exception of Africa and some areas of South Asia, have succeeded in increasing skilled attendance at delivery. Despite progress in a few countries in Africa, coverage has stagnated and, in some countries, has declined. Human resource shortages are the result of several factors, including the limited training capacity of medical and nursing schools; economic constraints; and emigration of health professionals to urban areas, the private sector, and developed countries. The human resource situation is worsening in Africa because of HIV-AIDS mortality and morbidity. In Africa and other regions of the world, rural areas suffer most because many of the trained and skilled providers are concentrated in urban areas. Remuneration and staff incentives in promotion and training are very poor. Staff deployment and rotation policies reflect poor governance within the health system. In addition, a shortage of female doctors exists in countries where culture demands female attendants.

Achieving this MDG of improving maternal health will require countries to improve human resource planning and development, review training capacities, explore shortening medical training, and offer distance learning. Although the brain-drain issue needs to be addressed both by developed and developing countries, all countries can begin to explore how to make working in the country more attractive than working abroad. Suggested solutions include faster advancement in the hierarchy of health services and better career development, higher salary grades, public acknowledgment of work, upgrading of training, and preferential admissions to courses (Kowalewski and Jahn, 2001). Contracting services to NGOs and the private sector can also improve efficiency (Mills, 1998). Continued progress will depend on investing in capacity building and on the availability of sufficient skilled planners, managers, and health providers.

4.5 IMPROVING QUALITY OF SERVICES

Many developing countries are plagued by poor service quality, which is characterized by poorly trained providers; a lack of effective supervision; weak referral systems; and drugs, contraceptives, and supplies that are in short supply and, frequently, out of stock. Drug policies and supply systems are often weak. As demand for contraceptive use increases, the challenge to sustain reproductive health commodities and contraceptives security is a looming problem in many poor countries. Women are often not provided with adequate information and counseling, even when they attend clinics, and clinic hours are not always convenient.

Improving the quality of maternal and other related reproductive health services is a major programmatic challenge in resource-poor countries. Although some progress has been made, much more needs to be done to develop technical expertise and capacity, establish quality standards and accreditation processes, provide adequate supplies and equipment, train staff members, and provide continuous supervision. Improving quality means more than improving technical competence and standards; it requires adapting standards and responding to clients' definitions of quality. A great deal more needs to be done to improve client-provider interactions; to provide appropriate information, education, and counseling; and to provide an appropriate constellation of services. Interventions that involve quality assurance methods as well as reorganization of services to ensure 24-hour coverage and convenient regular-service hours can improve technical quality; improve access, utilization of services, and referral to emergency obstetric care; and ensure client satisfaction. Improving information systems related to health and logistics can also help in improving planning and management.

4.6 STRENGTHENING PARTNERSHIPS

Partnerships are central and critical to addressing the implementation challenges. Much more needs to be done to realize the full potential of partnerships between the public and private sectors, between government and civil society, between government and donors, and among donors. In many countries, governments often still do not recognize NGOs and community-based organizations (CBOs) as legitimate partners, and dialogue is often lacking. The potential of the private sector remains untapped in many countries, although some progress has been made in contracting, regulation, skills development of private providers, accreditation, franchising, and inclusion in the public sector referral system. Donor coordination remains weak at the country level, imposing a heavy burden on governments to manage the many competing needs of different donor systems and requirements. Partnerships can be further strengthened through health reform, sector-wide approaches (SWAs) and the Poverty Reduction Strategy Paper (PRSP) process.

4.7 INFLUENCING POLITICAL WILL, POLICY, AND MANAGEMENT REFORMS

The range of policy and programmatic constraints impeding achievement of the MGD on maternal health varies according to the local setting's existing capacity and current performance. Political will or commitment to address reproductive and maternal health issues in many countries with high maternal mortality is often lacking. Although some countries have developed policies and are committed to addressing maternal mortality and improving maternal health, wide gaps between policies and their implementation as well as lack of coordination between policymakers and health specialists persist. For example, in India, the national health policy is committed to reducing maternal mortality, but generalist physicians are not trained or mandated to provide emergency cesarean sections in rural areas (where there are no obstetric specialists for referral). In the same setting, nurse midwives are not allowed to manage basic obstetric complications but, instead, must refer women for treatment at centers that have doctors. Inconsistencies between policy and well-meaning regulatory measures require a broad dialogue on maternal health within the health sector. Similarly, ineffective management systems can

render the referral systems ineffective and hamper quality of services (Mavalankar, 2002). Political commitment (both within the health sector and in the executive branches of government) will need to be galvanized to increase resource allocations to reach outlying areas, provide safety nets to poor women, and provide appropriate health financing to address the inequalities in health care. An enabling policy environment with supportive laws, and management reforms, are required to address demand and supply barriers to lifesaving services. These issues can be addressed through SWAps and the PRSP framework.

