Part 1

The Unheard Cry for Newborn Health

PART ONE

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MESSAGES FOR PART ONE

1. Understand the importance of newborn health for child survival and the health of adults and the need for an integrated focus on the mother and the baby.

2. Learn some of the reasons why fetal-neonatal health has received little international attention.

3. Gain information about the magnitude of fetal-neonatal mortality and when and where those deaths occur.

4. Learn the major direct and indirect causes of fetal-neonatal deaths, including the importance of low birth weight, the effect of delays in access to quality maternal and newborn health care, and the impact of the low social status of women and newborn babies.

5. Grasp that the complexity of the problems of newborn health requires a shift in priorities for international health programs towards community-based, systematic approaches in the periods during which most maternal and infant deaths occur.

TERMINOLOGY FOR PART ONE

Fetal-infant mortality rate = $\frac{\text{Stillbirths + infant (first year) deaths}}{\text{Total Births}} \times 1{,}000$

Gestational age: Number of completed weeks since the last menstrual period of the mother. A term baby is a baby born between 37 and 42 completed weeks of gestation.

Infant mortality rate (IMR) = $\frac{\text{Deaths of infants under one year of age}}{\text{live births}} \times 1{,}000$

Late fetal death rate[1] = $\frac{\text{Babies born dead after 28 weeks of gestation (or birth weight over 1kg)}}{\text{total births}} \times 1{,}000$

Live birth: A baby born with any sign of life regardless of weight or gestation.

Low birth weight (LBW): Birth weight less than 2,500 grams

Neonatal mortality rate (NMR) = $\frac{\text{Number of babies born alive who die in the first 28 days of life}}{\text{live births}} \times 1{,}000$

Neonatal period: The first 28 days of life; divided into early neonatal period (first 7 days) and late neonatal period (days 8-28). In this manual neonatal and newborn will be considered equivalent.

Perinatal mortality rate (PMR) = $\frac{\text{fetal deaths (either from 22 or 28 weeks gestation)} + \text{early neonatal deaths (first 7 days of life)}}{\text{total births (live births + late fetal deaths}} \times 1{,}000$

Post-term birth: Live birth after 42 completed weeks of gestation.

Preterm birth: Live birth before 37 completed weeks of gestation.

Stillbirth: Baby born showing no sign of life who weights over 1 kg or is over 22 weeks of gestation.

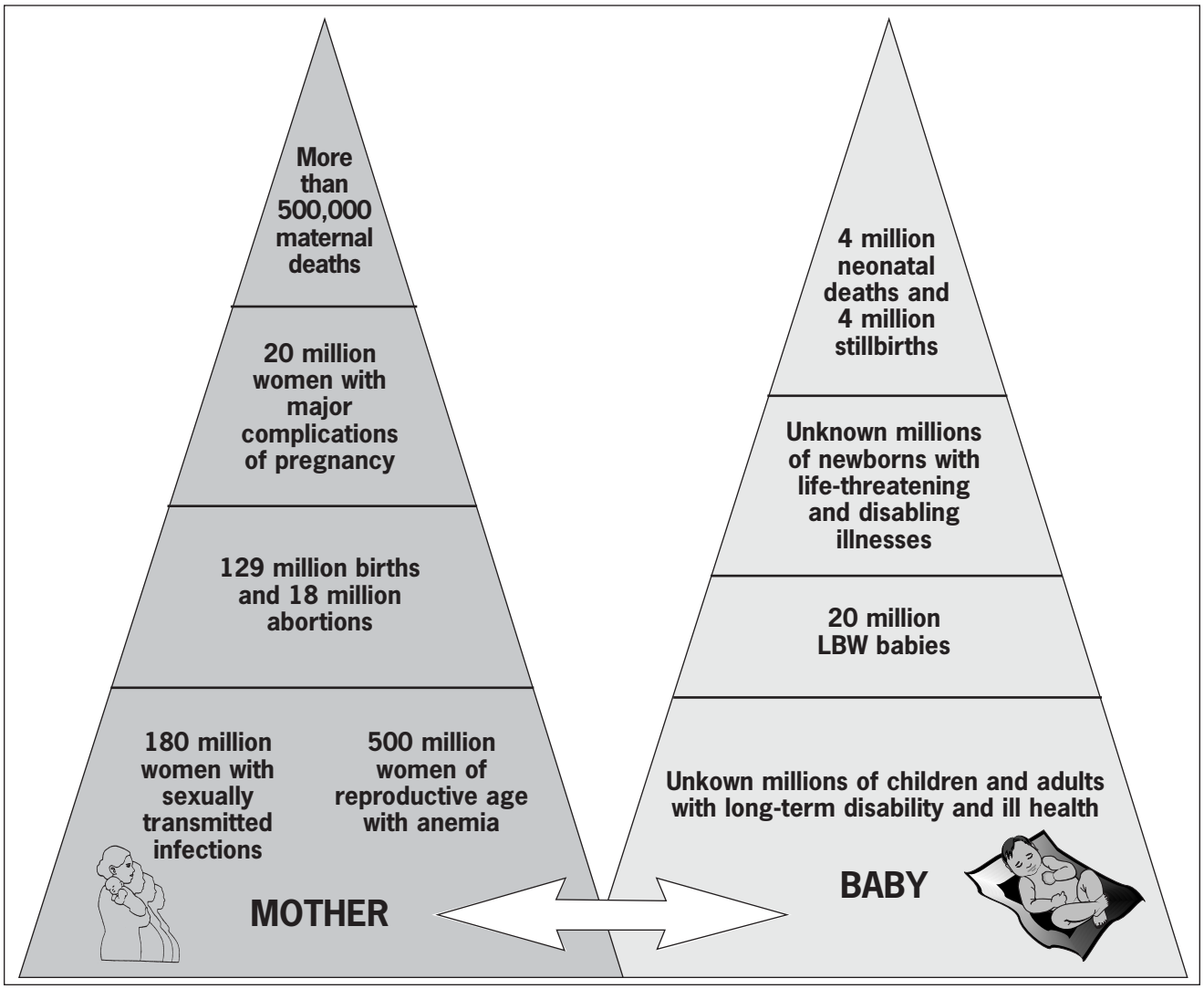
[1]WHO recommends that international comparison of fetal deaths or perinatal mortality be based on late fetal (after 28 weeks gestation of 1 kg birth weight). The International Classification of Disease definition of perinatal mortality includes fetal deaths from 22 weeks of gestation.

I. WHY FOCUS ON MOTHERS AND BABIES?

A. Maternal and Newborn Outcomes

Each year an estimated eight million babies are stillborn or die in the first month of life[1]. Almost all (98%) of these deaths occur in developing countries[2]. Of the seven million infants who die each year, approximately two-thirds die in the first month of life[3,4]. These shocking statistics should raise a loud cry for attention to newborn health in developing countries. Furthermore, despite over 10 years of safe motherhood programs, more than half a million women still die each year from pregnancy-related causes (Figure 1.1)[5-7].

FIGURE 1.1
REPRODUCTIVE HEALTH OF THE MOTHER AND OUTCOMES FOR THE BABY



Source: Based on data from WHO, 2001[1]; WHO, 1996[2]; Hill K et al., 1995[5].

Newborn deaths result from a combination of medical causes, social factors, and systems failures that vary by context and culture. In most settings, newborn health is closely associated with maternal health[8]. Maternal, fetal, and neonatal deaths have much in common:

- most occur in developing countries;
- many of the deaths occur at home;
- most of the deaths occur during delivery or in the early postpartum/neonatal period;
- many deaths occur without a skilled provider present;
- delay in access to quality care is critical for the survival of both mother and newborn;
- many families do not know the danger signs for the mother or the newborn;
- lack of transportation and resources are key issues related to delays in access to care;
- many of the pregnancy-related complications that negatively affect the mother also put the newborn at risk;
- the death of a mother may be directly linked to the death of her children;
- maternal, fetal, and neonatal outcomes are often unrecorded; and
- both women and newborns have low social status in many cultures with high maternal/newborn mortality[4,7,9-19].

B. Focus on the Newborn

The most obvious reason to focus attention and programs on newborns is the sheer number of fetal-neonatal deaths and the fact that neonatal mortality constitutes an increasing proportion of infant mortality. Neonatal deaths now account for about 66 percent of infant deaths globally because of falling postneonatal deaths over the last few decades[4]. However, there are many other compelling reasons, especially the importance of newborn health for health in later childhood and even adult life and the economic and social consequences of maternal and neonatal ill-health. The issue of healthy births has broader implications than simply reducing newborn deaths. In reality, it cuts across many priorities that are often considered separately.

Children's health: Approximately 66 percent of infant mortality occurs during the neonatal period[4]. Further progress in improving child survival requires more attention to newborn health. The benefits of a healthy newborn extend far beyond the neonatal period[8]. Babies with an unhealthy start, such as those with low birth weight, asphyxia, sepsis, or congenital abnormalities, may survive the neonatal period but are at greater risk of long-term disability and of dying later in childhood.

Women's health: Newborn health cannot be separated from the health and health care of women of reproductive age[8].

Chronic disease: Low birth weight babies may be more likely to develop diabetes and hypertension in later life[20-22]. A growing body of literature suggests that the health of the fetus may be a key determinant of chronic adult disease, such as hypertension, diabetes, and possibly chronic lung disease[20-22]. The "Barker hypothesis" suggests that the intrauterine environment "programs" aspects of chronic disease in adult life and that birth weight is a marker of this effect. There are many unanswered questions regarding this hypothesis[23]. If it is true, the implications would be enormous, especially for populations with high LBW rates, such as much of South Asia and sub-Saharan Africa[24]. Many developing countries are undergoing a demographic transition, resulting in rapid growth of the elderly population, along with an epidemiological transition, resulting in more chronic disease. Improving in utero health may be a highly cost-effective primary prevention intervention to reduce chronic disease, especially when compared with the cost of medical treatment of chronic diseases.

Individual and national economic prosperity: Low-birth-weight babies, preterm babies, and babies who were asphyxiated, severely jaundiced, or had a serious neonatal infection are much less likely to reach their educational or economic potential; they may also be more likely to require resources for care[25-27]. These children may have reduced intellectual development and chronic disability in adult life that limits their social and economic potential. Long-term follow-up of growth-restricted babies in Guatemala found that these babies grew up to be adults who weighed five kg less and were five cm shorter than their normal birth weight peers. Studies in several developed countries had similar findings[28]. Thus, LBW has implications for diminished physical strength and is especially important in communities where hard labor is common. Both school performance and cognitive abilities of LBW babies may be reduced, although study conclusions are complicated by difficulty in controlling for confounding environmental factors[25,26].

Ensuring that newborns are healthy is crucial to improving life expectancy and health for all persons.

C. Focus on the Mother

The influential call of "Where is the M in MCH?" of the mid-1980s helped focus attention on the "neglected tragedy" of maternal mortality and more generally on reproductive health[29]. Over 585,000 maternal deaths are estimated to occur each year; on average, more than one woman dies every minute of a pregnancy-related cause[5].

Maternal deaths are the tip of an iceberg of poor maternal health. Approximately 50 million women each year experience maternal health problems[30,31]. Pregnancy-related complications account for 18 percent of the global burden of disease among women of reproductive age. An estimated 40 percent of pregnant women will have some complication throughout their pregnancies. In addition, 15 percent of pregnant women may develop a potentially life-threatening complication requiring emergency obstetric services, which are often unavailable[32,33]. The burden of reproductive ill health is especially high for women in sub-Saharan Africa[31,34].

There is a large gap in maternal health outcomes between the developed and developing world[7]. The lifetime risk of maternal death (the product of the risk of maternal death and the average number of times a woman is likely to be pregnant) is as high as one in eight in some African countries. This is 150 times greater than the risk for a North American woman[9]. The death of a mother has many consequences, not least of which is the reduced probability of survival of her children. This is true for all infants, but girls are at even higher risk of dying if they lose their mothers[16].

Although most of the focus of interventions to reduce maternal mortality is on the antenatal and intrapartum periods, about two of every three maternal deaths occur in the postpartum period[12]. Maternal and newborn deaths both tend to occur in this same period, a fact that emphasizes the need to invest in systems that reduce both maternal and neonatal mortality by addressing the early postpartum and neonatal period.

D. Focus on the Mother *and* Baby

Although the immediate medical causes of maternal and perinatal deaths may differ, the underlying causes of these deaths are very similar. These causes include the inability to access quality maternal and newborn care, especially at delivery, and the low social status of women and newborns. Many of the conditions that result in complications for the mother during pregnancy, delivery, and after delivery also result in complications for the baby. Some of these are listed in Table 1.1, where the center column shows the maternal condition and the columns to the left and right show the potential effects on the mother and baby.

The dispersion of perinatal and maternal mortality over time is remarkably similar, and attention to the intrapartum and postpartum periods would benefit both mother and baby. The presence of a skilled birth attendant at delivery is associated with lower maternal deaths and newborn deaths[9,35,36]. Improvements in the health of mothers and babies are synergistic; interventions for the mother may reduce perinatal mortality by up to 75 percent, but many of these interventions also directly benefit mothers[8,37]. Efforts are required to strengthen the systems in which mothers and babies receive health care, so that communities and formal health care systems can work together to improve maternal and newborn health. The four systems causes of neonatal deaths are:

- poor pre-pregnancy health;
- inadequate care during pregnancy;
- inadequate care during delivery; and
- inadequate newborn/postpartum care.

These categories are the basis for the conceptual framework for causation of neonatal deaths (Figure 1.7), the BABIES assessment tool described in Part Two, and the Intervention Packages discussed in Part Four.

TABLE 1.1
ASSOCIATED ADVERSE MATERNAL AND NEWBORN OUTCOMES

POTENTIAL MATERNAL OUTCOME	MATERNAL CONDITION	POTENTIAL FETAL/NEONATAL OUTCOME
Infection during pregnancy	**Infection during pregnancy**	**Infection during pregnancy**
HIV/AIDS.	← HIV infection. →	Fetal death, IUGR, preterm birth, neonatal death, MTCT/HIV.
Puerperal sepsis, infertility, complications of syphilis.	← Syphilis infection. →	Preterm delivery, stillbirth, congenital syphilis.
Puerperal sepsis, infertility.	← Gonorrhea, chlamydia infection. →	Stillbirth, pneumonia, neonatal eye infection, blindness, preterm delivery (?).
Infections, especially after surgical procedures.	← Bacterial Vaginosis. →	Preterm delivery.
Anemia, increased likelihood of death if hemorrhage occurs.	← Malaria infection. →	Fetal death, IUGR, preterm birth in areas of unstable transmission.
Anemia	← Hookworm infestation. →	LBW due to IUGR and possibly preterm birth.
Poor nutrition during pregnancy	**Poor nutrition during pregnancy**	**Poor nutrition during pregnancy**
Death(?).	← Low pre-pregnancy weight, protein-calorie undernutrition while pregnant. →	Increased LBW and preterm birth.
Anemia.	← Folic acid deficiency. →	Stillbirth, neural tube defects, possibly congenital heart disease.
Night blindness, morbidity, death?	← Vitamin A deficiency. →	LBW, neonatal sepsis, increased MTCT/HIV (?).
Anemia, death due to hemorrhage.	← Iron deficiency. →	Risk of LBW due to IUGR and preterm birth, anemia, increased risk of infection.
Complications during delivery	**Complications during delivery**	**Complications during delivery**
Maternal infection leading to sepsis, potential infertility, death.	← Prolonged or premature rupture of membranes. →	Neonatal sepsis.
Convulsions, cerebrovascukar accidents, death.	← Preeclampsia/eclampsia. →	Stillbirth, pre-term, asphyxia.
Prolonged labor, vaginal tears, uterine rupture, vesico-vaginal fistula, C-section, potential death.	← Malpresentation/obstructed labor. →	Meconium aspiration, asphyxia, birth trauma, sepsis, fetal-neonatal death.
Maternal infection, sepsis, tetanus, death.	← Unclean delivery. →	Neonatal infection, sepsis, tetanus leading to death.
Complications after delivery	**Complications after delivery**	**Complications after delivery**
Postpartum hemorrhage, breast engorgement, abscesses.	← Early breastfeeding not initiated. →	Hypoglycemia, hypothermia, jaundice, loss of benefit of antibodies in colostrum, reduction in breast milk volume.
Postpartum hemorrhage leading to shock or death.	← Retained placenta. →	Reduced attention and breast milk and potential loss of mother.
Sepsis.	← Postpartum infection. →	Reduced attention and breast milk and potential loss of mother.
Maternal "depletion syndrome" if too close especially if lactation and pregnancy overlap.	← Too frequent pregnancies. →	Higher perinatal mortality rate if pregnancies too close, increased risk of morbidity & mortality from abuse, neglect.

Notes: (?) indicates that the relationship is uncertain on available evidence. LBW = low birth weight. IUGR= in utero growth restriction. MTCT/HIV = mother-to-child transmission of HIV.

II. WHY HAVE PREGNANCY, CHILDBIRTH, AND THE NEWBORN BEEN NEGLECTED?

This section examines some of the reasons why newborn health has been neglected. The program manager may not have data about newborn deaths in the local setting for many reasons. However, an understanding of some of the common reasons that limit the availability of data and attention to newborn health will help the program manager to examine the problems in the local setting. The main reasons include the following.

A. Low Status of Women and Newborns

B. Invisibility

C. Inadequate Quality of Available Data

D. Institutional and Programmatic Gaps

E. Perceived Impossibility

A. Low Status of Women and Newborns

The value given to certain groups in society affects their access to resources that may be scarce, such as food, health care, and education. The amount of concern and public expenditure focused on a given health problem is often a reflection of the social status of those affected. In many of the settings with the highest maternal, fetal, and neonatal mortality, women have low status. Indicators, such as the gender ratio for literacy, demonstrate this social phenomenon. The proportion of illiterate women is greater than that of men in many of the least developed countries[38,39]. Gender inequality is also evident in infant mortality. The male-to-female ratio for infant mortality should be greater than 1.0 because of the natural survival advantage of the female infant. However, in many developing countries, it is less than 1.0, as the ratio test shows that more girls are dying than would be expected[40]. Reasons for this inequity in mortality rates include disparities in feeding practices and utilization of health care, as well as more obvious causes in some settings, such as female infanticide[41,42].