4.8 MEASUREMENT, MONITORING, AND EVALUATION OF PROGRESS

Identifying the effects of programs and measuring changes in maternal health and safe motherhood indicators continues to be a challenge because maternal mortality and morbidity outcomes are difficult to ascertain and the measurement of service utilization is not straightforward. Accurate measurement of maternal mortality is difficult to achieve except where there is a good vital registration of deaths with good classification of causes of death.

Maternal mortality is commonly measured through several indicators: lifetime risk (LTR) of death, which combines risks associated with each pregnancy and the number of times a woman becomes pregnant; the maternal mortality rate, which is the number of maternal deaths per 100,000 women of reproductive age during a specified time period; and the maternal mortality ratio (MMR), which reports the number of maternal deaths per 100,000 live births and is a measure of obstetric risk.

Maternal mortality is measured through vital registration, household surveys, health service statistics, indirect and direct sisterhood methods using Demographic and Health Survey (DHS) data, reproductive age mortality surveys (RAMOS), verbal autopsy information, population-based surveys and censuses. Very few developing countries have vital registration systems, and even in developed countries (where good vital registration systems exist), causes of maternal deaths are often misclassified. Large population samples are required to measure maternal mortality, and many poor countries lack the resources to conduct large population surveys. Health statistics are often unreliable and suffer from selection bias because women who deliver in health facilities are likely to differ in health and socioeconomic characteristics from those who do not. Cultural and religious constraints may also lead to underreporting, especially in countries where most births occur outside a health facility. For a health facility, defining a catchment area may also be difficult.

Given these measurement problems, WHO and UNICEF have developed a model to estimate levels of maternal mortality using country data and adjusting for underreporting and misclassification. These estimates cannot be used to measure short-term trends because they are subject to wide margins of uncertainty. Consequently, several other process or intermediate indicators have been proposed for tracking maternal and reproductive health. The following list of core indicators was agreed on by WHO, UNICEF, UNFPA, and the World Bank in November 2001:

- Percentage of births with skilled attendant (a medically trained person), institutional deliveries,¹ or both
- Contraceptive prevalence rate, with additional data on quality of care, contraceptive methods, and client satisfaction
- Percentage of women with any antenatal care, with additional data on number of antenatal visits as well as gestational age at first and last visit
- Delivery of emergency obstetric care
- Syphilis in pregnant women and the proportion properly treated.

Political commitment and resources are greatly needed to track maternal deaths and establish cause. To demonstrate success, countries will need to develop more innovative information and monitoring systems, improve vital registration and build capacity for improved data collection and analysis, and be able to utilize the results for decision making by policymakers. A detailed discussion of the measurement of maternal mortality is included in Appendix B.

5. GUIDING LESSONS

The key interventions to improve maternal health and reduce maternal mortality are known. The challenge to achieving the MDG on maternal health is to implement these interventions in environments where political commitment, policies, and institutions and health systems are weak. Appendix C provides a summary of essential reproductive health services that could be offered at different levels of a health system. Guiding lessons from success stories follow:

- **Investments in maternal and reproductive health play a key role in promoting social and economic development.** They contribute to women's health and well-being and to improvements in child health, to women's role in the family, and ultimately to enhanced social welfare.
- **Effective programs focus on addressing demand constraints and improving health education.** Well-informed and educated families and communities will take responsibility for ensuring that women get good maternal health and nutrition and will help them to seek care for complications.

¹ Although efforts have been made to standardize the definition of *skilled attendant*, many countries include trained TBAs (who do not meet the WHO definition) as skilled attendants.