Newborns have even lower status than women and children and are often not considered to have "personhood" until later in the first year of life[43]. For instance, among the Akan peoples of West Africa, a baby is not named until the 40th day of life because so many are expected to die.

KEY QUESTIONS

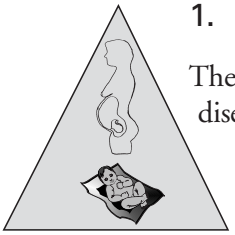
- ☞ Do women and newborns have poor social status in your area?
- ☞ Is the baby considered a person at birth or not until a naming ceremony?
- ☞ Is there a preference for boy babies, and are girl babies more likely to die?

B. Invisibility

Lack of data, one of the major barriers to recognition of the number of fetal-neonatal deaths, inhibits action to improve newborn survival. More data are needed at the international, national, and local levels. Currently both the quantity of data (coverage) and the quality of data (unreliable information on cause of death) are insufficient and unreliable. The invisibility of fetal-neonatal deaths in many developing countries results in a lack of interest and action, allowing the problem to remain largely unaddressed.

This invisibility existed globally until recently. Neonatal mortality has often been overlooked in policies and program implementation. For instance, neonatal mortality is rarely included on lists of major causes of death, even though the World Bank estimates that perinatal deaths account for approximately seven percent of the global burden of disease. The magnitude of the problem can be put in perspective by considering that neonatal mortality exceeds the combined global burden of disease due to malaria and all vaccine-preventable infections[32].

Reliable data are necessary not only to define a problem but also to choose appropriate interventions and evaluate their effectiveness. Difficulties with data are a major problem for newborn health programming. Even when national or local data are available, they are often not used to inform problem definition, to prioritize, or to evaluate interventions. Expensive cumbersome surveillance systems are not required. Simple techniques can translate easily collected data into useful information in order to manage health care decision-making at local and national levels. Some of these techniques will be discussed in Part Two of this manual.



1. Reliability of current global estimates

The World Bank estimate of seven percent of the total global burden of disease due to perinatal causes is an underestimation for two reasons.

The numbers of newborn deaths are underestimated. The World Bank calculations are based on 1996 WHO estimates of perinatal mortality rates (PMRs), which assume that 40 percent of both fetal and early neonatal deaths are not reported[9]. A review of the literature and an analysis of reported statistics suggest that PMRs are underreported by at least 60 percent, and possibly by as much as 500 percent in countries with higher death rates[17,44,45]. Hence, the actual numbers of perinatal deaths are likely to be considerably higher than the 1996 WHO estimate of 7.6 million a year.

Lack of information on perinatal morbidity. Consequently, the global burden of disease estimate for perinatal conditions is based solely on mortality. All of the other causes listed in the global burden of disease assessment included morbidity data[32]. Perinatal morbidity is a significant cause not only of short-term illness, but also of long-term physical and mental disability.

Even though the current data may represent a significant underestimate, the statistics are nevertheless staggering and require action.

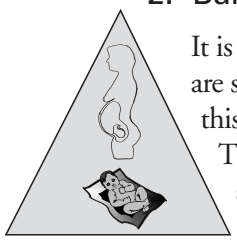
PANEL 1.1
LESSONS LEARNED

UNCOUNTED FETAL AND NEONATAL DEATHS IN THAILAND

A study in Thailand noted that the national PMR was officially 3.2 per 1,000 total births, lower than that in many developed countries although neonatal intensive care was not widely available. This community-based study in one province with a population of 80,000 found that none of the stillbirths and none of the early neonatal deaths were recorded. In contrast, 55 percent of infant deaths were registered. The study also reported that none of the babies who died (stillbirth, early neonatal deaths, or infant deaths) were registered at birth. Hence these babies were not included in the numerator (as deaths) or in the denominator (as stillbirths or live births) for the regional perinatal and neonatal mortality rates. Most of the deaths occurred at home, the families did not realize the importance of registration, and there were no incentives to promote registration.

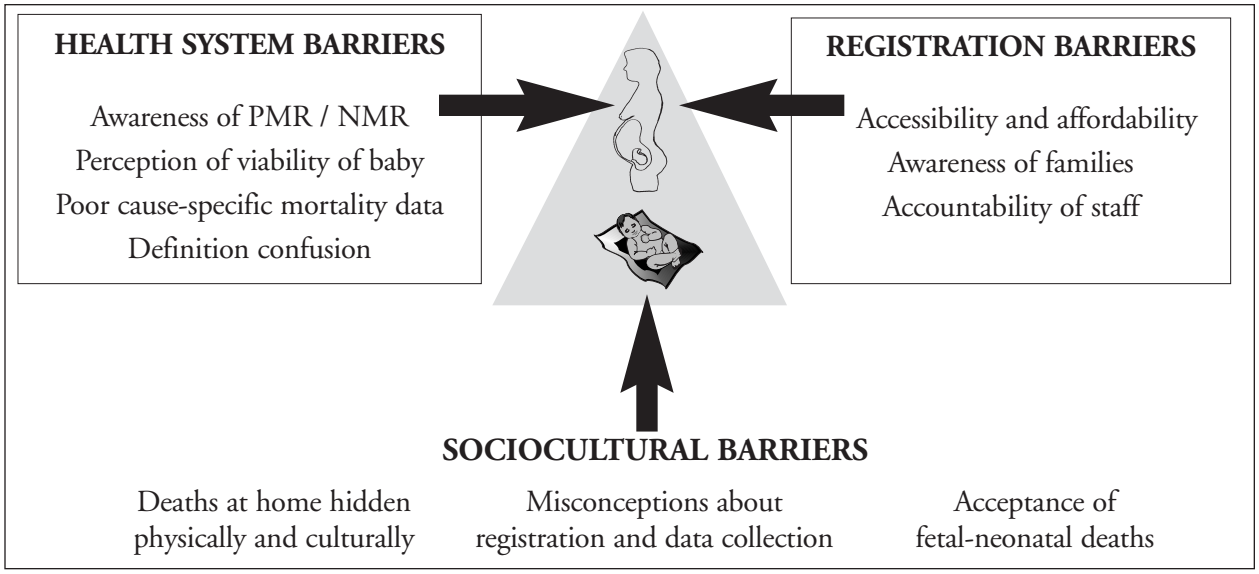
Source: Lumbig[44].

2. Barriers to data collection



It is believed that in many developing countries fetal and early neonatal deaths are significantly underreported, but there has been little systematic assessment of this. Studies, such as the one from Thailand, give us a snapshot of the problem. The main barriers to collecting data (Figure 1.2) on births and fetal, neonatal, and maternal deaths are sociocultural barriers, health system barriers, and barriers specific to vital registration of perinatal events.

FIGURE 1.2
BARRIERS TO OBTAINING INFORMATION ON PREGNANCY AND BIRTH OUTCOMES



Source: Lawn 1998

Sociocultural barriers: The invisibility of maternal and fetal neonatal deaths is often related to sociocultural beliefs and practices, including seclusion of women and newborns at home, acceptance of newborn deaths as normal, and often no perception of the newborn as a person. Recording events or collecting data is often not a priority in traditional societies and may be seen as futile if the baby dies. Many traditional cultures in Africa and Asia require a period of seclusion for the mother and the newborn after delivery (often for the first 40 days), during which time access to formal health care is limited[43]. Strong beliefs in the spirit world and fear that the baby or mother may be cursed can be very influential. In some settings, the mother is not allowed to mourn the death of the baby for fear of a curse affecting future babies. This taboo may also affect discussing and recording the death.

In many societies, there is also widespread acceptance of a high rate of fetal-neonatal deaths as normal[8]. Some ethnic groups in West Africa do not name their babies until 40 days of age, which may be a strategy used to cope with death rates that are the highest in the world. Infant deaths are more likely to be registered if the baby is bigger or if the death occurs after the critical age of acceptance for a given society – the age at which the newborn is viewed as a person[43,44]. In some countries, this acceptance comes after the seclusion period, whereas in others it comes after the naming ceremony. If a baby dies during this period and is not considered to have personhood, neither the birth nor the death may be reported.

Health system barriers: Barriers within the health system include the lack of motivation for staff to collect data and the selective collection of data when staff believe that the baby may not survive. Even when the event is recorded, confusion about definitions may alter the information. For example, a live birth may be recorded on the certificates as a stillbirth, or the cause may be incorrectly entered[46]. Subsequent coding of cause of death may introduce further error.

Medical perceptions of the viability of the baby influence whether the baby's birth and death are recorded. If the doctor or midwife thinks that the baby is unlikely to survive, the birth is less likely to be recorded. Even in settings with advanced neonatal care, both obstetricians and neonatologists tend to underestimate the survival chances of a preterm baby and thus reduce the level of care that is given to the mother and the baby[47].

The likelihood that a birth or death will be recorded is influenced by two factors:

- *Birth weight:* The smaller the baby, the less likely it is that the birth or death will be recorded. This is true even in many industrialized countries[48]; and
- *Age of the baby at death:* Fetal deaths are the least likely to be recorded[44]. Early neonatal deaths are less likely than infant deaths to be recorded. Some countries do not even record a live birth until the baby has survived the first 24 hours, a practice that reduces the NMR by about 40 percent[49].

Registration barriers: Registration is the civil government's process of recording births and deaths. In most developing countries, registration is the responsibility of the mother's relatives, but awareness of this fact is low among health care workers as well as families. Many barriers to registration exist, such as accessibility and affordability, either in direct cost or in terms of time lost traveling to the nearest town and waiting in line for a day[50,51]. Benefits of registration may not exist, or if the birth certificate is required for school entry, this may not be enforced.

Approximately two-thirds (66%) of the world's births are registered, although clearly there are great regional variations. The countries with the highest rates of newborn deaths often have the lowest rates of vital registration. Although efforts to improve civil registration is a long-term task and may not be a direct health service priority, such efforts eventually will provide better data as well as better civil rights for babies who will be afforded the simple dignity of being included on a record and being counted[40]. India has made dramatic progress in increasing birth registration, doubling coverage in some areas within a few years with the help of publicity campaigns.

KEY QUESTIONS

- ☞ What are the major barriers to collecting information on newborn health in your area?
- ☞ Do most deliveries occur at home or in institutions?
- ☞ Is there a time of seclusion for mother and baby?
- ☞ Does the health system collect data on births and fetal-neonatal deaths?
- ☞ Is there a functioning birth registration system in your area from which you can get data?

C. Inadequate Quality of Available Data

In addition to the lack of available data, the quality of existing data can be seriously compromised by several factors, including confusion in definitions and terminology, poor recording of birth weight and difficulties in attributing a cause of death in the newborn period.

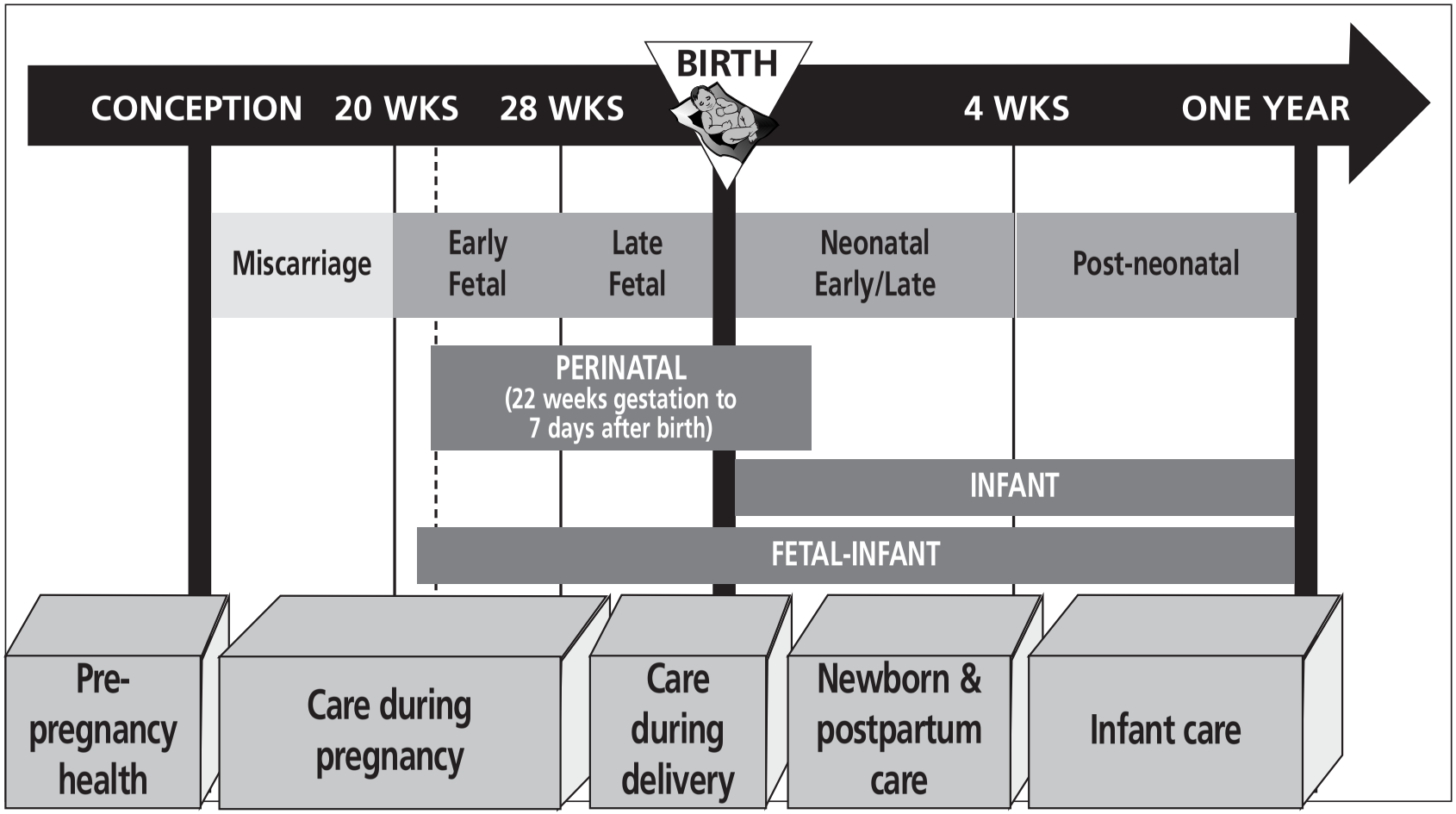
There is considerable confusion about the definitions and terminology for the perinatal and the neonatal periods[46,49]. Figure 1.3 shows the various time periods. The most common definitions for perinatal mortality apply to fetal and neonatal deaths in the following time periods:

- ✤ fetal deaths from 22 weeks to 40 weeks of gestation (equivalent to birth weight of 500 grams) and deaths among live births for days 0-7 of life (recommended in International Classification of Diseases (ICD)-10, used in industrialized countries);
- ✤ fetal deaths from 28 weeks to 40 weeks of gestation (equivalent to birth weight of 1 kg) plus deaths among live births for days 0-7 of life (WHO recommended for international comparison); and
- ✤ fetal deaths from 22 weeks to 40 weeks gestation plus deaths among live births (equivalent to birth weight of 500 grams) until the 28th day of life (traditional definition but not in common use now).

International comparability of data across countries is complicated by nonstandard definitions and highly variable application of definitions[46]. For the purposes of this manual, the ICD-10 definition of perinatal mortality is used (i.e., late fetal deaths from 22 weeks to 40 weeks and neonatal deaths in the first week of life). WHO usually refers to the expected weight at the given gestational age since gestational assessment is often not available.

Recording birth weight is important and very useful in attributing causes of newborn deaths. At present, birth weight is recorded in only about half of the world's births. Currently no countries in sub-Saharan Africa include birth weight on the death certificate. Clearly, for home deliveries without a skilled provider, rectifying this problem is more complex. There are several low-technology approaches to measuring birth weight, such as a hand-held spring balance that passes a mark if the baby weighs more than 2.5 kg (Program for Appropriate Technology in Health) or chest circumference tapes that are color-coded for low and normal birth weight[55]. (More details are given in Part Four under the "Extra Care of the LBW Baby Intervention Sub-Package.") However, as the proportion of deliveries attended by skilled personnel increases, the main issue will be not skill, but equipment, accountability, and recording.

FIGURE 1.3
INTERVENTION PACKAGE FOR TIME PERIODS OF PREGNANCY, NEONATAL, AND INFANT LIFE



Stillbirths = Babies born dead after 22 weeks of gestation (birth weight more than 500 g)
[Note: WHO recommends international reporting of fetal deaths only for those more than 28 weeks/(1 kg)]

Identification of the specific causes of fetal-neonatal deaths is often unreliable, partly because many causes of these deaths present with similar clinical signs and symptoms, such as poor feeding and thermal instability[52]. A correct diagnosis often requires a skilled clinical health care provider and laboratory facilities. Even in developed countries where such services and technology are available, difficulties in diagnosis persist, particularly for fetal deaths. Even if an appropriate diagnosis can be made, the information may be erroneously recorded and coded in the medical records or in civil registration data[46]. The ICD codes for fetal and neonatal deaths are extremely complex and often require investigative procedures that are unavailable. The lack of specific data on the cause of death may mislead health policy makers about which interventions will have the greatest impact. A number of word-based autopsy tools for infants have been validated, but the ones that have included neonatal causes of death either have numbers too low to validate or have had poor specificity except for neonatal tetanus[53,54].