- **High-level government commitment and effective donor partnerships are essential for effective maternal and reproductive health programs.** Sustained government commitment is needed to strengthen health systems and to provide complementary investments in other sectors such as women's education and empowerment as well as roads and communications systems.
- **Greater focus is needed to address inequities in access to health services.** Donors and governments need to be held accountable to achieving the MDGs for all income groups, which involves better targeting of public subsidies to reach poor women and their families.
- **Enhanced country-level capacity to conduct research as well as monitor and evaluate maternal and reproductive health programs and indicators is important, especially because data related to maternal health are scarce.** Data for decision making are essential to make program improvements that are adaptable to local conditions and sustainable for long-term development.
- **Improving maternal health requires a continuum of preventive and curative services, including referral capacity for management of pregnancy complications.** These services require staff members who are trained in midwifery skills in the community as well as well-functioning facilities that provide quality care and are equipped with essential obstetric drugs, reproductive health and family planning commodities, and supplies.

6. CONCLUSIONS

In conclusion, this paper notes that modest progress has been made, but much more needs to be done to accelerate the achievement of the maternal health MDG. The paper also shows that, although we know a lot about the underlying determinants and the technical interventions related to maternal reproductive health, the challenge continues to be how to address impediments to implementing and scaling-up appropriate programs. In general, progress requires an appropriate mix of adequate resources, political will, and good policies as well as sufficient management and implementation capacity at the country level. Evidence-based interventions to prevent maternal deaths depend on a functioning health system to be able to provide skilled care to the mother and her baby during pregnancy and childbirth and to provide emergency obstetric care.

Guidelines for designing and implementing an effective maternal health program are not provided in this paper. The reader is referred to the Web sites of WHO (<http://www.who.int/reproductive-health>) and the Safe Motherhood Initiative (www.safemotherhood.org) for toolkits and managerial guidelines that have been developed for that purpose.

Evidence from countries that have succeeded in improving maternal health and reducing maternal mortality indicates that increasing the supply of services is a necessary but not

sufficient element of success. Equally important is the need to understand demand factors and to understand why women do not use services, even when they are available and their quality has been improved.

We also show that, although the interventions to prevent maternal deaths are different from those that improve maternal health and reproductive health, the constraints impeding progress in both are similar. Strengthening the capacity to provide quality maternal health services at the primary health-care and referral centers and creating effective linkages between each level of the health-care delivery system are preconditions to increasing the use of emergency obstetric care.

Additionally, nonhealth sector interventions are important in addressing the underlying socioeconomic determinants that affect the demand and health-seeking behaviors of women (e.g., education and community-driven development activities). Because women's reproductive health is so closely related to women's social status and gender-related inequities—including lack of reproductive health rights—efforts to improve women's access to education and their reproductive health and rights through initiatives that operate across sectors and that are tailored to reach the poor and disadvantaged are vital.

Even though measurement of maternal mortality is a challenge, investments need to be made in improving data collection systems, especially those involving vital registration. Essential to improvements in measurement are political commitment as well as continuing research to develop appropriate indicators and technologies. In addition, building capacity to monitor and evaluate is critical to measuring progress.

Although no magic solution or blueprint exists to guide efforts, answers are likely to be found in a combination of mutually reinforcing country multisector strategies that take into account the synergies with other relevant MDGs. The adoption of the MDGs brings an opportunity to focus attention on and intensify efforts to improve maternal and reproductive health and save women's lives.

APPENDICES

A. SUMMARY TABLE OF KEY DETERMINANTS, INTERVENTIONS, AND EFFECTS BASED ON EVIDENCE FOR THE MDG#5—IMPROVING MATERNAL HEALTH

MILLENNIUM DEVELOPMENT GOAL: Improve Maternal and Reproductive Health				
Indicators: <i>To reduce Maternal Mortality Ratio by 75%, To improve access to all reproductive health services by the year 2015</i>				
Determinants of Maternal Health and Mortality	Key Interventions	Mechanisms	Impact	Key Evidence
Mortality-Related Determinants: Direct Determinants (percentage of maternal mortality): - Hemorrhage (25%) - Infection (15%) - Unsafe Abortion (13%) - Hypertension and Eclampsia (12%) - Obstructed and Prolonged Labor (8%) - Other Causes (8%)	Manage obstetrical complications through access to Emergency Obstetrical Care services as needed, and availability of essential obstetrical care services for uncomplicated deliveries	Stops hemorrhage	Estimated 47% of hemorrhage averted by skilled attendance	WHO (1994); Gelband, Liljestrand, Nemer, Islam, Zupan, and Jhan (2001)
		Prevents infection	Estimated 48% of infection deaths averted by skilled attendance	Graham, Bell, and Bullough (2001); Gelband, et al. (2001)
		Enables labor induction, cesarean section (surgical intervention)	Estimated 45% of eclampsia deaths averted by skilled attendance Estimated 98% of obstructed deaths averted by skilled attendance	Graham et al. (2001); Gelband, et al. (2001)
	Increase access to and improve the quality of health services (facilities, providers) and community programs to increase demand	Decreases time to reach services and see a health care provider; Community programs increase awareness of risks, preparation for emergency situations	Related to reduced mortality due to timely provision of emergency and essential obstetrical care services	Thaddeus and Maine (1994); Tinker, Finn, and Epp (2000); Johansson, Lap, Hoa, Diwan, and Eriksson (1998); MacDonald and Starrs (2002); Van Lerberghe and Brouwere (2001)

MILLENNIUM DEVELOPMENT GOAL: Improve Maternal and Reproductive Health				
Indicators: <i>To reduce Maternal Mortality Ratio by 75%, To improve access to all reproductive health services by the year 2015</i>				
Indirect Determinants (20% of all mortality): - malaria - anemia - diabetes - hepatitis	Access to medical care for incomplete, unsafe abortion	Prevents complications from unsafe or incomplete abortion Reduces morbidity and mortality by emergency medical treatment of complications	Estimated 13% of all maternal mortality attributed to unsafe abortion	WHO (1995)
	Use of insecticide-treated bed nets and prophylaxis; treatment	Prevents transmission of malaria and development (once transmission has occurred); Cure for infection	Estimated 30%–50% reduction in malaria mortality; 20% reduction of malaria case fatality through treatment	Brabin, Hakimi, and Pelletier (2001); AbouZahr and Royston (1991)
Underlying Determinants of Maternal Health and Mortality - High Parity - Age - Nutrition - STIs	Access to family planning services	Reduces unwanted, unplanned pregnancies; Reduces the likelihood of uterine prolapse due to multiple pregnancies	Family planning programs were responsible for approximately 43% of average fertility decline in developing world between 1960s and 1980s; Children born 3 years or more after a previous birth are healthier and more likely to survive first 5 years	Bongaarts (1995); Younis, Khattab, Zurayk, El-Mouelhy, Amin, and Farag (1993); Rutstein, (2002); Conde-Agudelo and Belizan (2000)
	Adolescent health and social development services	Delay age of marriage, increase age at first birth, access to family planning for youth	Young and nulliparous mothers are more likely to experience prolonged labor as a result of immature pelvis, leading to complications such as vesico-vaginal fistulae	Tahzib (1989); Hoestermann, Ogbaselassie, Wacker, and Bastert (1996)

MILLENNIUM DEVELOPMENT GOAL: Improve Maternal and Reproductive Health

Indicators: *To reduce Maternal Mortality Ratio by 75%, To improve access to all reproductive health services by the year 2015*

	<p>Improve maternal nutrition</p>	<p>Reduce risk of complications and death during pregnancy and childbirth by ensuring appropriate weight gain and preventing or controlling iron deficiency and anemia, among nonpregnant girls or women of reproductive age and pregnant women</p>	<p>Adolescent girls are more likely to require assisted delivery during pregnancy because of pelvic bone immaturity; as are women of short stature due to poor growth (malnutrition) Severe anemia increases the risk of during childbirth (an estimated 20% of maternal deaths attributed to anemia). Maternal mortality decreased by about half in Nepali women who received vitamin A for at least 3 months before and during pregnancy. Giving vitamin A with iron supplementation has a greater effect on reducing anemia prevalence.</p>	<p>Tinker, Finn and Epp (2000). WHO (1995b)</p> <p>Ross and Thomas (1996)</p> <p>West, et al. (1999)</p> <p>Suharno, et al. (1993)</p>
	<p>Dual Protection (contraceptive and protection against STIs); Treatment; Awareness and education; Voluntary counseling and testing</p>	<p>Reduce risk of pelvic inflammatory disease, sterility, and complications from untreated syphilis and HIV infection</p>	<p>Consistent use of male latex condoms significantly reduces the risk of HIV infection in men and women.</p>	<p>Tinker, Finn, and Epp (2000); WHO (2001)</p>