KEY QUESTIONS

- ☞ What are your national definitions for fetal, perinatal, and neonatal mortality?
- ☞ Might small babies who die in your area be unrecorded?
- ☞ Is cause-specific mortality for fetal-neonatal deaths available in your area? If so, how reliable do you think it is? (i.e., do many neonatal tetanus deaths occur at home?)

D. Institutional and Programmatic Gaps

Attention and funding directed at care for the mother are still inadequate, given the size of the problem[56]. International attention and resources for the newborn seem lost in the gap between the Safe Motherhood and the Child Survival programs. For example, none of the "Safe Motherhood Action Points" include the newborn, and the Integrated Management of Childhood Illness protocols currently start after 1 week of age[57,58], by which time about 40 percent of infant deaths have occurred. Apart from the WHO landmark document, the "Mother-Baby Package"[59], few integrated approaches have been proposed. The best answer is not a new vertical program for the newborn but greater focus on and integration of existing programs while keeping the mother and baby together.

KEY QUESTIONS

- ☞ Do you have Safe Motherhood and Child Survival activities in your area?
- ☞ Do either of these activities have goals/programs that address newborn health or ways that newborn health programming could be integrated?

E. Perceived Impossibility

It is a common misunderstanding among the international health community that expensive technology is needed to save newborn lives[60-64] and that inexpensive interventions cannot be applied effectively in low-resource settings. There are two strong arguments against this belief. First, history shows that in developed nations NMR and PMR fell dramatically before neonatal intensive care units were functioning. Most of this decline resulted from better obstetric care (especially from skilled attendants at delivery) and from better routine newborn care, as well as general improvements in maternal health[35,36,65].

The second argument is that the evidence of current local successes indicates a growing list of simple, relatively inexpensive interventions that can save newborn and maternal lives in developing countries. Despite this fact, most of these interventions have not been effectively implemented on a large scale[59,66-68]. Examples of effective interventions to address fetal-neonatal mortality include tetanus toxoid (TT) vaccine to prevent neonatal tetanus, treatment of maternal syphilis (particularly to reduce late fetal deaths), antimalarial prophylaxis to reduce LBW and preterm birth[69], and clean delivery care. Although there are successful examples of community-based care, especially for safe motherhood, only a handful involve the newborn[70-73]. Lack of dissemination of information about these successes relating to the newborn has prevented their replication. Many of these successes will be highlighted in Part Four.

KEY QUESTIONS

- ☞ In your area, do health care personnel and community members believe that newborn lives can be saved?
- ☞ Are health care providers aware of evidence-based practices that improve newborn care? If not, how could this information be shared?
- ☞ Are there babies who have survived complications, such as severe infection or preterm birth, that can be used as examples to show that survival is possible?

III. MAGNITUDE OF FETAL-NEONATAL MORTALITY

The magnitude of global fetal and neonatal mortality is overwhelming with approximately eight million deaths occurring each year[1]. As postneonatal causes of infant death have declined, neonatal mortality has become increasingly apparent. Although the common image of newborn care is intensive care for very preterm infants, the vast majority of newborn deaths in developing countries could be prevented with simple, low-technology interventions. Fetal-neonatal deaths are closely related to maternal health and to access to quality maternal and newborn health care. The major direct causes of fetal-neonatal death include birth asphyxia, infections, and complications of preterm birth.

In this section the following aspects of fetal-neonatal deaths are discussed:

A. How Many Fetal-Neonatal Deaths Occur?
B. When Do Infants Die?
C. Where in the World Do Newborns Die?
D. Where in the Health Care System Do Newborns Die?

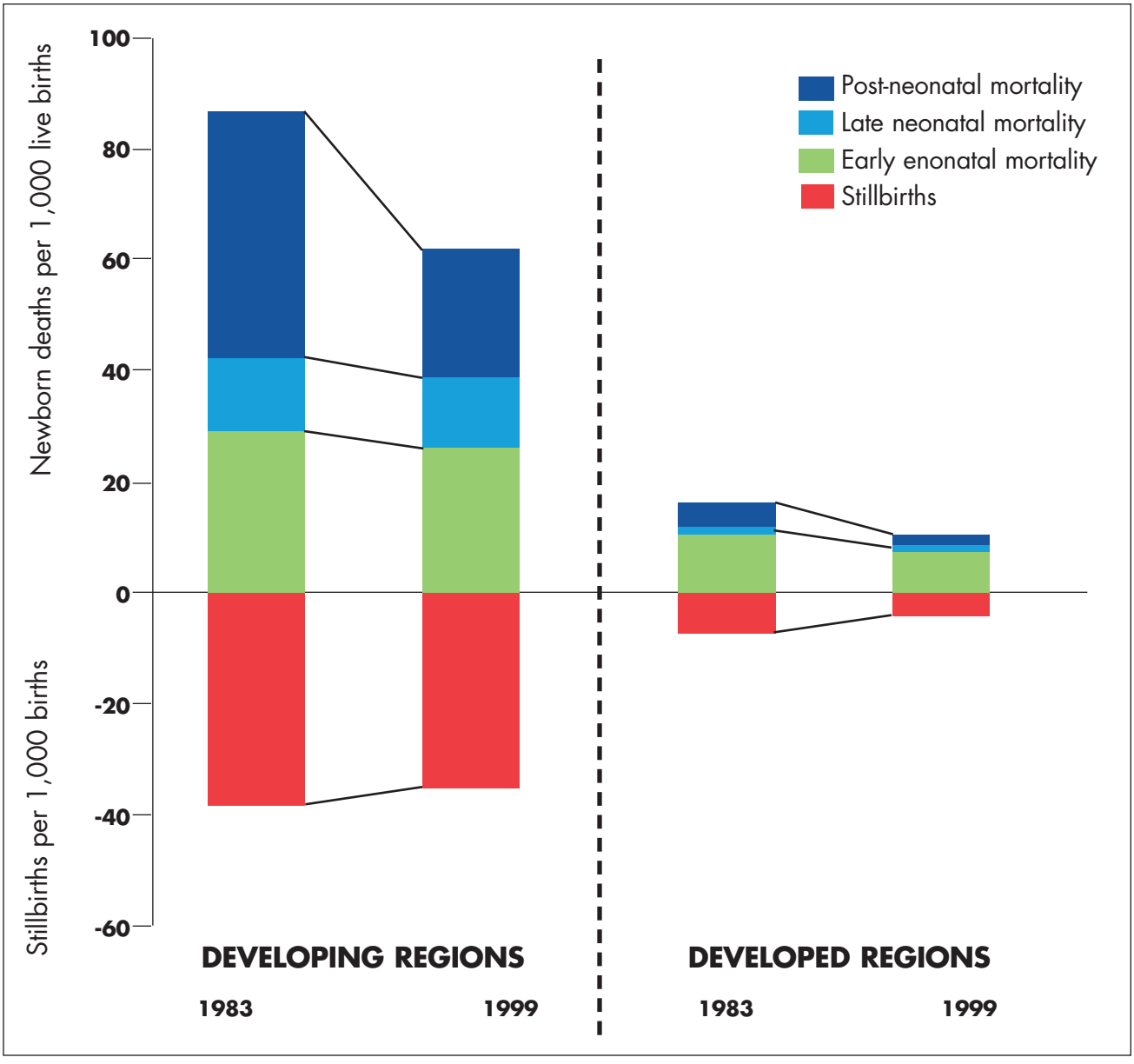
A. How Many Fetal-Neonatal Deaths Occur?

Conservative estimates from WHO suggest four million stillbirths and four million neonatal deaths occur each year[1]. Allowing for changes in rates, this means that in the last decade, over 900 million newborns – a number similar to the entire population of India – were either stillborn or died before the 28th day of life.

The global burden of disease due to perinatal causes exceeds that of malaria and all vaccine-preventable infections combined. (World Bank 1993)

Over the last decade, programs targeting specific childhood illnesses, such as diarrhea and acute respiratory tract infections, along with higher immunization coverage and better management of illness in children have contributed to a significant decline in infant mortality rates in many developing countries. The average infant mortality rate worldwide has dropped from 95 per 1,000 live births in 1983 to 60 per 1,000 live births in 1995. The greatest reduction was due to improvements occurring between 2 and 12 months of life, or the postneonatal period[4,8,60,65]. Unfortunately, some of this progress is being affected by the HIV epidemic, especially in regions of sub-Saharan Africa. In contrast to decreases in postneonatal mortality, neonatal and fetal deaths have remained almost unchanged in many developing countries (Figure 1.4.). Neonatal deaths, and especially early neonatal deaths, now represent a much larger proportion of the overall total infant mortality rate (Figure 1.4). This proportion will continue to rise as postneonatal mortality falls[74].

FIGURE 1.4
CHANGES IN LATE FETAL, NEONATAL AND POST-NEONATAL MORTALITY RATES 1983 TO 1999



Source: WHO presentation at "Neonatal Survival Intervention Research Workshop," Kathmandu, Nepal, April 29-May 3,[20]
NOTE that stillbirths and neonatal death rates have fallen much less than the post-neonatal mortality rates and so account for a bigger proportion of the deaths.

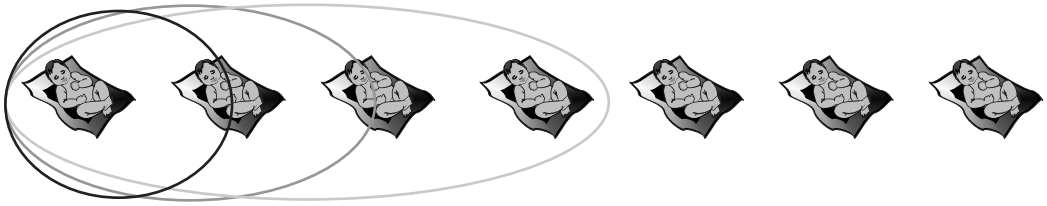
B. When Do Infants Die?

Of the world's estimated seven million infant deaths per year, approximately two-thirds occur in the neonatal period. Many deaths occur during the early neonatal period, particularly during the first day (Figure 1.5), an indication that the intrapartum period and the first 24 hours are the most critical period for infant survival. Long-term disability is also strongly influenced by this crucial period[8].

FIGURE 1.5
WHEN DO INFANTS DIE?

The Infant Mortality "Two-thirds Rule"

1. Almost 66 percent of infant deaths occur in the first month of life.
2. Among those who die in the first month of life, over 66 percent die in the first week of life.
3. Of those who die within the first week, approximately 66 percent die in the first 24 hours of life.



First day **First week** **First month** **Months 2-12**

Each baby represents one million infant deaths

Source: Based on Hill[4] and WHO estimates[1].

There are an estimated 11 million fetal and infant deaths each year. In general, about 70 percent of these deaths are in the fetal and neonatal period (8 million globally)[1].

Late fetal deaths (28 weeks of gestation to birth; 4 million annually): In many settings, fetal deaths or stillbirths are under recorded, but they can often be estimated by using the ratio of stillbirths to early neonatal deaths, which is usually 1:1. Thus, if the number of deaths during the first week of life is known, the number of late fetal deaths will normally be about equal to this number. In some situations, such as high rates of syphilis infection, there may be more stillbirths than early neonatal deaths. Sub-Saharan Africa is reported to have a higher ratio of stillbirths to early neonatal deaths, which may be associated with a high prevalence of syphilis and malaria as well as poor access to emergency obstetric care.

Early neonatal deaths (0 - 7 days postpartum; 2.9 million annually): The neonatal period and especially the first 24 hours of life is a crucial time for the newborn. Approximately 66 percent of neonatal deaths and 40 percent of infant deaths occur in the first week of life. The major causes of early neonatal deaths are asphyxia, infection, complications of prematurity, and birth defects[1].

Perinatal deaths (late fetal and early neonatal deaths; 6.9 million annually): Perinatal deaths include both late fetal and early neonatal deaths, a grouping that avoids difficulties in different interpretations of whether a baby was a live birth or not. In addition, late fetal and perinatal deaths have very similar causes.

Late neonatal deaths (8-28th day of life; 1.1 million annually): Late neonatal deaths account for approximately 16 percent of infant deaths. The major cause is infections but preterm birth and small-for-gestational age babies are at higher risk of dying during this period.

Neonatal deaths (0 – 28th day of life; 4 million annually): Neonatal mortality now accounts for the majority of infant deaths (60%) and thus far has received relatively little attention and resources.

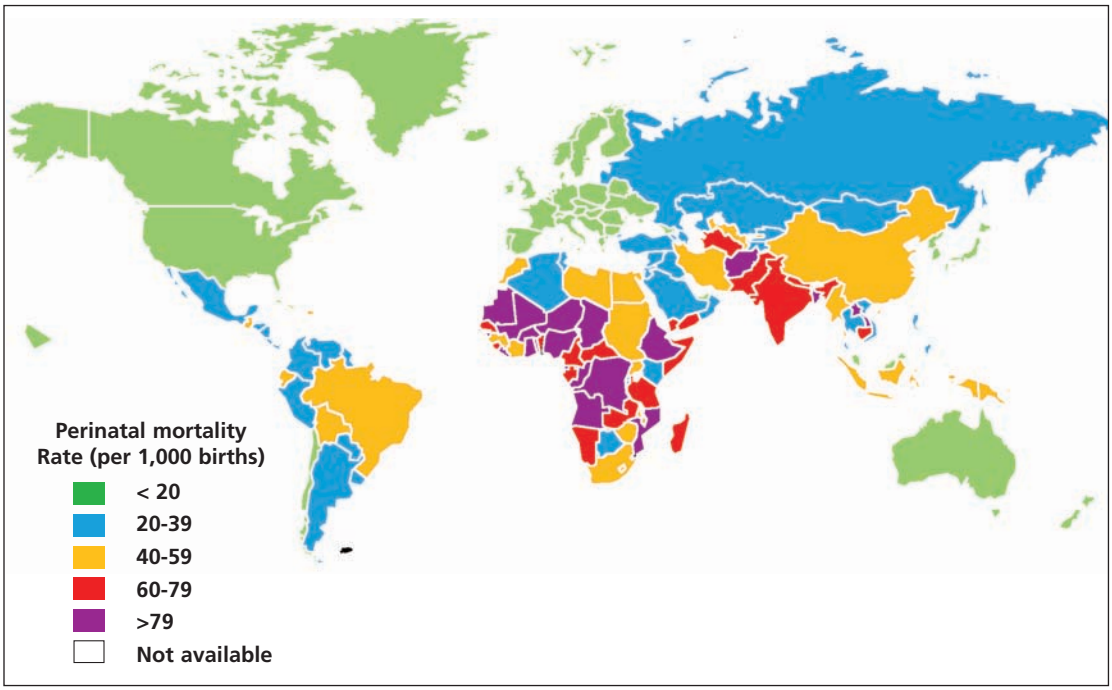
Postneonatal deaths (1 - 12 months after birth; 3 million annually): In developing countries, poor living conditions contribute to malnutrition, disease, and high rates of death among infants. Postneonatal mortality is being reduced in many countries as a result of a combination of improved living standards and interventions, such as immunization[68]. Unfortunately, the HIV epidemic in sub-Saharan Africa has reversed some of these gains in child survival. Globally, only approximately 25 percent of fetal/infant mortality occurs in the postneonatal period, and this proportion is expected to fall.

Despite the fact that most infant deaths occur in the neonatal period, child survival programming and funding continue to focus on the postneonatal period and often target specific diseases (i.e., diarrhea, acute respiratory tract infection) rather than long-term health. A paradigm shift is needed in both the timing and the focus of interventions. Programming also needs to emphasize the early neonatal period, focusing on asphyxia, tetanus, and neonatal sepsis as well as infections in the late neonatal and postneonatal period. This approach would reduce mortality in the neonatal period while improving health in the postnatal period and beyond. Maternal outcomes would also benefit, as mortality trends over time for the mother mirror those of the baby. Approximately two-thirds of maternal deaths are in the postpartum period, and about thirty percent are in the first 24 hours after delivery[12,75].

C. Where in the World Do Newborns Die?

Ninety-eight percent of perinatal deaths (late fetal and early neonatal) occur in developing countries (Figure 1.6). Perinatal mortality is highest in Africa where the average is 76 per 1,000 total births, and in some areas it is as high as 200 deaths per 1,000 total births – more than 20 times the rate in Western Europe[1,2]. Although perinatal mortality rates are lower in Asia (53/1,000), 60 percent of all neonatal deaths (about 2.6 million) occur on that continent. This higher proportion is due to the sheer magnitude of Asian populations and numbers of births, particularly in India and China.

FIGURE 1.6
GLOBAL DISTRIBUTION OF PERINATAL MORTALITY



Source: WHO / FRH / MSM / 96.7 data[2].

The geographical distribution of neonatal mortality rates is similar to perinatal rates with the rates higher in Africa (42/1,000) followed by Asia (34/1,000). Most neonatal deaths occur in Asia because of the large population.

It is should be stressed that *all* of these figures are based on estimates. Many countries with the highest death rates have the lowest rates of both birth and death registration. As a result, these countries have little information on newborn health. For example, Ethiopia has a perinatal mortality rate greater than 80 per 1,000 total births and no system for birth registration. In Bangladesh, the PMR is also above 80, and less than 30 percent of births are registered. In comparison, Thailand has a PMR of 20-39 per 1,000 total births, and at least 90 percent of the births are registered[(17)].

KEY QUESTIONS

- ☞ In your setting, do you have an estimate of the numbers of late fetal and neonatal deaths? If not, you may be able to calculate a rough estimate from national rates applied to the number of births in your area. If your national rate is not known, WHO has estimates of rates per country for 2001, and NMR may be available in the State of the World's Newborns report. Part Two gives more details on how to use available data or collect selected data to understand the number and causes of fetal-neonatal deaths in your area.
- ☞ If the majority of infant deaths are in the neonatal period, are there interventions in place to prevent these deaths?