MILLENNIUM DEVELOPMENT GOAL: Improve Maternal and Reproductive Health				
Indicators: <i>To reduce Maternal Mortality Ratio by 75%, To improve access to all reproductive health services by the year 2015</i>				
Nonhealth-Related Determinants of Maternal Health and Morbidity - Education - Transportation - Finance	Expanded access to education	Gender equity; Improved maternal skills	Educated women are more likely to receive prenatal care (including TT immunization), use contraceptives, delay marriage and first pregnancy, increase child spacing, and have lower overall parity	Das Gupta (1990); Gokhale, Rao, and Goarole (2002); Jejeebhoy (1995); Basu (1996)
	Improved transportation systems to facilitate emergency referral for emergency obstetric services	Reduced time in transportation during emergency; Increased access to specialized care	Better transportation can increase the ratio of health facilities per population. Kilometers of paved roads are associated with lower maternal mortality rates.	Samai and Sengeh (1997); Wagstaff (2002)
	Make maternal health care services more affordable for poorest segments of society	Insurance schemes, community financing, social safety net programs	National total of skilled birth attendants increased (from 43% to 59%) after health insurance scheme became operational in Bolivia.	Koblinsky, Campbell, and Heichelheim (1999); McPake (1993); Gelband et al. (2001); Nahar and Costello (1998); Konde-Lule and Okello (1998)

B. ISSUES IN MEASURING MATERNAL MORTALITY

1. Introduction

Setting goals and specific numerical targets for health indicators can lead to positive results. Targets help in focusing attention on the outcomes to be achieved, and they help in the analysis of what needs to be done to get there: how many resources are needed to achieve the goals and which interventions are most effective in making progress.

In maternal health, several targets have been set. During the 1987 Safe Motherhood Conference, participants agreed on a global goal of halving maternal mortality by the year 2000, and the Millennium Development Goals (MDGs) adopted by the Millennium Summit call for all countries to achieve a 75% reduction of maternal mortality between 1990 and 2015. But these goals are meaningful only if there is a way to determine whether progress is being made and, eventually, whether or not the goal has been achieved. In addition to setting targets and a specific date by which the goal is to be reached, what is needed are indicators that will be monitored and data collection efforts that will provide measures for the selected indicators. For the Safe Motherhood goal, no specific indicator was selected: maternal mortality reduction could have been interpreted in terms of the number of deaths, the risk of dying of maternal causes, the death rate of maternal causes, or the lifetime risk of maternal mortality. In the case of the Safe Motherhood goal, the lack of a specific indicator did not really matter; no baseline of global maternal mortality was established, and countries were generally not able to report on maternal mortality in 2000. The MDG is more specific: it refers to a 75% reduction in the maternal mortality ratio between 1990 and 2015. Measurement remains a tremendous problem, and monitoring of progress toward the goal has been limited. Many countries will be unable to measure progress and will, instead, report on intermediate indicators such as access to and use of health services.

Other countries have been strengthening surveillance systems and vital registration that will, in the long run, provide more reliable outcome measures. In Tanzania, for example, data are being collected in surveillance sites in several areas, and recently, it was reported that “Tanzania has reduced maternal deaths by up to 72% over the past 10 years” (Kaiza, 2003). On reading Kaiza (2003) further, however, one clearly sees that this figure needs to be interpreted with caution because it applies only to Dar es Salaam, is based on a small sample (107 deaths over a 7-year period), and refers to the maternal mortality rate rather than to the ratio that is being monitored for the Millennium Goals. Nevertheless, the results are an important example of the potential for—and need for caution about—surveillance as a way to monitor information about trends in cause-specific mortality that is otherwise unavailable.

This appendix is intended to help with the interpretation of maternal mortality data by discussing the definitions used for indicators that measure maternal mortality, the advantages and disadvantages of each indicator, and how the data can be obtained to provide estimates.

2. What is a Maternal Death?

According to the Tenth Revision of the International Classification of Diseases (WHO, 1992), a maternal death is defined as the following:

The death of a women while pregnant or within 42 days of termination of the 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 causes.

Maternal deaths are further classified as direct obstetric deaths and indirect obstetric deaths. Direct obstetric deaths are those resulting from complications of pregnancy, labor, and puerperium. Four obstetric complications account for most maternal deaths: postpartum hemorrhage, sepsis, unsafe induced abortion, and obstructed labor. Indirect obstetric deaths are those resulting from previously existing disease or disease that developed during pregnancy and that was not due to direct obstetric causes but that was aggravated by physiologic effects of pregnancy.

Although the definitions of a maternal death are clear, in reality, many maternal deaths are misclassified. Even in countries with complete coverage of deaths in vital registration, maternal deaths may be misclassified in 50% of cases (Hill, AbouZahr and Wardlaw, 2001). In many other countries, cause of death is sometimes established through the “verbal autopsy” method in which surviving household members or others (such as health-care workers) who were close to the dead individual are interviewed to establish cause of death of those who have died in a household or community. The questionnaire used in these studies includes questions about signs and symptoms of illnesses at the time of death, medical history, and obstetrical history; it may also include various sociodemographic and medical risk factors such as age, socioeconomic status, and distance to health-care facility (World Health Organization, 1995b). The verbal autopsy methodology often fails to identify deaths early in pregnancy that are due to ectopic pregnancy or abortion or deaths occurring some time after delivery. The methodology is not limited to maternal mortality but has been used extensively to assess cause of adult mortality.

3. Indicators to Monitor Maternal Mortality

Maternal mortality is conventionally measured with several indicators, each of which has distinct characteristics and requires different ways of measuring and interpreting. These measures provide different types of information and do not always lead to the same conclusions. The following list summarizes the most commonly used measures and their definitions:

- **Number of maternal deaths:** Number of women dying of maternal causes in a given time period.

- **Maternal mortality ratio:** The number of maternal deaths in a period divided by the number of live births during the same period, expressed per 100,000.
- **Maternal mortality rate:** The number of maternal deaths in a period divided by the average number of women of reproductive age (15–49) during the same period, usually expressed per 1,000 (but sometimes per 100,000).
- **Lifetime risk:** The cumulative probability that a woman entering the reproductive ages would die of maternal causes if subject to the current schedule of fertility and mortality rates.
- **Proportion of deaths that are maternal:** The number of maternal deaths in a period divided by the by all deaths to women of reproductive age during the same period, expressed per 100.

For monitoring trends in maternal mortality, the MDGs stipulate the use of the MMR. For other purposes, the use of several of the measures listed above will give a more complete picture of maternal mortality conditions. These measures are further described in the following subsections.

Number of maternal deaths The number of maternal deaths is frequently used at the global and aggregate regional level as an indicator of the magnitude of maternal mortality. An often quoted estimate is 515,000 annual maternal deaths at the global level during the 1990s of which 273,000 were in Africa (Hill, AbouZahr and Wardlaw, 2001). These estimates are aggregated from individual country estimates, using models to generate the data for countries without reliable estimates. At the national level, some countries report estimates of the number of maternal deaths from vital registration or from specific surveillance efforts. Vital registration-based estimates tend to be underestimated because maternal causes are often not correctly attributed. Surveys that measure the risk of maternal death can also be used to estimate the number of deaths by applying the risk to the number of estimated pregnancies. The number of deaths is the product of obstetric risk and the number of pregnancies and is, therefore, sensitive to changes in the risk, the age structure of the population, and fertility rates.

Maternal mortality ratio (MMR) The maternal mortality ratio (MMR) is the most frequently used measure of maternal mortality. The ratio is a measure of obstetric risk, with live births as the denominator used to approximate all pregnancies. Because not all pregnancies result in live births, the ratio always overestimates the true risk of dying of maternal causes. The use of births as the denominator makes it theoretically possible for the measure to be greater than one, and the lack of age-standardization could slightly distort comparisons of countries with different age structures. However, MMR is generally accepted as a good measure for analyzing trends over time of the risk of dying of maternal causes.

Maternal mortality rate The maternal mortality rate expresses the incidence of death of maternal causes in a way that is comparable with statistics on other causes of death. The

rate of dying of maternal causes may change because of two reasons: a change in the proportion of women who become pregnant in a given time period and changes in the risk of dying of maternal causes. A decline in fertility with a fixed risk of maternal mortality would result in a decline of the maternal mortality rate; the measure is therefore subject to uncertainty about trends in maternal mortality risks and is often misinterpreted as an improvement in obstetric risk.

Lifetime risk The lifetime risk of dying of maternal causes combines both the obstetric risk and the expected number of pregnancies for a woman entering childbearing age, which are based on estimates of current fertility and maternal mortality. The lifetime risk reflects the cumulative aspect of maternal mortality risks for an individual woman.

Proportion of deaths that are maternal The proportion of all deaths to females of reproductive age that are maternal deaths (PMDF) is a measure of the importance of the burden of maternal mortality in the context of the overall level of mortality. By itself, this indicator cannot provide information on trends in mortality risks but provides additional information on the significance of maternal mortality in a given setting. The PMDF is frequently obtained as an intermediate result to calculate the maternal mortality ratio.