TABLE 1.2
PERINATAL AND NEONATAL MORTALITY BY REGION

Region	Estimated number of live births per year (thousands) 1999	Estimated neonatal mortality rate (per 1000 live births) 1999	Estimated number of neonatal deaths
World	**129,596**	**31**	**4,035,000**
More developed regions	**13,045**	**5**	**65,000**
Less developed regions	**116,550**	**34**	**3,970,000**
Africa	**28,685**	**42**	**1,205,000**
Eastern Africa	10,057	41	408,000
Middle Africa	4,107	39	162,000
Northern Africa	4,607	32	147,000
Southern Africa	1,277	18	23,000
Western Africa	8,636	54	465,000
Asia	**76,090**	**34**	**2,561.000**
Eastern Asia	21,106	20	421,000
South - Central Asia	38,442	46	1,753,000
Souther - Eastern Asia	11,432	24	277,000
Western Asia	5,110	22	110,000
Europe	**7,374**	**6**	**44,000**
Eastern Europe	3,001	9	27,000
Northern Europe	1,074	4	4,000
Southern Europe	1,405	5	8,000
Western Europe	1,895	3	5,000
Latin America/Caribbean	**11,553**	**17**	**196,000**
Caribbean	773	19	15,000
Central America	3,427	13	46,000
South America	7,354	18	135,000
Northern America	4,098	4	18,000
Oceania*	**225**	**34**	**8,000**
Melanesia	192	39	7,000
Micronesia	18	6	< 1,000
Polynesia	15	8	< 1,000

*Japan, Australia and New Zealand are excluded from the regional estimate but are included in the total for developed countries. NMR is based on WHO estimates for 2001[1]. Estimated numbers of neonatal deaths were calculated using the estimated births per year for 1999 (UNICEF, State of the World's Children 2001).

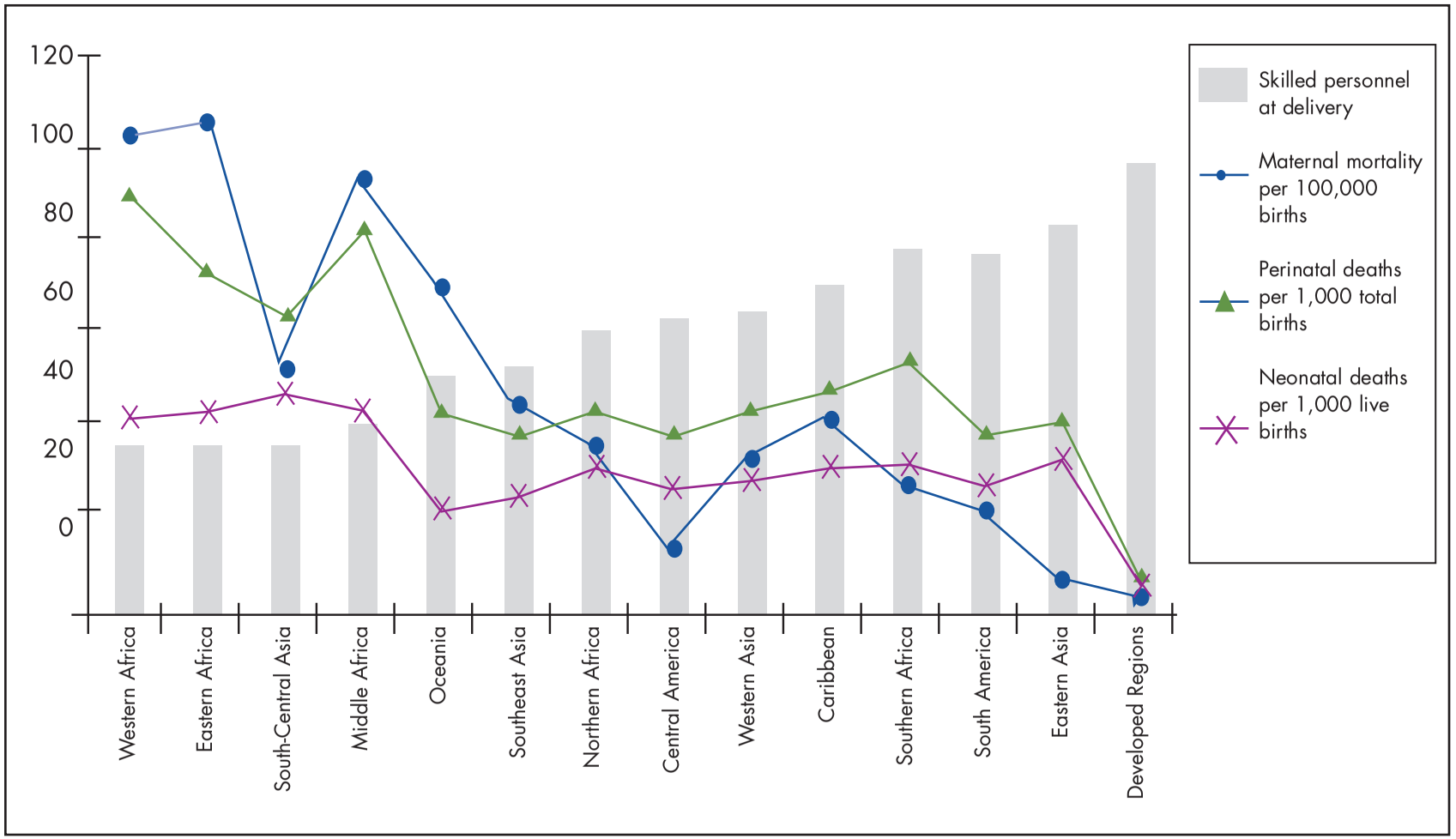
D. Where in the Health Care System Do Newborns Die?

Many fetal-neonatal deaths occur at home, often without the presence of a skilled attendant. Only about one-third (37%) of deliveries in developing countries take place in a health care facility. In addition, about half (53%) of all pregnant women deliver with the assistance of a skilled attendant[6]. As the proportion of deliveries with a skilled attendant increases, both maternal and perinatal deaths decrease (Figure 1.7). In considering skilled attendant coverage or the percentage of institutional births, it is important to remember that these proportions are averages; many subpopulations, such as those in rural areas and the peri-urban poor, have much lower coverage. Often these populations are the most likely to have high rates of maternal and fetal-neonatal death. The World Bank and Demographic and Health Surveys are producing a series of documents that describe a variety of indicators, such as immunization coverage by income quartile (available from the World Bank Website at www.worldbank.org). Some services, such as immunization coverage, are fairly constant across income groups. However, skilled attendance at birth varies most with income, ranging from 20 percent for the poorest to 90 percent for the richest[76].

KEY QUESTIONS

- In your setting, what proportions of deliveries occur in institutions or at home?
- Do you have an estimate of what proportion of deliveries is with a skilled attendant?
- Are there certain groups of people (rural areas, poorer people, and different ethnic groups) that are less likely to deliver with a skilled attendant?

FIGURE 1.7
PROPORTION OF DELIVERIES WITH A SKILLED BIRTH ATTENDANT, RELATED TO MATERNAL, PERINATAL, AND NEONATAL MORTALITY



Source: Adapted from Koblinsky[75] with using WHO data[2]

IV. WHY DO NEWBORNS DIE?

This section discusses the causes for neonatal and, to a lesser extent, fetal deaths. Discussion of fetal deaths is limited by the lack of information. There are several conceptual frameworks describing factors related to maternal mortality and child mortality. Understanding fetal and neonatal deaths can build on these frameworks, particularly the importance of delay as a contributory cause. Newborn deaths result from a combination of medical causes, social factors, and systems failures that vary by context and culture. Therefore, this section is organized as follows.

A. Conceptual Framework

B. Direct Medical Causes of Fetal-Neonatal Deaths

1. Direct medical causes of fetal deaths.
2. Direct medical causes of neonatal deaths.
3. Low birth weight and preterm birth.

C. Underlying Causes of Fetal-Neonatal Deaths

1. Inadequate pre-pregnancy health.
2. Inadequate care during pregnancy.
3. Inadequate care during delivery.
4. Inadequate newborn care (essential, extra, and emergency).

D. Delays in Access that Contribute to Fetal-Neonatal Deaths

1. Delays in problem recognition within the home.
2. Delays in deciding to seek care.
3. Delays in reaching the health facility due to lack of transport and resources.
4. Delays in receiving appropriate, quality care at the facility.

E. Fundamental Causes of Fetal-Neonatal Deaths

1. Newborn outcomes as a marker for women's health and social status.
2. Traditional care practices in the home and the community.

The following sections will discuss each of these factors in detail. The BABIES tool described in Part Two also uses the underlying causes of fetal-neonatal deaths (pre-pregnancy health care, care during pregnancy, care during delivery and newborn care) to help the program manager prioritize interventions. The Intervention Packages covered in Part Four are based on these categories, including examples of lessons learned.

TERMINOLOGY

MATERNAL AND NEWBORN HEALTH SERVICES

Basic emergency obstetric care (BEmOC): The ability of a health institution to perform manual removal of retained placental/pieces; assisted vaginal delivery (i.e., vacuum extraction), as well as the ability to administer antibiotics, sedatives (i.e., Valium, Magnesium Sulfate) and oxytocics (i.e., Ergometrine, Pitocin) IM or IV and IV fluids. It is recommended that there should be four basics EmOC facilities per 500,000 people.

Care during pregnancy (antepartum): Care throughout pregnancy until the onset of labor, including care both at home and in the formal health care system, such as in an antenatal clinic.

Care during delivery (intrapartum): Care from the onset of labor until the delivery of the placenta.

Comprehensive emergency obstetric care (CEmOC): The ability of a health instituion to perform all the Basic EmOC functions, as well as the ability to perform surgery under general anesthesia, assisted removed (i.e., D&C) of retained placental pieces, and provide blood replacement. It is recommended that there should be one Comprehensive EmOC facility per 500,000 people.

Emergency newborn care: Identification, stabilization, and management of sick babies with conditions such as neonatal sepsis, asphyxia, and jaundice.

Essential newborn care: Basic preventive care for all newborns, especially warmth, cleanliness, breastfeeding, cord and eye care, and immunizations.

Extra newborn care: Identification of and additional support for babies who are born weighing less than 2,500 grams. Mortality rates for babies with birth weight 1,750-2,500 grams can be improved significantly with simple interventions. Babies weighing less than 1,750 grams at birth are likely to require more specialized care. May also apply to other babies who are not LBW, but have other special requirement, such as babies born to HIV positive mothers.

Fresh stillbirths: Fetal deaths that occur within the uterus less than 12 hours before delivery and are mainly caused by complications during labor and delivery (asphyxia).

Macerated stillbirths: Fetal deaths that occur within the uterus more than 12 hours before delivery and so appear more disintegrated and with broken skin. These deaths are most commonly due to maternal syphilis, other infections, and congenital abnormalities.

Newborn (or neonatal) care: Care from birth until the 28th completed day of life, including care both at home and in the formal health care system.

Postpartum care: Care from the delivery until the sixth completed week after delivery, including care both at home and in the formal health care system.

Pre-pregnancy health: The health of the woman before she becomes pregnant.

Skilled attendant: Individuals with "midwifery skills (i.e., doctors, midwives, and nurses) who have been trained to proficiency in the skills to manage normal deliveries, diagnose and manage or refer complicated cases."[77] Although trained traditional birth attendants are not included, this does not mean that they cannot play a role in promoting maternal and newborn health.

TERMINOLOGY

FOR THE SMALL BABY

Assessment of gestational age of baby: The gestational age of a baby can be assessed be use of:

- ultrasound assessment in utero (the gold standard but unavailable in most developing countries);
- the last menstrual period, which will be less accurate in societies where prolonged lactational amenorrhea is common or where calendars are not used; and
- clinical assessment of gestation after delivery, using a variety of scores. The well-validated scores are fairly complex and require considerable skill. Simpler scores are available and give moderately accurate assessments.

Assessment of size of baby: The size of the baby can be assessed by means of:

- foot sole size;
- tape measurement of chest, head, arm;
- spring scales; and
- balance scales (more details in Figure 4.7).

Intermediate LBW (ILBW): (Also called moderate LBW.) Birth weight of 1,500–2,499 grams.

Intrauterine growth restriction (IUGR): IUGR is a process of growth restriction during pregnancy that results in the birth of a baby who weighs less than expected for gestation. This process may be due to inadequate nutrition, infection (such as malaria), or other reasons. Not all growth-restricted babies are LBW. For example, a baby may weigh more than 2,500 grams but have the potential to have weighed more. Hence, the rate of IUGR will be higher than the LBW rate.

Low birth weight (LBW): Birth weight less than 2,500 grams (caused by IUGR and/or preterm birth).

Preterm birth: Birth before 37 completed weeks of gestation.

Small for gestational age (SGA): SGA refers to a baby who's weight is less than the 10th percentile for gestation and gender. This term is often used as a proxy for IUGR because of the difficulty determining the "expected weight for gestation and gender." However, some babies who are SGA may not have been growth restricted but are simply inherently small and would normally be under the 10th percentile.

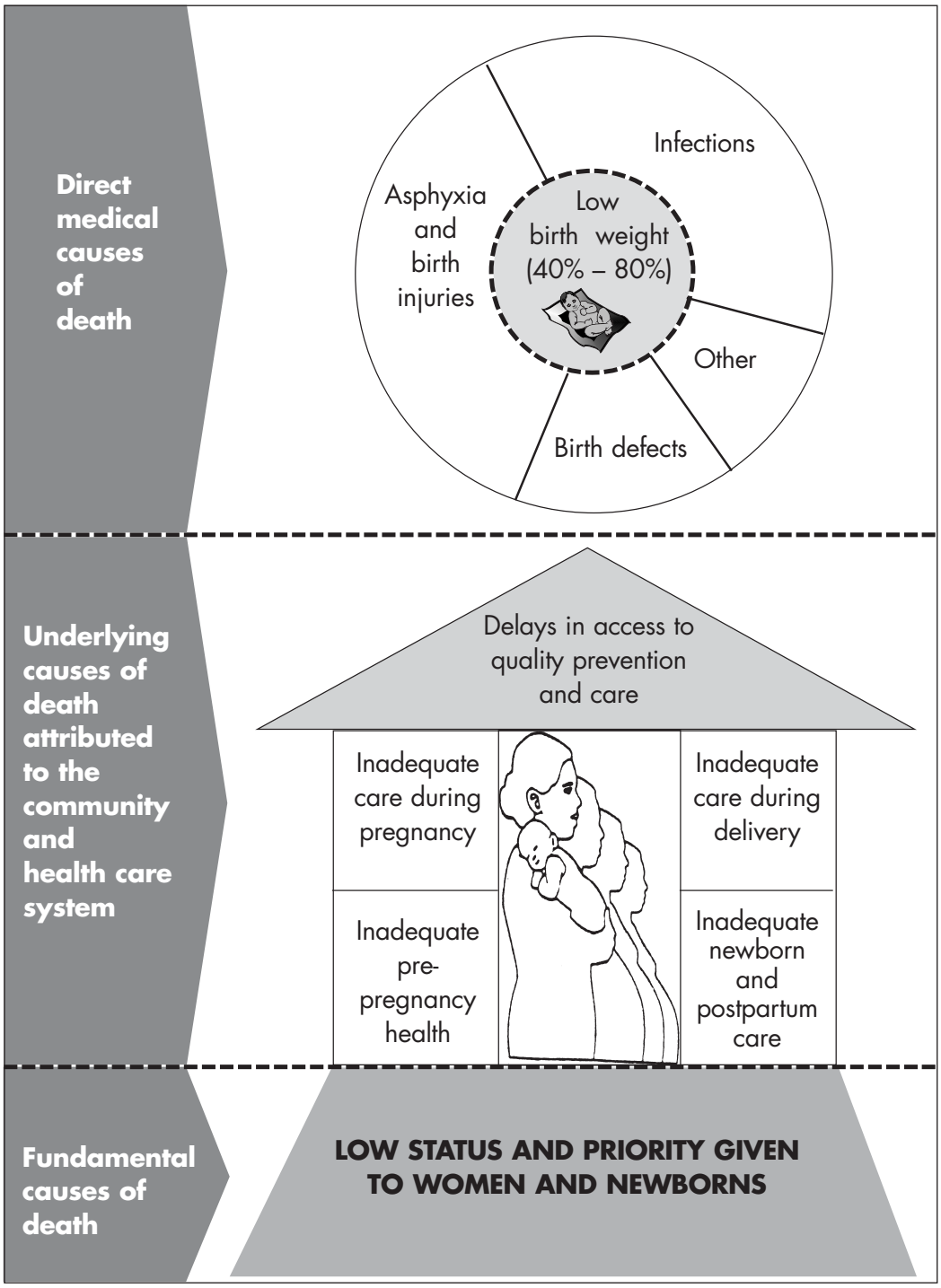
Very LBW (VLBW): Birth weight less than1,500 grams.

Source: WHO, ICD[9] and ICD[10], UNSCN 2000[24].

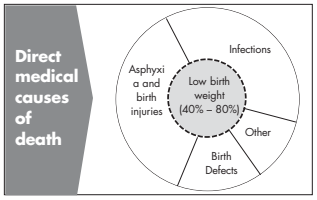
A. Conceptual Framework

There are many conceptual frameworks that articulate various aspects of maternal mortality. Others articulate factors related to child mortality, which may or may not include newborn mortality. However, there are very few frameworks that show the inter-relationship between the mother and the newborn, as well as their health outcomes. Experience has shown that there are several factors that can influence the type of outcomes that a woman and her newborn may experience. Figure 1.8 is a simplified conceptual framework that outlines the factors and their relationships that affect maternal and neonatal mortality.

FIGURE 1.8
CONCEPTUAL FRAMEWORK FOR CAUSATION OF FETAL-NEONATAL DEATHS



Source: Lawn 2000



B. Direct Medical Causes of Fetal-Neonatal Deaths

This section discusses the three main causes of fetal-neonatal deaths.

1. Direct causes of fetal deaths.
2. Direct causes of neonatal deaths.
3. Low birth weight and preterm birth.

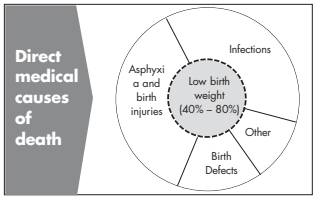
There is a lack of community-based data on causes of fetal-neonatal deaths, many of which occur at home. For this reason, the top three causes of death (infections, birth asphyxia, and birth defects) are listed without attributing percentages.

Low birth weight, especially that due to preterm birth, is a major contributing factor to fetal-neonatal deaths. It is included in the center of the diagram of medical causes (Figure 1.8). Between 40 percent and 80 percent of neonatal deaths occur among babies who were born weighing less than 2,500 grams[78]. It is often difficult to classify neonatal deaths due to specific causes because many neonatal conditions have nonspecific symptoms, such as poor feeding and lethargy. Stillbirths are more difficult to classify, even with sophisticated technology. Table 1.3 summarizes the current information on major causes of fetal-neonatal deaths.

TABLE 1.3
MAJOR CAUSES OF FETAL-NEONATAL DEATH

Late fetal deaths (28 weeks up to delivery)	Early neonatal (0 - 7 days)	Late neonatal death (8 - 28 days)
Fresh stillbirth • Intrapartum birth asphyxia • Preterm birth • Birth defects	• Birth asphyxia/birth injuries • Infection – Sepsis – Meningitis – Tetanus – Acute lower respiratory infection – Diarrhea	• Infections – Sepsis/meningitis – Meningitis – Tetanus – Acute lower respiratory infection – Diarrhea
Macerated stillbirth • Infection, especially syphilis • Hypertension/preeclampsia • Placental abruption • Birth defects • Maternal diabetes • Post-term pregnancy (more than 42 weeks gestation)	• Complications of preterm birth (respiratory distress, jaundice, increased risk of sepsis) • Birth defects	• Early feeding failures (more common for preterm and LBW babies) • Infanticide/neglect
Estimated annual total 4 million	2.9 million	1.1 million

Source: Wigglesworth 1980[80], Stoll, B. 1997[91], Hovatta, O et al 1983[79], Huang DY 2000[80], WHO 2001[1], Child Health Research Project, 1999[66], Van Dam, 1995[82].



1. Direct medical causes of fetal deaths

A late fetal death or stillbirth is the death of a baby before birth. These deaths refer to fetuses that are at least 22 weeks of gestational age and shows no signs of life at delivery.

Even with careful pathological investigation, a specific cause cannot be attributed to 25-50 percent of stillbirths[79,80]. Furthermore, in most of the world, pathological investigations are extremely rare. Most fetal deaths are unrecorded and uninvestigated. The simplest classification for stillbirths is by their appearance at birth, either fresh or macerated, which determines time of death[81].

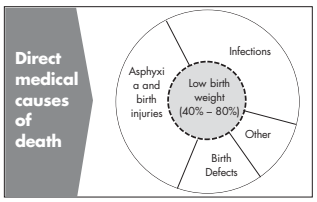
> ***Fresh stillbirths*** are deaths that occur within the uterus less than 12 hours before delivery and are due almost exclusively to intrapartum asphyxia.
>
> ***Macerated stillbirths*** are deaths that occur within the uterus greater than 12 hours before delivery, therefore appearing more disintegrated and with broken skin.

The fresh/macerated classification for stillbirths is used at all reporting levels, including national reporting in some countries, such as Malaysia, and at the local level in diverse settings in sub-Saharan Africa and South Asia. For example, health center delivery log books in rural Tanzania often include a column for macerated/fresh stillbirths.

Maternal sexually transmitted infections (STIs) are a major, preventable cause of stillbirth. The consequences of STIs on the fetus and newborn can be devastating. STIs can cause spontaneous abortion, LBW, congenital abnormalities, neonatal infections, and blindness[68,82]. STIs are discussed further on pages 1.40 through 1.44. Additionally, Part Four outlines interventions for STIs as part of the Pre-pregnancy Health Intervention Package and Care During Pregnancy Intervention Package.

KEY QUESTIONS

- ☞ In your setting, what information is available about fetal deaths?
- ☞ Does the institutional delivery log book record fetal deaths, and if so, are they categorized as fresh or macerated? The fresh stillbirth rate can be an estimate of the rate of asphyxia during delivery. A high rate of macerated stillbirths would prompt you to investigate the need for syphilis screening during pregnancy.



2. Direct medical causes of neonatal deaths

These deaths are most commonly due to maternal syphilis or other infections and congenital abnormalities[81] (Table 1.4). Information and estimates are available for neonatal deaths, although much of the available estimates are based on hospital data, which may not be representative. Table 1.4 summarizes the global estimates, issued by WHO in 2001, based on 1999 data.

TABLE 1.4
ESTIMATES OF NEONATAL MORTALITY BY MAJOR CAUSES

Cause of death	Percentage (%)	Number of deaths/year
Birth asphyxia/trauma	29	1,160,000
Prematurity	24	960,000
Pneumonia	15	600,000
Congenital anomalies	10	400,000
Neonatal sepsis	9	360,000
Neonatal tetanus	7	280,000
Other	5	200,000
Diarrhea	1	40,000
TOTAL	100	4,000,000

Source: WHO, 2001[1]. Numbers calculated assuming four million neonatal deaths.

Asphyxia and birth injuries: *Every year, up to six million newborns need resuscitation at birth, and about 1.2 million die of birth asphyxia/ trauma*[67,83]. Risk factors for birth asphyxia identified in a prospective study in a hospital in Nepal included:

- multiple births (odds ratio = 22);
- meconium-stained amniotic fluid (odds ratio = 18);
- prolonged rupture of membranes (odd ratio = 3.8);
- malpresentation (odds ratio = 3.4); and
- first pregnancy (odd ratio = 2.0).

Older maternal age and shorter maternal height were also associated with birth asphyxia, but no specific cut-offs were described as predictive[84]. In Nepal, a study of 131 infants who were asphyxiated showed that, of the 78 percent that could be found at one year of age, 44 percent had died (generally in the first few days), and 18 percent had major impairments, mainly spastic tetraplegic cerebral palsy[84,85]. Therefore, it is evident that birth asphyxia causes significant disability and death.

Approximately one third of babies who need resuscitation do not have obvious danger signs, so it is critical that skilled providers be equipped and trained to perform simple and effective neonatal resuscitation at every delivery[67,86,87]. Implementation of standardized resuscitation protocols can be highly effective in reducing neonatal mortality[88]. Unfortunately, there is little information on the effect of simple resuscitation at the community level[89,90].

Infections: *Every year, an estimated 30 million newborns acquire a neonatal infection, and 1-2 million neonates die from infection*[91]. These infections include neonatal tetanus, sepsis, and acute lower respiratory tract infections. Some infections, notably tetanus, are preventable by immunization. The umbilical cord is a major source of infection in the early neonatal period, accounting for the majority of neonatal tetanus infections and many cases of neonatal sepsis[68]. Simple clean cord care is an important intervention strategy that can prevent many cases of neonatal sepsis and tetanus, yet many babies do not benefit from this simple cleanliness[92].

A baby with neonatal sepsis in sub-Saharan Africa is not only more likely to develop sepsis but is also 8-80 times more likely to die than a baby in Europe with a similar condition[96]. This discrepancy in survival is caused by delays in accessing quality maternal and neonatal services. The major organisms that cause neonatal sepsis in industrialized countries are different from those in the developing world. Group B beta-hemolytic Streptococcus has become the major organism causing neonatal sepsis in the developed world, whereas Pneumococcus, E. Coli, and Staphylococcus are the predominant causes in developing countries[91,96]. This finding has significant treatment implications, particularly for antibiotic selection and sensitivity[97].

Each year an estimated 300,000 babies, typically between the ages of 3 and 14 days of life, die from neonatal tetanus[1]. In 1989, the World Health Assembly called for the elimination of neonatal tetanus. Yet it is still a major threat to newborn survival in many places. The countries with the highest number of estimated cases are listed in Table 1.5. Neonatal tetanus is seriously underreported, with only about three percent of cases recorded, largely because the condition is more common among poor rural communities where data collection is least likely to be efficient.

TABLE 1.5
COUNTRIES WITH THE HIGHEST ESTIMATED NUMBERS OF NEONATAL TETANUS CASES

Bangladesh	China	Ethiopia
Uganda	Indonesia	India
Nepal	Nigeria	Pakistan
Somalia	Sudan	D.R. Congo

Reference: UNICEF, Maternal and Newborn Tetanus Elimination by 2005. New York: UNICEF, 2000.

Tetanus has a very high case fatality rate, with around 90 of every 100 victims dying. Treatment is difficult, even in settings where intensive care is available. Hence, prevention is the key to reducing these deaths[93-95]. Preventive measures include maternal tetanus toxoid coverage, clean deliveries, and appropriate cord care. These interventions are detailed in Part Four, and additional references are provided on the CD-ROM.

Birth defects: *Each year around 400,000 babies die and unknown millions are disabled due to birth defects.* Although birth defects are a leading cause of neonatal deaths in developed countries, they are estimated to cause only about ten percent of deaths in developing countries[83,98]. Since this is a much smaller percentage than deaths due to infections and asphyxia, programs concerned with preventing neonatal deaths should focus on congenital abnormalities that are common and cost-effective to prevent[1,100], such as:

- neural tube defects, many of which are preventable by preconception folic acid;
- cretinism, preventable by adequate maternal iodine intake, often achieved by iodinization of salt; and
- congenital rubella syndrome disabilities, preventable by rubella immunization[101-108].

Other causes of neonatal deaths include:

- *Hypothermia,* defined as a rectal temperature of less than 36°C (98°F), can occur rapidly in a newborn, even at moderate environmental temperatures. This can happen due to a baby's large ratio of body surface area to body mass and to poor thermal insulation. A baby left wet while the placenta is delivered is especially vulnerable. The effects of hypothermia are potentially severe and contribute to illness and death, especially in preterm babies. Standard care guidelines advise early drying and thermal protection of the newborn, a warm delivery room, and other efforts to maintain the "warm chain"[109]. In a Nepali hospital, even though staff had been extensively trained on this topic, 80 percent of newborns were hypothermic[110,111]. A seven-country evaluation of newborn thermal control knowledge and practices of health care professionals found that both knowledge and practices related to hypothermia were frequently inadequate[112]. Skin-to-skin care of LBW infants, called "kangaroo care," was first developed in Colombia in 1978 and has been subjected to clinical trials in hospital settings. This care is more effective than incubators for thermoregulation of medically stable LBW infants, with a 30 percent reduction in the rate of serious illness for LBW babies in hospitals[113]. However, the intervention has not been systematically evaluated for home care. Kangaroo care is described in more detail in Part Four.

- *Hypoglycemia* is defined as a blood sugar level less than 2.2 mmol/L. Severe hypoglycemia increases the risk of death, although this is complex to investigate since hypoglycemia is often caused by conditions, such as neonatal sepsis or asphyxia, that also cause death. Even moderately low blood sugar in the first few days of life has been linked to long-term reduction in intelligence[114]. Moderate hypoglycemia is a surprisingly common event, even in apparently well babies. Asymptomatic hypoglycemia was found in 80 percent of well babies in a hospital in Nepal, many of whom were LBW[115]. The key issue in prevention of hypoglycemia is early and exclusive breastfeeding and extra attention with LBW babies. This attention applies especially to preterm babies, who may need cup feeding or tube feeding with expressed breast milk initially because they may be too immature to breastfeed effectively. Because even simple screening tests for detecting hypoglycemia (such as blood sugar testing sticks used for diabetics) are unavailable in many settings, this condition is often missed.

- *Jaundice* in the neonatal period may cause death and long-term disability, especially severe cerebral palsy. Two main types of jaundice are seen in the first week of life:

  – Physiological jaundice arises 48 - 72 hours after birth and usually resolves by the fifth day. This condition occurs in about half of normal birth weight babies and 90 percent of preterm babies and has no serious consequences.

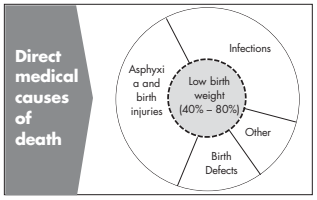
– Pathological jaundice may start in the first 24 hours after birth and worsens rapidly because of the breakdown of red blood cells. Common causes are blood group incompatibilities, particularly ABO or Rhesus, and abnormal red blood cells in the baby. Abnormal red blood cells can occur with glucose-6 phosphate dehydrogenase deficiency (G6PD), which is relatively common in some parts of Africa and South Asia. Early treatment with phototherapy can often prevent serious complications, but only if the jaundice is recognized early and appropriate care is given. Quality care of severe neonatal jaundice is difficult to achieve without an investigation of the level of bilirubin, and this test is often unavailable.

Vitamin K deficiency can cause bleeding in an infant in the first weeks of life. This is known as hemorrhagic disease of the newborn. Many babies are born with a lack of Vitamin K, which is necessary for blood to clot. The newborn may present with bleeding after circumcision, from the cord or the gut (vomiting blood or bleeding out of the rectum). Intracranial bleeding is the most dangerous effect of hemorrhagic disease of the newborn. Colostrum has high levels of Vitamin K but often is not given. Exclusively breastfed babies may not develop the bacteria in the gut that synthesizes Vitamin K and so may be more at risk of Vitamin K deficiency[116]. Part Four discusses current policies regarding prevention of hemorrhagic disease of the newborn. Policy discussion is limited by the lack of data on the incidence of hemorrhagic disease in developing countries[117].

Many of the causes of fetal-neonatal deaths are highly preventable, especially in the two largest categories — infections and asphyxia. Yet simple preventive measures are not practiced for many of the world's newborns.

KEY QUESTIONS

- ☞ Is neonatal tetanus common?
- ☞ Do you have information (i.e., incidence, types of organism) on neonatal sepsis?
- ☞ Do many babies die of asphyxia (are there many normal birth weight babies who die from asphyxia)?
- ☞ Are particular birth defects common (i.e., neural tube defects, Downs Syndrome)?
- ☞ Do you have local policies for simple newborn care, such as clean delivery, cord care, eye care, and breastfeeding support?



3. Low birth weight and preterm birth as an important cause of fetal and neonatal deaths.

Low birth weight is defined as a birth weight less than 2,500 grams. Every year, approximately 20 million LBW babies are born[1]. These births represent about 16 percent of the world's births[1,12,112]. LBW babies can be categorized as one or more of the following:

- preterm babies (born before 37 weeks);
- babies with intrauterine growth restriction (IUGR) who are full term; and
- babies who are preterm and growth restricted.

Although LBW is not an immediate cause of death, it is a major contributing factor and jeopardizes the newborn's chances of survival. This is why it is in the center of the medical causes of death shown in Figure 1.8. Birth weight is one of the best predictors of neonatal mortality[119,120]. Studies estimate that preterm birth and IUGR may be underlying causes in 40 to 80 percent of neonatal deaths[119]. A growth-restricted baby born at full term is two to three times more likely to die than a normal birth weight, term baby. However, a moderately preterm baby (32-37 weeks of gestation) has a 6–20 times higher mortality rate[119]. A severely preterm baby (less than 32 weeks gestation) has up to a 100 percent chance of dying, depending on gestation and the care available. To reduce mortality in this small group of babies, high-tech care is required. Mild and moderate preterm birth (32–37 weeks of gestation) does not carry as high a risk of death, but it is much more common. Hence, mild to moderate prematurity accounts for a significant number of neonatal deaths that are also more preventable than deaths in severely preterm babies[121].

This section will discuss the key issues related to low birth weight and preterm birth, which include global variation in LBW, causes of LBW, and strategies to reduce deaths for LBW babies.

Global variation in low birth weight: The rate of LBW differs markedly around the world and even within countries. Most (97%) LBW babies are born in developing countries (Table 1.6). The highest rates of LBW are in South Asia, which accounts for about 54 percent of all LBW babies, and about 80 percent of these LBW babies are believed to be full term (between 37 and 42 weeks of gestation)[18]. In South Asia, about 70 to 80 percent of neonatal deaths occur among LBW babies[153].

However, even in sub-Saharan Africa, where LBW is on average about 15 percent, certain subpopulations have much higher rates. Local information is therefore needed to guide decision-making.