4. Measurement

Measurement of maternal mortality is complex, partly as a result of the concept itself (a cause-specific mortality rate) and because of the rarity of maternal mortality. Several options for attempting to measure maternal mortality indicators exist, which are described in the following subsections.

Hospital-based studies Hospital-based studies analyze data that are available from the number of maternal deaths and live births taking place within hospitals. Cause of death is usually reliably established in a hospital setting, but the lack of representativeness makes hospital-based studies unsuitable for monitoring overall levels and trends in maternal mortality. The lack of representativeness affects both the numerator and denominator for maternal mortality indicators.

Vital registration systems Vital registration systems exist in many countries, but the incompleteness of the systems is a major obstacle for their use in epidemiology. Where vital registration is complete, both the numerator and denominator for the MMR can be obtained as well as information on fertility needed to calculate the lifetime risk. In the majority of developed countries, death registration is virtually complete, but only some countries have high levels of accurate information about the cause of death. Even in countries with relatively good overall data on the cause of death, maternal causes are generally not very accurate; estimates of 50% under-registration of maternal causes is typical in high-income countries. The completeness of vital registration has improved a great deal in the Latin American-Caribbean region, but most countries in Africa and Asia have inadequate systems.

Reproductive age mortality surveys (RAMOS) RAMOS refers, not to a data collection instrument, but to an approach to identifying the cause of all deaths of women of reproductive age occurring within a certain time frame and area. RAMOS may be done retrospectively or prospectively; they are usually conducted at the population level. In addition to providing estimates for all of the maternal mortality indicators, RAMOS can also collect information on risk factors for maternal mortality and morbidity and, in addition, can be used to assess the accuracy of cause of death reporting in vital registration. RAMOS consist of two phases. In the first phases, all deaths to women of reproductive age occurring in a community are identified through vital registration records, hospital records, burial records, etc. In the second stage, family members, health providers, and others are interviewed to establish the cause of death and other information about the death. The cost of data collection for RAMOS is high because of the time-consuming aspect of determining the cause of death, and only a few dozen countries have conducted these studies. Data quality is best for the PMDF indicator because less emphasis is placed on identifying births that are needed to calculate the MMR.

Household surveys Household surveys have used several approaches to estimate maternal mortality. In larger household surveys (or in censuses), a respondent may be asked to report all deaths in the household in the year before the survey and may be asked additional questions on cause of death. This approach tends to lead to underreporting of deaths not only for maternal mortality but also for infant and child mortality.

A more common questionnaire is based on the sisterhood method in which female respondents are asked to report on the survival of sisters. Two main variants of the sisterhood method are commonly used: indirect and direct. In the indirect sisterhood method, respondents are asked four questions about how many of their sisters reached adulthood, how many have died, and whether those who died were pregnant at the time of death. This approach uses models of the relationship between age-specific fertility and mortality rates to estimate the lifetime risk of maternal death, which can be converted to the maternal mortality ratio. The method does not produce reliable results when fertility is low (a total fertility rate of about 3 or lower) or where fertility has changed a great deal in recent years. The reference point for the estimates of maternal mortality is for 10–12 years before the survey. In the second approach, the direct sisterhood method, respondents provide additional information on the age at death and the year of the death. With this additional information, demographic models with assumed fertility and mortality schedules are avoided. The method produces an estimate of the maternal mortality rate, which can be converted to the maternal mortality ratio as well as to the PMDF and lifetime risk of maternal death. The reference period of the estimates is generally 0–6 years before the survey, but it can be specified for other periods.

Neither the direct nor indirect method can reliably report on early pregnancy-related deaths because pregnancy status will be less likely to be known to the respondents. Deaths related to induced abortion are similarly likely to be underreported. Even with large sample sizes needed for the direct method, standard errors tend to be very large. For

example, the Malawi Demographic and Health Survey in 1992 generated a MMR of 752, with a 95% confidence interval of 523 to 803, for the 6 years before the survey (Macro International, 1994). Because of such large confidence intervals and the number of years before the survey to which the estimate refers, household surveys are not suitable instruments to monitor short-term trends in maternal mortality or for assessing the effect of programs.

Censuses A relatively new approach, and only attempted so far with data from a few countries, is the use of census data 10-or-so years apart (Hill, Stanton and Gupta, 2001). The methodology requires that information on deaths in a given time (usually in the 12 months before the census) in households enumerated in the census be included as part of the census questionnaire. In addition, information needs to be collected on the age, sex, and whether those who died were pregnant or had recently given birth. Data on age and sex are available from the household tabulations; data on the number of births also need to be included.