TABLE 1.6
ESTIMATED LBW PREVALENCE AND NUMBERS BY REGION (1995 - 1999)

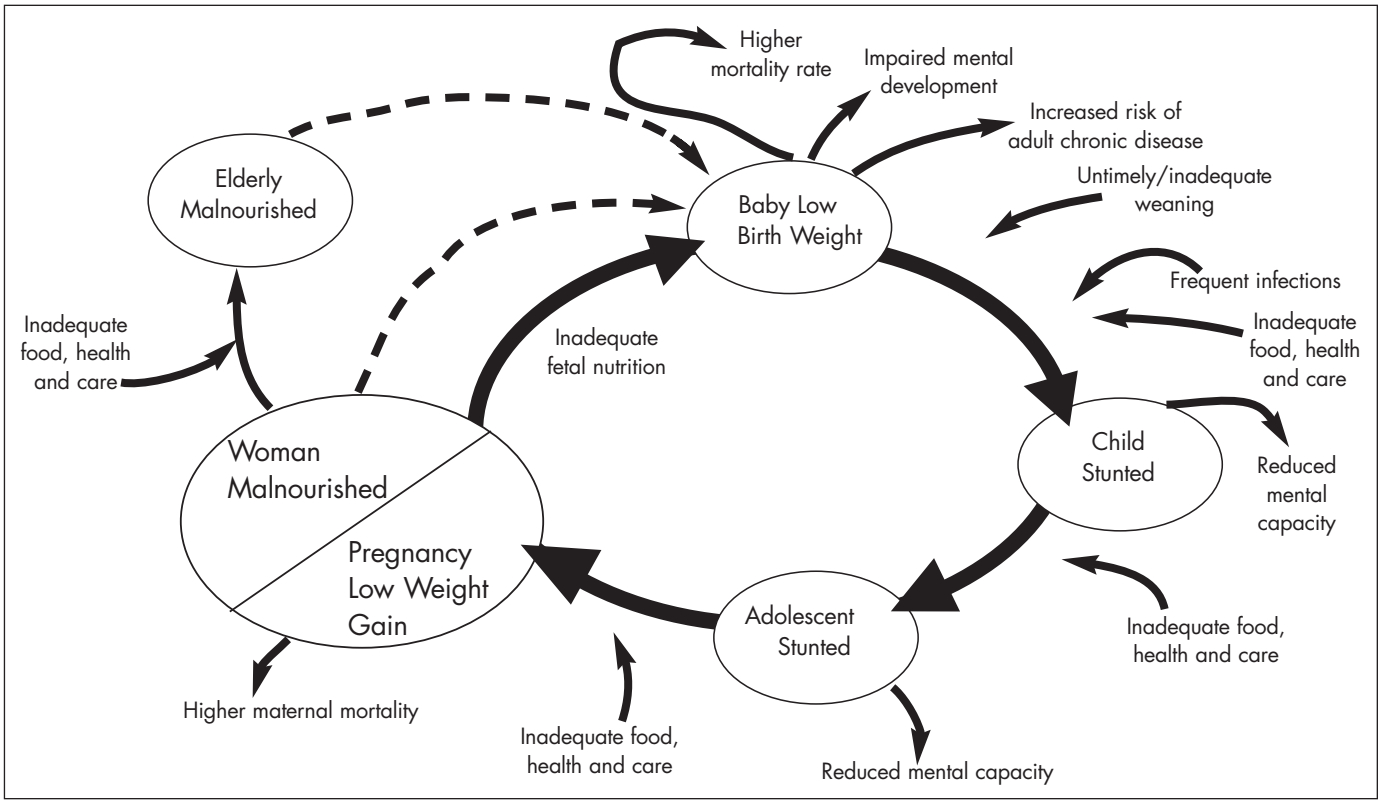
Country	LBW rate	LBW number	Percentage of the world's LBW babies per region
World	16%	20,368,200	-
Developed countries	6%	586,080	2.9%
Developing countries	17%	19,782,120	97.1%
Sub-Saharan Africa	15%	3,606,600	17.7%
Mid-East and North Africa	11%	1,023,660	5.0%
South Asia	31%	11,061,110	54.3%
East Asia and Pacific	8%	2,611,360	12.8%
Latin America and Caribbean	9%	1,031,040	5.1%
CEE/CIS and Baltic States	7%	448,350	2.2%

Source: UNICEF, 2001[27].

Causes of low birth weight: LBW may be due to the baby's being born too soon (preterm birth), too small (IUGR), or too soon and too small. Much of the literature on LBW assumes that most cases of LBW in developing countries are due to IUGR in term babies. Kramer's meta-analysis found that preterm birth and IUGR were both more common in developing countries than in industrialized countries and that IUGR was the predominant identified cause of LBW[119]. He estimated the rate of IUGR in term babies to be approximately 16 percent in developing countries and almost seven percent in industrialized countries. In addition, the study found the rate of preterm birth was seven percent in developing countries and three percent in industrialized countries. More recently, de Onis and colleagues found IUGR to be the predominant cause of LBW in developing countries[118]. One limitation of these findings is that they are largely based on data using last menstrual period to assess gestational age, which may affect the proportion of LBW cases attributed to preterm birth. Even in industrialized countries, there has been an apparent rise in the preterm birth rate over the last decade, an increase believed to be due to better assessment of gestational age[122].

The single most significant cause of IUGR globally is poor nutrition among women of reproductive age throughout the life cycle (Figure 1.9)[123]. The Institute of Medicine recommends an additional 530 calories per day for pregnant women. Unfortunately, many pregnant women do not have access to this level of nutrition. Undernutrition in pregnancy can be exacerbated because women are often expected to maintain a heavy workload in the fields and household, including child care duties. Other causes of IUGR include maternal infection, particularly malaria, and conditions such as hypertensive disorders in pregnancy. Smoking is a potentially preventable cause of LBW, especially in industrialized countries[119,124].

FIGURE 1.9
NUTRITION AND LBW THROUGH THE LIFE CYCLE



Source: ACC/SCN[24].

The causes of preterm birth are often unknown, but the major identified reasons are infections, such as bacterial vaginosis, syphilis, and malaria, and obstetric or medical complications of pregnancy, such as hypertension, multiple pregnancy, and placental abruption. The disease burden due to preterm birth is particularly difficult to assess. At present, only about half of the world's babies are weighed at birth, and far fewer are assessed for gestational age. Antenatal ultrasound is the "gold standard" for assessing gestational age, but is unavailable for most women. Relying on the date of the woman's last menstrual period is accurate if this date is known and if the woman has a regular menstrual cycle close to 28 days. In settings where women often breastfeed until their next pregnancy, the last menstrual period may be unknown or the woman's cycle may be irregular, which may make this method unreliable. The baby can be examined after delivery to assess gestational age by evaluating physical and/or neuromuscular development, but even simplified methods for doing this require training and skill[(125)]. In many cases, the preterm baby will die of another specific cause, such as infection or asphyxia, and so the effect of the preterm birth may not be recorded.

Ways to address the LBW:

There are two approaches to reducing neonatal deaths in LBW babies.

- *Reduce the LBW rate:* If the rate of LBW is greater than 15 percent in a region or country, it is recommended that LBW be a major public health priority[118]. Depending on the local causes of LBW, this is likely to require long-term investment, especially given the intergenerational effect of the causes of LBW throughout the life cycle (Figure 1.9). For certain causes of LBW, a more immediate impact may be seen. For example, giving presumptive treatment sulphadoxine-pyrimethamine (SP, known as Fansidar) to pregnant women in their third trimester is associated with increased birth weight and up to 40 percent reduction in neonatal death[69,126].

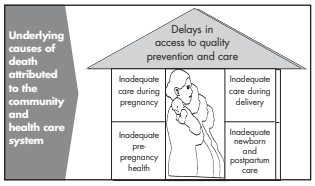
  Although a few research projects have demonstrated improvements in birth weight with nutritional interventions, this has not been documented on a large scale[127,128]. Many of the issues require major behavioral change, such as reducing the workload for pregnant women or addressing the cultural belief that "eating down" in pregnancy will prevent the delivery of a big baby. Although this may seem challenging, the gains from reducing LBW rates would amply justify efforts to develop and implement packages to address this problem. Although much of the impact may be beyond the usual three- to five-year cycle for program management, preventing LBW is an important goal that will continue to improve health and well-being for generations.

- *Improve the chances for survival of babies with LBW:* Although it may take a long time to reduce the LBW rate, the number of deaths among LBW babies could be significantly reduced by improving care in the first hours and weeks of life, especially for term IUGR babies and moderately preterm (32-37 weeks). Extra attention to warmth, support for breastfeeding, cleanliness, and early identification and management of illness could result in low-cost improvements in survival. One hospital in Ghana had more than a 30 percent reduction in the mortality rate for LBW babies by paying attention to these simple principles of care (Panel 4.18). Another simple evidence-based approach is giving steroid injections to mothers in preterm labor. This intervention reduces by 40 percent the risk of severe neonatal respiratory problems related to immaturity of the lungs. Also, it is an inexpensive (about US $1.00) and feasible intervention that is applicable to low- and high-resource settings.

Specific interventions for both approaches are discussed in Part Four. Reducing the LBW rate is covered in the Pre-Pregnancy Health and Care During Pregnancy Intervention Packages. Interventions to address improving survival of LBW babies are covered in the Extra Care of the LBW Baby Intervention-Sub Package.

KEY QUESTIONS

- ☞ Do you have an estimate of the LBW rate in your area? Even a hospital-based estimate is better than no data. What proportion of neonatal deaths occur among LBW babies?
- ☞ What proportion of LBW babies are full term versus preterm?
- ☞ What are the major causes of IUGR or preterm birth in your setting? Is it feasible to address any of them now, such as presumptive treatment of malaria in pregnancy?



C. Underlying Causes of Fetal-Neonatal Deaths

Any intervention to prevent fetal deaths must focus on the mother. This is also true for many of the causes of neonatal deaths. The majority of neonatal deaths (around 66%) occur in the first week of life, and direct causes of death, such as asphyxia, respiratory distress in a preterm baby, and early sepsis, are related to the health or care of the mother. The main causes of neonatal deaths are poor pre-pregnancy health and inadequate care during pregnancy and delivery. Newborn care is also important in preventing neonatal deaths, particularly essential care of the normal newborn to prevent illness, extra care of LBW babies, and access to quality emergency care for the sick newborn.

Postpartum care of the mother is also crucial. Most maternal deaths occur in the immediate postpartum period. Thus, integrating care for mother and baby during this important period is vital to reducing mortality for both. The death of a mother also has a direct impact on the newborn's long-term chances of survival[16]. There are socioeconomic consequences for surviving children because women are more likely than men to spend their income on family welfare. A Tanzanian study found that children are more likely to drop out of school or miss school after the death of a mother [6,129]. Since the main focus of this manual is the newborn, postpartum care of the mother will not be discussed in detail. Overall goals will be outlined in Part Four, and the aim should be to integrate postpartum and newborn care.

1. Inadequate pre-pregnancy health

The health of women of reproductive age is a critical determinant of pregnancy outcomes for both mother and newborn. Birth weight and the gestational age of the baby are the two strongest determinants of fetal and infant outcome and are largely determined by the health of the mother[78]. However, improvement in the health of women of reproductive age requires long-term input and often behavioral changes in nutrition, education, sexual behavior, and health care seeking practices. Maternal health affects the baby through the mother's poor nutrition, infections, and lack of pregnancy spacing, especially starting with teenage pregnancies.

> ***Unmet need for family planning:*** Family planning improves fetal and newborn outcomes as well as maternal health in general[130]. An analysis of Demographic and Health Survey data from 17 countries suggests that meeting unmet need for spacing of pregnancies could reduce perinatal and neonatal mortality by about one-quarter while also reducing the LBW rate[54].

Undernutrition among women of reproductive age: The single most important cause of IUGR globally is poor nutrition among women of reproductive age[123]. (The importance of nutrition throughout the life cycle is illustrated in Figure 1.9.) Possible interventions of protein-energy and micronutrient supplementation are covered in Part Four as part of the Pre-Pregnancy Health and Care During Delivery Intervention Packages.

Infections among women of reproductive age: Many infections affect women of reproductive age in developing countries, but reproductive health outcomes are particularly influenced by STIs. Identification and treatment of STIs are often difficult for many reasons, including:

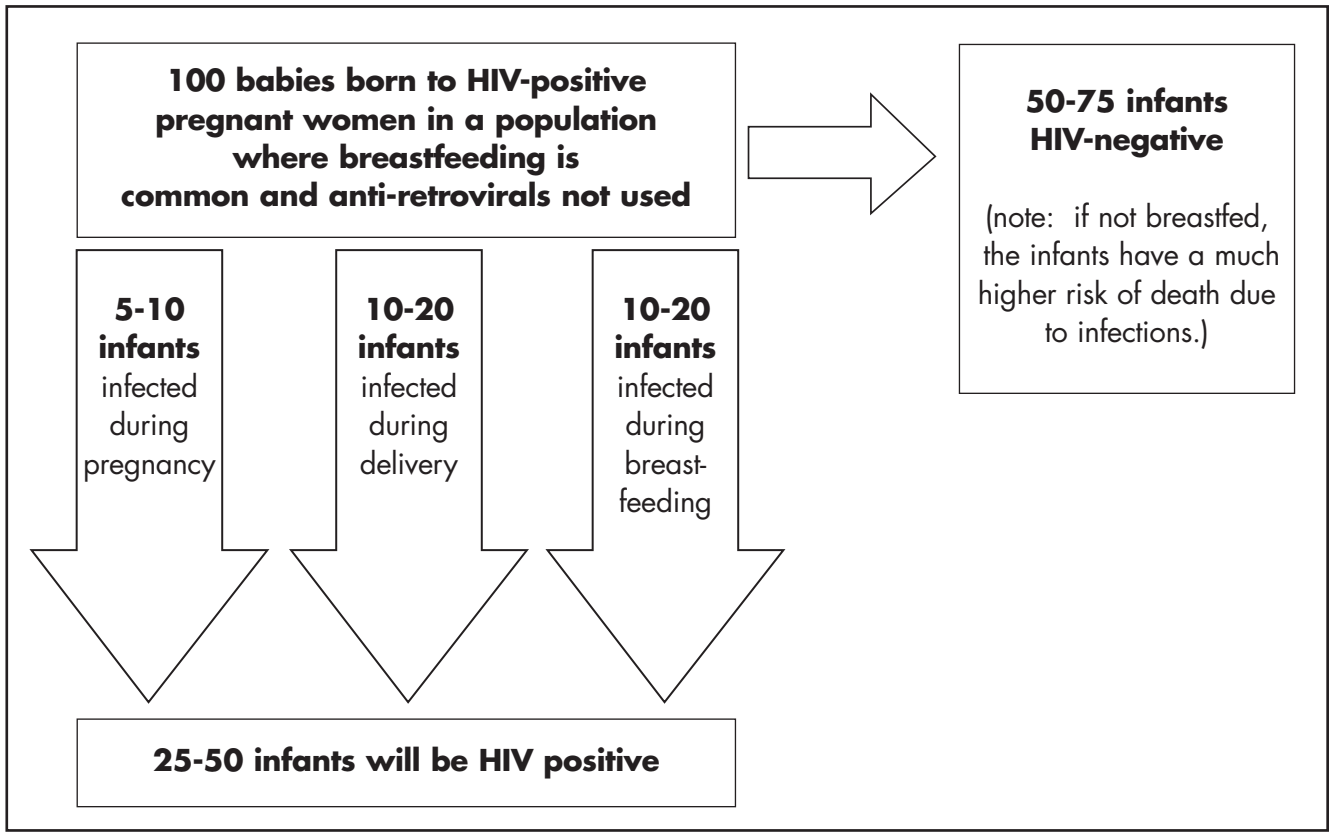
- ✔ STIs are often asymptomatic in women;
- ✔ women are often unaware of the significance of symptoms they experience;
- ✔ coverage of STI services is often poor;
- ✔ use of maternal health services is often limited by social taboos;
- ✔ investigations to reliably diagnose STIs are often unavailable;
- ✔ quality of services for STI treatment is often low because of unclear guidelines for treatment;
- ✔ treatment supplies may be unavailable; and
- ✔ partner tracing is difficult, thus making reinfection likely.

Although treatment of STIs is important and the quality of services needs to improve, prevention is the key, especially among adolescents. Prevention is particularly important for HIV because a cure is not currently available, and the impact on mother, infant, and society is catastrophic. A woman who is HIV-positive has a higher chance of having a spontaneous abortion or fetal death[131]. Worldwide, about 60,000 infants are infected with HIV each year as a result of mother-to-child transmission[131]. For every 100 pregnant women who are HIV-positive, (in a setting without antiretroviral drugs and breastfeeding is common) between 25 and 50 of their babies will be infected with HIV. The virus may be passed from mother to baby, and this is commonly termed mother-to-child transmission (MTCT/HIV). There are three major methods of MTCT/HIV:

- ✤ during pregnancy, the virus can pass across the placenta;
- ✤ during delivery, the newborn can be infected as the vaginal secretions touch the baby;
- ✤ after delivery, the newborn can be infected through breastfeeding.

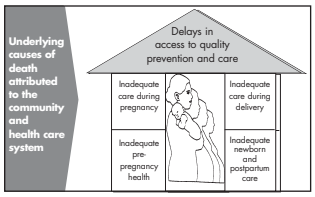
Figure 1.10 illustrates the outcomes for babies of HIV-positive mothers in a population where breastfeeding is common and anti-retrovirals are not used.

FIGURE 1.10
OUTCOMES FOR BABIES OF HIV-POSITIVE MOTHERS



Source: De Cock K et al, 2000[131]; Note that the rate of transmission varies with many factors including stage of HIV infection, strain of HIV, and possibly the mother's nutritional status.

Although new interventions, such as short-course antiretroviral regimens, may reduce MTCT/HIV, the translation of such policies into action is extremely complex, especially those regarding breastfeeding by HIV-infected women in low-resource settings[132,133]. Prevention of HIV infection in women of reproductive age, especially among adolescent girls, is crucial for success against AIDS, as experience in Uganda has shown[131]. Interventions to address MTCT/HIV are discussed in Part Four with examples of lessons learned.



2. Inadequate care during pregnancy

The care of a pregnant woman in her home, in the community, and in the formal health care system is an important determinant of maternal and newborn deaths[134]. In the home, key issues include nutrition, the workload for the pregnant woman, and planning for the pregnancy. In many settings, the mother is expected to continue her heavy workload even until full term[129]. Excess workload, specifically, more than five hours of standing per day, is an independent risk factor for preterm labor and is also a factor in IUGR. Nutrition in pregnancy affects outcomes for the baby. Although research trials of improved nutrition in pregnancy have shown a significant reduction in LBW rates and fetal-neonatal mortality, reviews of programs addressing nutrition in pregnancy have not found such dramatic effects[24,127].

Inadequate quality of caren during pregnancy: The contribution of care during pregnancy to the improvement of outcomes is unclear, possibly because the highly variable quality of care makes comparisons difficult. When the quality of care is poor, even numerous visits will not improve outcomes for the mother or the baby. However, even a few antenatal visits at which standard protocols of care are followed may have a significant impact on outcomes. A recent WHO randomized control study on antenatal care modes with four visit of specified care was not detrimental to the outcome. Some reviews suggest that antenatal care is more effective in improving fetal-neonatal outcomes than maternal outcomes[135]. Specific interventions shown to be effective in improving maternal or fetal-neonatal outcomes include tetanus toxoid, identification and treatment of STIs, presumptive treatment of malaria[69,126] and hookworm in endemic areas, and identification and management of high blood pressure and malpresentation[136, 139]. These and other evidence-based interventions are discussed in more detail in Part Four.

Undernutrition during pregnancy: Maternal nutrition interventions during pregnancy can improve neonatal birth weight and reduce perinatal mortality by up to 50 percent[127]. Between 24 and 67 percent of pregnant women worldwide are anemic, and this is a risk factor for IUGR and preterm birth, in addition to adverse outcomes for the mother. Iron supplementation has been shown to increase maternal iron levels, yet many pregnant women do not receive or take iron during pregnancy. Nutrition throughout the life cycle for the female child is crucial because the pre-pregnancy weight of the mother has the strongest correlation with maternal and newborn health outcomes[24].

Infections during pregnancy: Maternal infections have a major impact on both maternal and fetal-neonatal outcomes. There are four major categories of adverse fetal-neonatal outcomes due to maternal infection in pregnancy presented below.

- *Birth defects* are classically caused by infection in early pregnancy, such as maternal rubella infection resulting in congenital rubella syndrome with the typical triad of congenital heart disease, cataracts, and deafness[138].

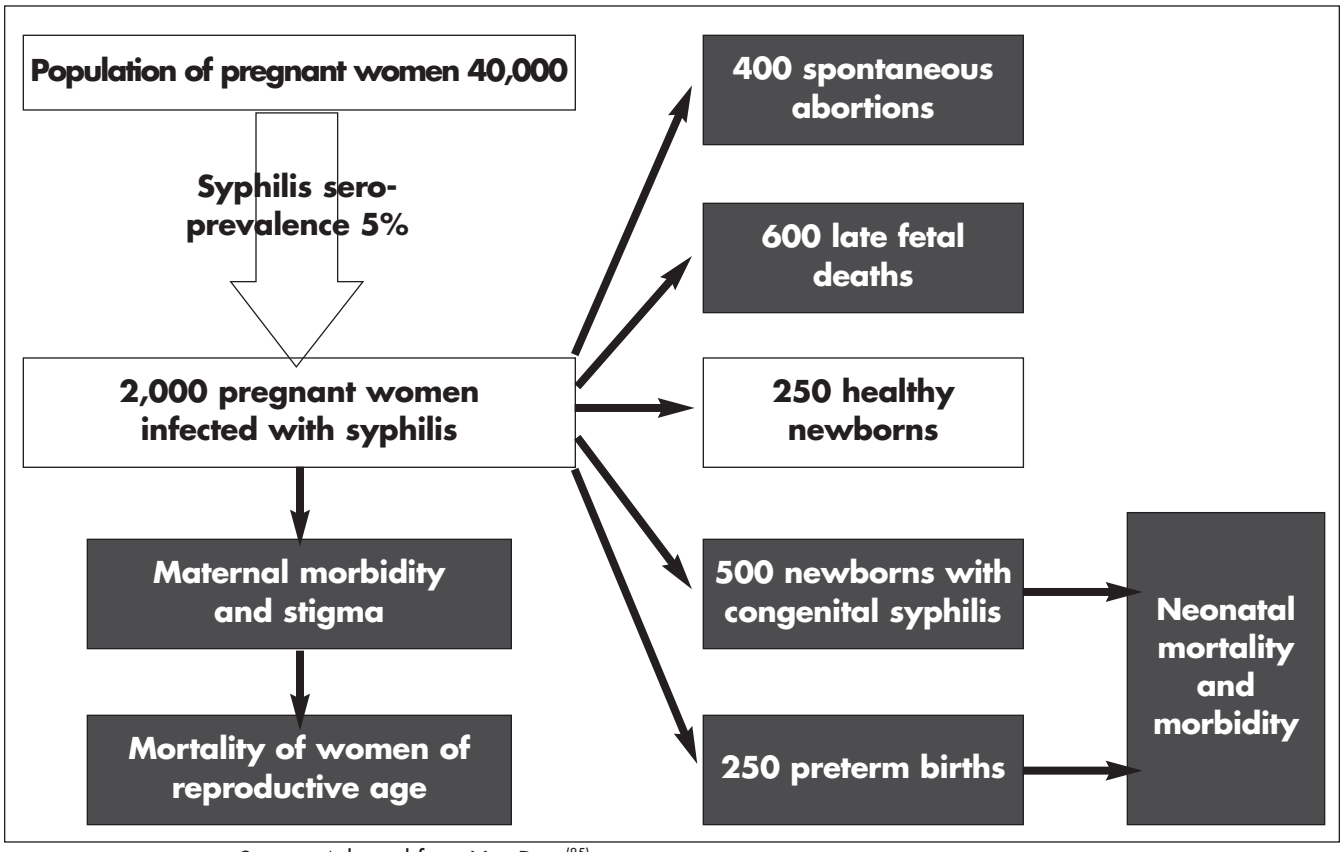
- *Spontaneous abortion or fetal death* is often of unknown cause. There is a paucity of information on causation for the estimated 4 million stillbirths a year. The available information suggests that maternal syphilis infection is a leading cause of spontaneous abortion and fetal death[82] (Figure 1.11).

- *Neonatal infection* is the cause of an estimated 1-2 million neonatal deaths[91]. Some neonatal infections, especially early-onset infections that have the highest case-fatality rate, are directly related to maternal infections, such as gonorrhea and group B streptococcus.

- *Low birth weight* may be related to maternal infection. Maternal infections, such as malaria, may indirectly increase the risk of fetal-neonatal death due to IUGR, preterm birth, or both[69].

Every year an estimated 333 million new cases of STIs occur worldwide[57]. A few of the significant infections and their results are summarized in Table 1.7. The effects of maternal syphilis are particularly harsh for newborns, resulting in large numbers of stillbirths and preterm births[68,82]. In a population where five percent or more of adult women have syphilis (this may be true for much of sub-Saharan Africa), it is likely to be the major cause of late fetal deaths and also a major factor in neonatal mortality and illness (Figure 1.11). Yet treatment has been available for over half a century. The problem is not with new interventions but with policy and management for implementation. HIV infection also has a devastating effect on both maternal and fetal-infant outcomes, although most infant deaths due to HIV probably occur after the first month of life. HIV is discussed in Part Four under the Pre-Pregnancy Health Intervention Package as well as MTCT/HIV in the Essential Newborn Care Intervention Sub-Package.

FIGURE 1.11
FETAL-NEONATAL OUTCOMES OF MATERNAL SYPHILIS

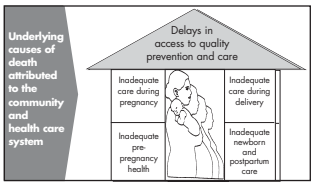


Source: Adapted from Van Dam[85].

TABLE 1.7
INFECTIONS IN PREGNANCY RELATED TO MATERNAL AND FETAL-NEONATAL OUTCOMES

Maternal infection	Prevalence of infection in pregnant women (1990-1999)	Maternal outcomes	Vertical transmission rate	Fetal manifestations	Neonatal manifestations
Syphilis (Treponema pallidum)	Industrialized: 0.03–3%. SSA / SA: 3–22%.	Complications of primary, secondary and tertiary syphilis. Infertility.	Early: ~ 100%. Late: ~ 23%. Overall: 40 – 70%.	Spontaneous abortion rate: 20%. Late fetal death rate: 12%.	Preterm birth: 12.5%. Congenital syphilis: 12.5%.
Gonorrhea (GN) (Neisseria gonorrhoeae)	Industrialized: <1%. SSA / SA: 4–20%.	Puerperal sepsis. Infertility.	Isolated gonorrhea: ~ 47%. Gonorrhea and chlamydia. infection: ~ 68%.	"Septic abortion" rare event?	LBW (preterm birth or IUGR): 11 – 25%. Ophthalmitis, risk of blindness.
Chlamydia (CT) (Chlamydia trachomatis)	Range 2–37%. Global data poor quality.	Puerperal sepsis. Infertility.	Conjunctivitis: 60–70%. Pneumonia: 5– 15%.	Fetal loss believed to be rare.	Severe conjunctivitis: 25%. Severe pneumonia: 5%.
Bacterial vaginosis (Mycoplasma hominis, Ureaplasma urealyticum)	USA: 10-19%. Global data unavailable.	No major effects documented.	Not applicable.	No major effects documented.	Preterm birth: 10 – 25%.
Group B streptococcus carriage (Group B streptococcus)	Industrialized: 15–45%. Latin Am: ?. Turkey: <10%. SSA / SA: low.	No major effects documented.	Not applicable.	No major effects documented.	Neonatal sepsis and meningitis with high fatality rate especially if early onset.
Rubella (Rubella virus)	Indust: high vaccination coverage. Latin Am: sero-susceptibilty 3-40%. SA /SSA: sero-susceptibility 5-30%.	Usually minor illness. Maybe significant arthralgia.	Infection in first trimester results in about 90% of fetuses seriously affected.	Early pregnancy loss. Increased late fetal deaths.	Congenital rubella syndrome, 50% with deafness alone, 10 -15% with severe disability(cardiac, cataract, failure to thrive).
HIV (Human Immunodeficiency Virus)	Industrialized: <1%. Latin Am:<5%. SA: 5–10%. SSA: 5-40%.	AIDS/death. Reduced fertility. Social stigma.	15-30% in-utero or at birth. 10-20% via breastfeeding. Varies with maternal HIV viral load and other factors.	Increased pregnancy losses.	Preterm birth. IUGR. AIDS/death.
Genital herpes simplex virus (Herpes simplex virus)	USA: 20–30% old infection 0.01–.039% active at delivery. Europe: <5%.	Cervical cancer.	Primary infection: 30 – 50%.	No major effects documented.	80 % chance of Herpes encephalitis if active maternal infection and vaginal delivery.
Malaria (Plasmodium falciparum)	Endemic in many parts of sub-Saharan Africa.	Anemia. Risk of severe malaria especially in primiparas.	Congenital malaria is believed to be rare.	IUGR. Some preterm birth, especially in areas of unstable transmission.	Complications of IUGR and preterm birth.

Source: VanDam, 1995[82], Schulman, 1999[126], Cuhs, 1999[107], DeCock, 2000[131].

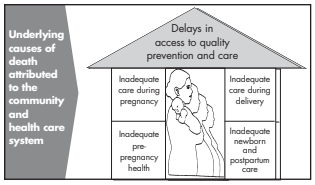


3. Inadequate care during delivery

Many women and newborns have a normal delivery, and for these women, the experience should be clean, safe, and joyful. For the 15 percent of women who do develop complications, rapid identification of danger signs and their appropriate management is crucial both for the mother and for their babies.

Delivery without a skilled birth attendant: The presence of a skilled attendant at birth is associated with reduced maternal and perinatal mortality[2,13]. Yet only about half of the world's deliveries currently occur with a skilled attendant. WHO's "Making Pregnancy Safer Initiative" is an important effort to increase coverage with skilled attendants, but success will depend on national, regional, and local managers. Current practices of even well-trained providers often differ widely, and there is a need to monitor and improve quality of care, even among those who are considered to be skilled.

Inadequate access to emergency obstetric care: Access to quality, emergency obstetric care is crucial, especially to reduce maternal mortality[35,139]. Many of the causes of maternal death and stillbirth/early neonatal deaths cannot be handled by an isolated attendant, regardless of skill level. Emergency care is important for the mother and the newborn, especially to prevent asphyxia. It has been estimated that about 15 percent of women experience a life-threatening condition during delivery. Yet many pregnant women do not live within safe distance of a functioning emergency obstetric service, and even fewer live near a facility that provides quality service. "Medicalization" and unnecessary or even harmful interventions should not be confused with the need for emergency care. Unnecessary cesarean-sections are common in some Latin American settings, are harmful for both mother and baby, and have been documented to raise the perinatal mortality rate[140].



4. Inadequate newborn care

Care of the newborn is important, both in the home and in the formal health care system.

Lack of essential newborn care: Although many newborn complications, such as asphyxia or sepsis, have high case-fatality rates and treatment is difficult, prevention is highly feasible and cost-effective. Even basic prevention of newborn illness is often lacking. Prevention measures include the "Six-Cleans" promoted by WHO (clean hands, clean delivery surface, clean blade, clean tie for the cord, and clean cloth for mother and baby), early exclusive breastfeeding, and warmth. These simple interventions could prevent many neonatal deaths, and yet they are inadequate in many settings, even those with health institutions[87]. The benefits of breastfeeding after delivery cannot be stressed enough (Table 1.8).

TABLE 1.8
BREASTFEEDING ADVANTAGES

FOR THE BABY
- ✔ Protects the baby from infections, especially diarrhea and respiratory tract and ear infections.
- ✔ Provides all the required nutrition for optimal growth for the first 6 months.
- ✔ Provides an important source of nutrition from 6 months to 2 years.
- ✔ Colostrum provides valuable antibodies and is high in protein, Vitamins A and K, and zinc.
- ✔ Reduces the risks of later allergies and diabetes.
- ✔ Promotes proper jaw, teeth, and speech development.

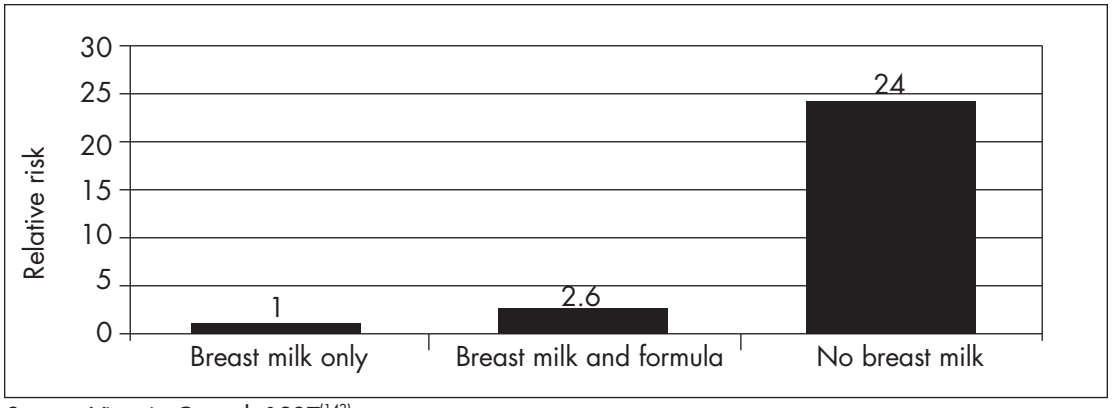
FOR THE MOTHER
- ✔ Decreases the risk of postpartum hemorrhage.
- ✔ Provides a natural way to help space pregnancies and thereby protect both mothers and children.
- ✔ Delays the return of menses, helping to protect the mother against anemia by conserving iron.
- ✔ Fosters mother-infant bonding.
- ✔ Decreases the risk of breast and ovarian cancers and osteoporosis.

FOR THE FAMILY
- ✔ Costs no money.
- ✔ Saves medical costs by preventing illnesses and allergies.
- ✔ No preparation necessary.

FOR SOCIETY
- ✔ Decreases the pollution of air, water, and land from the production, transportation, and preparation of artificial baby milks and disposal of containers and packaging.
- ✔ Avoids importation of artificial milk which may increase the trade deficit.
- ✔ Limits population growth by a natural and effective method of family planning.

Breast milk provides balanced nutrition, giving the best weight gain for the infant's first 6 months[141,142]. It is also effective in protecting the infant from infection. In fact, a baby in a setting with many infections who is not breastfed is at least 24 times more likely to die than an exclusively breastfed baby in a similar setting[143].

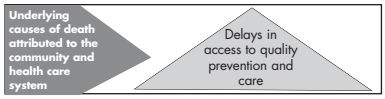
TABLE 1.9
INCREASING RELATIVE RISK OF NEONATAL MORTALITY WITHOUT BREASTFEEDING



Source: Victoria C, et al. 1987[143].

Lack of extra newborn care for the LBW baby: Even simple interventions for LBW babies, such as maintaining warmth and skilled support for breastfeeding, are often not routinely practiced. Recognition of the LBW baby or of danger signs in the newborn has not been widely incorporated into community-based programs in areas where most of these babies are born and often die[144].

Lack of emergency newborn care: Lack of quality, emergency newborn care is a factor in the higher case-fatality rates seen in many low-resource settings. Case-fatality rates for neonatal sepsis vary around the world[52]. WHO is producing documents promoting standards of care for the mother and the newborn (more details in Part Four), but these have not yet been widely implemented. There is a lack of skilled personnel, trainers, and training materials in many of the settings with high neonatal mortality.



D. Delays in Access that Contribute to Fetal-Neonatal Deaths

Women and their families in developing countries face many barriers to receiving quality maternal and newborn care. The expectation of survival for a sick newborn, especially a LBW baby, is often so low that even well-educated families may not seek care. Baby girls may be less likely than boys to receive timely and appropriate care. Delays in obtaining care occur at four critical points:

- ***Delay #1: Delays in problem recognition within the home.***
- ***Delay #2: Delays in deciding to seek care.***
- ***Delay #3: Delays in reaching the health facility due to lack of transport and resources.***
- ***Delay #4: Delays in receiving appropriate quality care at the facility.***

Delay #1: Delays in problem recognition within the home: A sick newborn's condition can deteriorate very quickly, often in a few hours. The signs and symptoms are often subtle, and family members or health workers often do not recognize or cannot identify danger signs. Many newborn deaths occur in the first 24 hours after birth, and a lack of skilled attendance reduces the chances of rapid identification and management of life-threatening situations.