The most important advantage of using censuses to estimate maternal mortality is that this approach can generate subnational-level estimates. The accuracy of the estimates depends on the completeness of census counts and other factors. For an application of this approach to data from Zimbabwe, see Hill, Stanton and Gupta (2001).

Models The cost and complexity of collecting data with any of the previous methods has led WHO and UNICEF to develop a model that can predict maternal mortality indicators (Hill, AbouZahr and Wardlaw, 2001). These types of models use variables such as the proportion of births with a skilled attendant, fertility rates, variables indicating regions, and HIV-AIDS prevalence to model either the MMR or the PMDF. These variables may not be good predictors of the maternal mortality indicators, they may be poorly measured themselves, and the MMRs estimated in this way have wide margins of uncertainty.

5. Interpreting the Data

The difficulties associated with collecting maternal mortality data and the complexity of the indicators means that data should be interpreted with caution. The following issues need to be considered in this type of interpretation:

- Trends in the maternal mortality rate, or the proportion of deaths from maternal causes, cannot be considered definite evidence for a change in the risk of death from maternal causes because they are affected by changes in fertility.
- Direct sisterhood estimates of maternal mortality ratios derived from household surveys (mainly DHS) have large standard errors and are generally averages for the 7 years before the survey. When monitoring trends in maternal mortality ratios with these methods, standard errors and reference points should be considered.
- Modeled estimates should be seen as giving an order of magnitude because they are based on rather weak associations between independent variables and include

additional model-derived estimates of the total number of deaths and births. Model-derived estimates cannot be used to monitor progress.

C. SUMMARY TABLE OF ESSENTIAL REPRODUCTIVE HEALTH SERVICES AT DIFFERENT LEVELS OF THE HEALTH SYSTEM

A need exists to clearly define the package of essential reproductive health services at different levels of the health system. However, development of these norms would depend on the organization of health services, geographic terrain, population density, and presence of providers in the private and NGO sectors. A notional set of service delivery norms are presented in the attached table, building on the mother-baby package developed by WHO (1996). Governments can use this matrix as a performance tool to either provide or purchase these services.

Area	Service	Health Post and Outreach	Health Center	Hospital
Preventing unwanted pregnancy	Information and counseling about (a) ill effects of early marriage, and (b) benefits and availability of family planning services	Yes	Yes	Yes
	Supply of condoms/oral pills	Yes	Yes	Yes
	Depo-Provera/Norplant	Yes	Yes	Yes
	IUD insertion	Yes	Yes	Yes
	Sterilization	No	Lap sterilization	Yes
Preventing complications during pregnancy	Antenatal care	Yes	Yes	Yes
	Treatment of severe anemia	Clinical diagnosis	Confirmation and referral	Yes
	Management of malaria	Yes	Yes	Yes
	Screening and treatment of syphilis	No	Yes	Yes
	Treatment of other RTIs/STIs	Identification and referral	Syndromic management	Laboratory diagnosis and management
	Management of pregnancy-induced hypertension	Identification and referral	Clinical management	Clinical management
Management of abortion complications	Identification and referral	MVA	Comprehensive management	

Area	Service	Health Post/Outreach	Health Center	Hospital
Preventing deaths when complications occur	Normal delivery by a skilled birth attendant, including clean and safe delivery and routine newborn care	Yes	Yes	Yes
	Management of eclampsia	Identification and referral	Identification, stabilization with magnesium sulfate, and referral	Yes
	Management of postpartum hemorrhage	Active management of third-stage labor and early referral	Identification, stabilization (injectable oxytocics, manual removal of placenta or products), and referral	Blood transfusion
	Management of obstructed labor	Identification and referral	Assisted vaginal delivery and timely referral of complicated cases	Cesarean delivery
	Management of sepsis	Identification and referral	Injectable antibiotics and referral of severe cases	Yes
	Management of basic newborn complications	Clearing of airways and warming	Management of mild newborn infections	Comprehensive newborn care
	Postpartum care	Yes	Yes	Yes
Preventing unwanted pregnancies	Condom	Yes	Yes	Yes
	Depo-Provera	Yes	Yes	Yes
	IUD	Yes	Yes	Yes
	Norplant	Yes	Yes	Yes
	Oral pill	Yes	Yes	Yes
	Sterilization	No	Lap sterilization	Yes

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