Delay #2: Delays in deciding to seek care: Even if danger signs are identified, the family might not seek care in a timely manner for many reasons, including:

- lack of understanding of the urgency attached to newborn illnesses or obstetric emergencies;
- traditions regarding seclusion of mother and newborn or "non-personhood" of the newborn;
- fatalistic outlook, belief in evil spirits;
- lack of family finances to pay for care and transport;
- traditional leaders may have to be consulted;
- distrust of the formal health care system, including fears of procedures;
- lack of clarity about where to go in the health system (health center versus hospital, etc.);
- previous poor experiences with the health system (rudeness, delays, shame, language barrier, etc.); and
- gender selection, with a female child being less likely to receive appropriate attention[42].

Beliefs may dictate that traditional remedies (i.e., herbs, traditional medicines) must be tried before treatment is sought from the formal health sector. Although many traditional medicines may be somewhat beneficial or benign, some are harmful. The main concern is that access to appropriate quality health services is significantly delayed, possibly ending in death. For example, a baby with neonatal tetanus has only a ten percent chance of surviving, and delay in seeking appropriate care may rapidly eliminate any chance of survival.

PANEL 1.2
LESSONS LEARNED

DELAY IN DECISION-MAKING

In Cambodia, Chan brought her baby to the health center on the baby's fifth day of life. Sopha was Chan's 14th child (they were all born alive but six had died). On the second day, the baby had redness around the cord. Chan was not able to seek health care because women and newborns are not allowed to leave the home until the "dropping the stone ceremony" is completed three days after birth. This ceremony symbolizes that the mother and the newborn have survived the birthing process. By the time Sopha reached the health center, she had a very high fever and was not feeding. Despite having antibiotic injections, she died the next day.

In many traditional societies, men make the key family decisions. If the mother or the newborn needs to seek care, critical time can be lost in waiting until the husband or another male family member is present. A study of 150 maternal deaths in Pakistan identified the refusal of the husband or his absence as a major factor in 29 percent of deaths[75]. After many discussions in a CARE project in Somalia, the village elders decided that if a woman or sick child needed to go out of the village when the male relatives were away, the village chief could make the decision to send the woman or child to a health facility or could assign an elder to accompany her.

Delay #3: Delays in reaching the health care facility due to lack of transport and resources: Lack of adequate or affordable transportation is a common problem and affects outcomes for the baby in two ways. First, the pregnant woman may be delayed in accessing quality emergency services, possibly resulting in asphyxia or even death for the baby, as well as the risk of death for the mother. Second, it may delay prompt health care for a sick newborn, significantly decreasing potential for survival. Lack of transport and no money were cited as the major reasons for maternal deaths in a study in rural Zimbabwe. A maternity waiting home was effective in addressing this delay in Zimbabwe[145].

PANEL 1.3
LESSONS LEARNED

A BEAUTIFUL DAUGHTER

One of the village leaders had a beautiful daughter and was waiting for his first grandchild. When his daughter went into labor, she had pains for almost a day, but the family was not worried because they thought this was normal. By the next day, her pains were getting worse and she looked weak, so the family called the village doctor. He could not relieve the pain. Finally, the father decided to take his daughter to the hospital.

It took several hours to find a rickshaw driver, and the journey to the hospital was long. When they got to the hospital, it was some time before the daughter was seen. The doctor found that the baby had already died and the woman's uterus had ruptured. She had to have a hysterectomy. Now the girl, not yet 20 years old, was infertile. Her husband has since taken another wife.

The village leader was determined that such a tragedy should not happen to someone else's daughter. This man, with assistance from CARE, has spearheaded a community transportation fund. The fund is supported by donations from all of the village leaders. They have also established a standing committee to escort women to the hospital. The girl's father now says that had he known more when his daughter was in labor, he would have taken her to the hospital earlier.

Delay #4: Delays in receiving appropriate quality care at the facility:
Many causes of fetal and newborn death are related directly to the use of inadequate maternal health services. There are often delays in the mother or newborn receiving care even after they reach the facility for reasons, such as:

- inadequate staffing, equipment, and supplies;
- facilities that operate only for a few hours a day, a few days a week;
- no system for rapid assessment of the mother or baby;
- lack of standard protocols to promote quality of care;
- unskilled providers and inadequate supervision;
- poor interpersonal skills of staff;
- lack of transportation or referral between health facilities; and
- poor record-keeping or no referral letter.

Neonatal illnesses are subtle in presentation and may be missed or incorrectly diagnosed even by skilled medical personnel. Many of the interventions that affect mortality, even at the tertiary care level, are simple and inexpensive, such as:

- simple equipment and skills for neonatal resuscitation;
- support for early initiation of breastfeeding;
- "kangaroo care" for temperature control of small babies; and
- treatment of jaundice using light bulbs.

Even among preterm babies, deaths potentially could be significantly reduced with attention to these interventions. These and other interventions are discussed in Part Four with more details on the CD-ROM.

TABLE 1.10
UNDERSTANDING REASONS FOR DELAYS IN ACCESS AROUND THE WORLD

- In Nepal, mothers-in-law attend most deliveries, and additional care or help is sought only if the mother-in-law decides that such care is needed.
- In Ghana, a study found that 64 percent of women who died of pregnancy-related complications had sought help from an herbalist, soothsayer, or other traditional provider before going to a health care facility.
- In Benin, the government put significant pressure on women, including fines, to have institutional deliveries. Many women continued to choose to deliver at home because of the honor brought to families if they were seen as stoic during labor and childbirth.
- In Tanzania, a study found that 21 percent of women delivered at home because of the rudeness of health staff – even though they thought delivering in a health care facility was safer.
- In Ecuador, women perceive hospital-based deliveries as entailing a violation of privacy, unacceptable attendance by male providers, and unfamiliar birth positions.
- In Sudan, a study found that many women were ashamed of being poorly dressed in front of health care workers (who were generally of a higher socioeconomic class) and were afraid that the health care workers would react negatively to their illiteracy.

Source: "Improve Access to Maternal Health Services," published by Family Care International and the Safe Motherhood Inter-Agency Group in 1998.

Programs that promote planning for the possibility of maternal emergencies may dramatically increase access to emergency services. However, very few birth planning or emergency preparedness programs include the newborn.

E. Fundamental Causes of Fetal-Neonatal Deaths

1. Newborn outcome as a marker for women's health and social status

The perinatal mortality rate is a good marker of maternal health and quality of maternal services. This rate is strongly influenced by women's social and health status and by home care and practices for mother and newborn, as well as by maternal and newborn health care services[146].

The LBW rate could be considered a "social indicator," reflecting the status of women of reproductive age in a society. Women who give birth to LBW babies have often been undernourished themselves since childhood[24]. In fact, it has been found that women who themselves were LBW are more likely to have LBW babies, even when other determinants of LBW are controlled for[118,119]. In addition, these women often have many children spaced close together, maintain their full workload during pregnancy, and may restrict their diet due to fear of delivering a big baby. India and Bangladesh have the world's highest LBW rates, at 33 and 30 percent, respectively. These rates may reflect the intergenerational effect of undernutrition of female children (Figure 1.9).

2. Traditional care practices in the home and the community

Many factors affect girls and women before they become pregnant, including sociocultural conditions and traditional beliefs and practices. In many cultures, women are valued less than men. This attitude may manifest through sex-selective abortions, female infanticide, limited access to food, lack of educational opportunities, restricted mobility, lack of participation in decision-making, early marriage, expectation to bear many children, female genital cutting, heavy workloads, physical and emotional abuse, and inadequate access to health services. As a result, women in the developing world often begin their pregnancies at a disadvantage regarding nutrition, workload, and access to health services.

Undernutrition of girls and women throughout life: Girls often have less access to food than boys. Research in Bangladesh found that five-year-old boys were given 16 percent more food than girls of the same age[42]. A study in India found that boys were more likely than girls to be given fatty foods and dairy products. As a result, girls were four times more likely than boys to suffer from malnutrition. The study also found that girls were 40 times less likely than boys to be taken to the hospital. These practices are common in South Asia and, to a lesser extent, in parts of Africa. A high LBW rate may reflect intergenerational neglect of nutrition of females in that society.

Early marriage: In many countries, girls are often married shortly after or even before menarche to ensure that babies are not born out of wedlock, bringing shame to their families. "Society will condemn us if our daughters are not married by the age of 15," say women in an Indian village[147]. Early marriage limits educational and economic opportunities for girls and often leads to early pregnancy.

High fertility rates: In many societies, young women are trapped by traditions that strongly promote early and frequent childbearing to gain respect within the society. Although fertility rates have dropped, there are still 35 countries with total fertility rates greater than five[1]. Sub-Saharan Africa has the highest lifetime risk of maternal death because it has the highest fertility rate. The combination of poor nutritional status and heavy workloads also increases the risk of LBW. These factors all contribute to an increased risk of perinatal and neonatal mortality. Studies have shown that there is a rise in mortality when children are spaced closer than 18 months. There is also an increased rate of LBW babies with close birth intervals[130].

Lack of educational opportunities: Female literacy is a useful indicator of women's status and also a strong predictor of child survival and early childhood development. There is a well-documented link between women's literacy and lower rates of infant mortality. Higher levels of female education are also associated with lower rates of maternal morbidity and mortality. Of the 130 million children who are not attending primary school in the developing world, 60 percent are girls. Although more girls are entering primary school than before, the dropout rates for girls remain high in many countries[148]. Of the estimated 960 million people who are illiterate, two-thirds (66%) are women. This lack of education significantly restricts their earning potential and involvement in decision-making about family resources and health care.

Care practices for the mother and newborn: In every society, pregnancy, childbirth, and newborn care are strongly associated with traditional practices, which can be classified as beneficial, harmful, or benign. Beneficial practices may include special nutritious foods for the mother, massaging the mother and newborn, and support with breastfeeding. Examples of harmful practices include putting cow dung, ash, and herb mixtures on the umbilical cord, withholding colostrum, pre-lacteal feeding, and giving hot water and pepper enemas to neonates who do not pass stool daily. Harmful practices for the mother, such as female genital cutting, also have effects on the baby, increasing the risk of obstructed labor. Assessment of such practices as beneficial, harmless, or harmful is discussed in Step 2 of Part Three.

V. WHAT CAN BE DONE TO IMPROVE NEWBORN HEALTH?

There is a huge gap in newborn health outcomes between the industrialized world and developing countries. Many industrialized nations have a perinatal mortality rate of less than 5 per 1000 total births, yet some sub-Saharan African countries have rates of over 100 per 1,000 total births, a 20-fold difference. These deaths are not due to obscure diseases seen only in the tropics, but to causes that we know how to prevent and treat, such as neonatal tetanus, asphyxia, and syphilis. Even within many industrialized nations, there are sub-populations with perinatal mortality rates substantially higher than the national average.

These gaps are not due to a lack of interventions, but to a lack of implementation, particularly a lack of implementation where the majority of these deaths occur. The major issue is not our knowledge, but our action. Little attention has been given to the newborn, especially at the community level where most of the deaths occur. The solution must involve adequate attention to both the mother and the newborn. Thus, health services that benefit the newborn and the mother should be given priority.

The huge "Opportunity Gap" in global newborn health is not due to a lack of possible interventions, but to a lack of effective implementation of interventions where most babies are dying.

Moving towards a new paradigm in global newborn health – Unfortunately there is no "magic" single solution. To address newborn (and also maternal) deaths, we need a shift in paradigms (Figure 1.12).

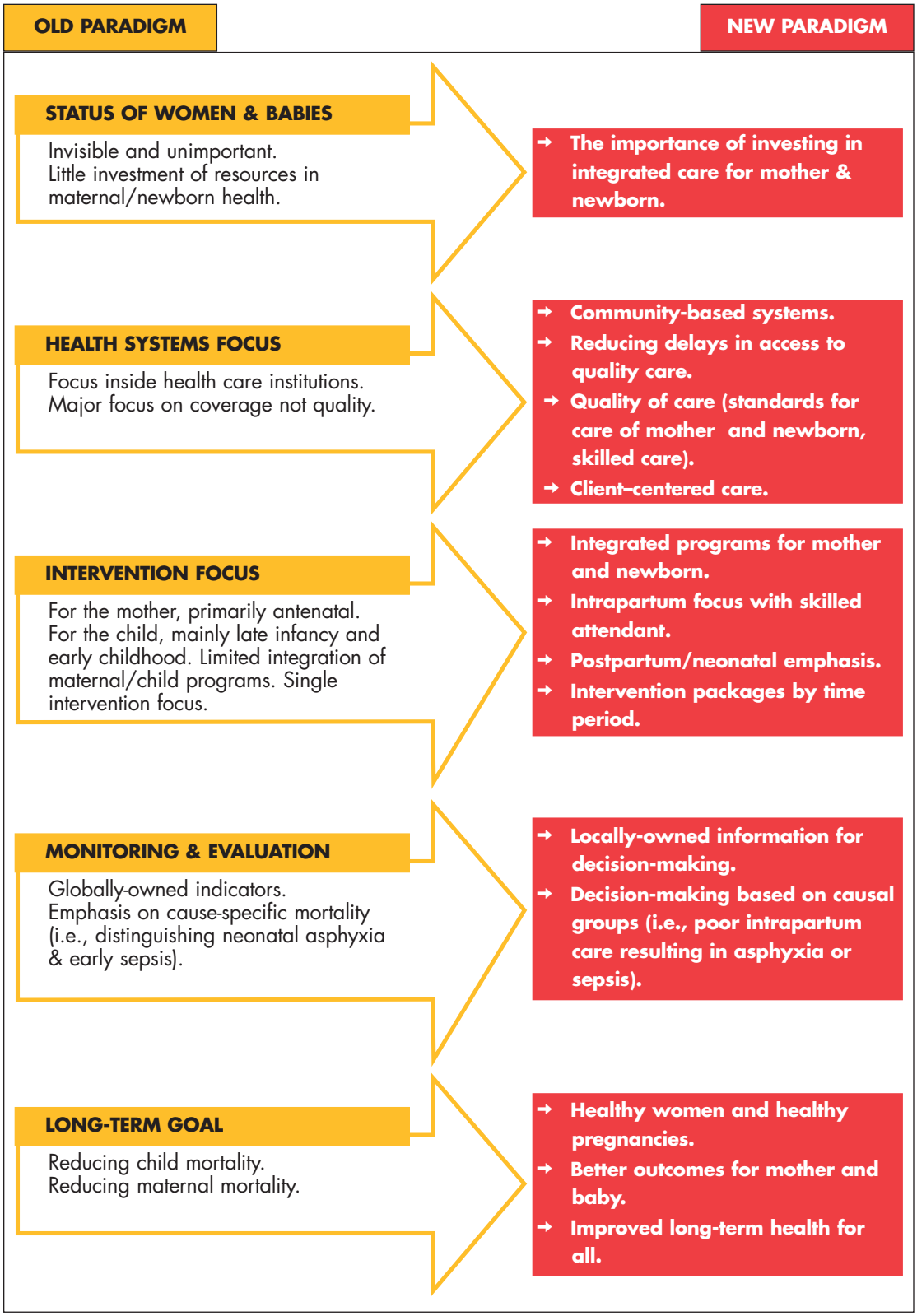
- The time focus of care for the mother and newborn needs to emphasize the time when most deaths occur, in the first week after delivery, especially the first 24 hours.
- The place focus needs to shift to where most deaths occur – in the home.
- The drive to increase coverage of care needs to shift from blaming mothers for coming late for treatment to reducing critical delays in recognition of danger signs, decision-making, and transportation and to improving the quality of the health care system.
- The efforts to improve quality of care in the health institution need to focus on building the capacity of the system, as well as improving the quality of the client-provider interaction.
- The focus of record keeping needs to shift from globally-owned indicators to locally owned information for decision-making.
- Our long-term goal needs to include the improvement of health, as well as the reduction of mortality.

"Rights-based" paradigm: Successful application of the health systems programming model as detailed in this manual is based on the principle that women and their newborns have a fundamental *right* to access quality health services[149-151]. This is detailed further in the Introduction.

Moving towards a community-based systematic approach for newborn health: It is impossible to ensure healthy births and newborn health with a single intervention. For effective programming, a systems approach is critical. If there was a single, simple solution for newborn health, the statistics would be very different from the ones we have[152]. In settings where resources are apparently dwarfed by huge problems, it is especially crucial to use data to identify the "Opportunity Gap" – the gap in health care outcomes that is not necessarily the biggest cause of mortality, but the most appropriate and cost-effective for intervention. A community-based systems approach that is focused on the mother-baby dyad and uses local information to make decisions systematically can help to close this gap. Adaptable approaches to implement this will be covered in Parts Two and Three of this manual.

Moving towards partnerships for priorities for newborn health policy: Since most deaths of babies and mothers occur in the community, this is where the priority should be focused. However, implementation of interventions at the community-level will be more effective if there are clear global priorities and partnerships to share resources and information. International collaboration can be effective in developing successful approaches for key problems of newborn health and health care and finding ways to apply old solutions or develop new ones. Global policy agreement also increases the chances of successful advocacy for resources to promote newborn health. An interagency group on the newborn (Healthy Newborn Partnership) is currently being developed. The secretariat is based at the Saving Newborn Lives Program of Save the Children in Washington, D.C. The World Health Organization and JHPIEGO are producing global standards of care during pregnancy and the postpartum/newborn period. The first book, *Management of Complications of Pregnancy and Childbirth,* has also been endorsed by the World Bank, UNICEF and UNFPA (included on the CD-ROM). This is a critical step forward in improving quality of care, but it will not change outcomes for women and babies unless these guidelines are adapted at the national level and implemented at the local level. Implementation at the local level depends on the program manager. You, the program manager, can make a significant difference to improve newborn health in your community.

FIGURE 1.12
MOVING TOWARDS A NEW PARADIGM FOR MATERNAL AND CHILD HEALTH PROGRAMMING



BEST READING

FOR PART ONE

AN UNHEARD CRY FOR NEWBORN HEALTH

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