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Overview of Global Perinatal Mortality

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1. Introduction

Perinatal mortality refers to the death of a fetus or neonate and is the basis to calculate the perinatal mortality rate. The perinatal period is the most vulnerable period in the life of an individual and the rate of death during this period is higher than at any other period of life. Deaths during this short period equal the rate of death over the next forty year period. Social, cultural, environmental and genetic factors all play vital roles in determining the outcome of this period of life.

Perinatal mortality is at an unacceptably high level in low income countries, especially those in sub-Saharan Africa and south central Asia [1]. Recent estimates show that the perinatal mortality rate in high income countries of the world is about 10 per 1000 live births compared with 50 per 1000 live births in low income countries [2]. These figures are particularly troubling because the perinatal mortality rate is a key indicator of the health status of a community. Specifically, it reflects the quality of prenatal, delivery and early infant care practices available in any setting. It is also a major contributor to overall under-five mortality [1].

Reducing the 1990 childhood mortality levels by two-thirds by the year 2015 is one of the Millennium Development Goals (MDG-4) set by the United Nations. Recent evidence shows that perinatal mortality accounts for about 40% of infant mortality globally (Figure 1). In addition 75% of all neonatal deaths occur during the perinatal period. It is therefore obvious that MDG-4 cannot be achieved without substantially reducing these perinatal deaths most especially in the high burden countries of south central Asia and sub Saharan Africa. [3, 4].

While substantial gains have been made in the reduction of infant and under5 mortality rates (IMR and U5MR), same cannot be said for perinatal and neonatal mortality rates. As a result of this disparity, neonatal mortality now accounts for a greater proportion of IMR. Neonatal mortality was responsible for 27% of IMR globally in 1970 but accounted for 41% of IMR in 2010 [5]. In countries with low IMR and U5MR, the NMR accounts for an even higher proportion of IMR [1-5].

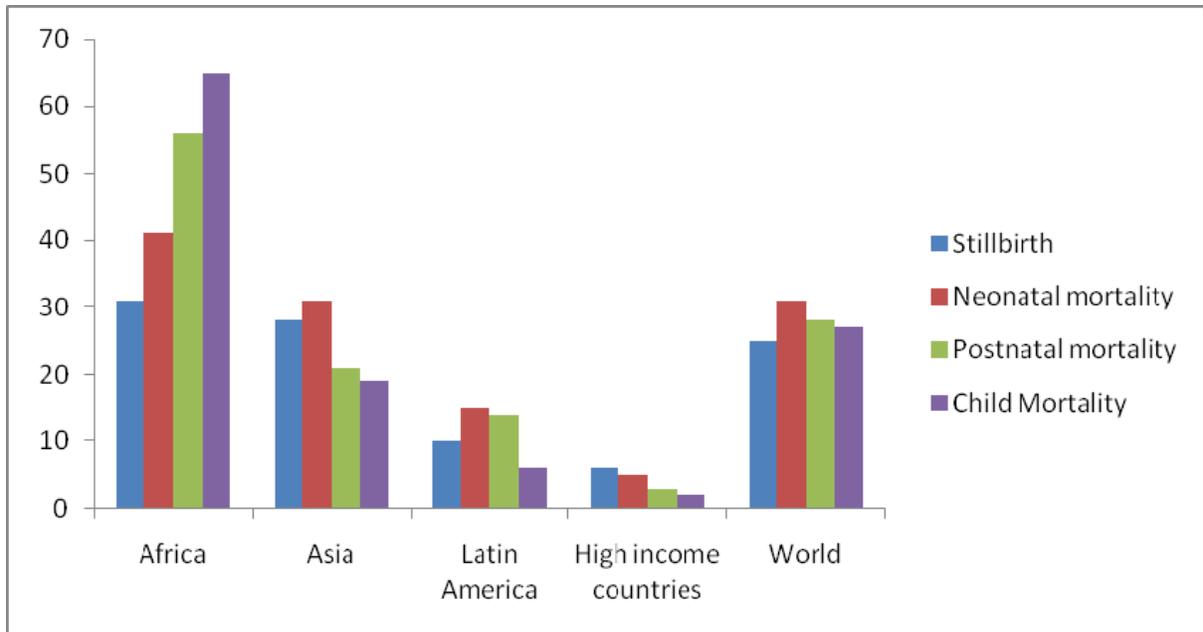


Fig. 1. Child mortality and stillbirth rates in 2000 – adapted from WHO 2005¹

While perinatal mortality rate is a useful indicator of the quality of antenatal and perinatal care, its wholesale application in international comparisons can be misleading if a number of factors and important determinants that need to be assessed separately before reaching conclusions about quality-of-care issues are not taken into consideration [6].

This chapter provides a general overview of perinatal mortality. It will address the burden of perinatal mortality and its contribution to global childhood deaths. The relationship between quality of antenatal and perinatal care and risk factors for perinatal mortality, and how these lead to the perinatal mortality rate will be discussed. Finally evidence based strategies for reduction and prevention of perinatal mortality and future thrust will be highlighted.

2. Definition of terms

Neonatal Period: The first 28 days of post natal life is the neonatal period. It is subdivided into the immediate (first 24hours), early (first 7 days) and late (8-28 days) neonatal periods.

Perinatal Period: This is the period from the age of viability of the fetus to the first 7 days of postnatal life.

Live birth: A product of conception which, after complete extraction from its mother, shows signs of life such as breathing, beating of the heart, umbilical cord pulsation or spontaneous movement of voluntary muscles regardless of gestational age and whether the cord has been cut or the placenta has been extracted or not.

Stillbirth: Still birth refers to fetal mortality or death. According to WHO, stillbirth is the birth of a baby with a birth weight of 500 g or more, 22 or more completed weeks of gestation, or a body length of 25 cm or more, who died before or during labour and birth. For international comparisons, WHO recommends reporting of stillbirths with birth weight of 1000 g or more, 28 weeks' gestation or more, or a body length of 35 cm or more [4].

Neonatal mortality: Neonatal mortality (NM) refers to neonatal death. It is the death of a new born within the first 28 days of life. It can also be divided into death of a live-born baby within the first seven days of life (early neonatal mortality-ENM) and death after 7 days until 28th day of life (late neonatal mortality-LNM).

$$NM = ENM + LNM$$

Perinatal Mortality: Perinatal mortality (PM) refers to the death of a fetus after the age of viability, until the 7th day of life. It equals the sum of still birth and early neonatal death.
 $PM = SB + ENM$

Neonatal Mortality Rate: Neonatal mortality rate (NMR) is the number of deaths which occur in the first 28 days of life over the total number of live births in a given locality over a given time period divided by 1000. It is usually expressed as *number of deaths per 1000 live births*.

Still birth rate: Still birth rate (SBR) is the number of fetal loss prior to or during labour i.e. babies born dead over the total number of births in a given period and *is expressed as still births per thousand births*.

3. Perinatal mortality rate

Varying definitions have been applied to perinatal mortality rate. While some definitions are more inclusive and encompass infant deaths at age of less than 28 days of age and fetal deaths of 20 or more weeks gestation, the more conservative definition that only includes infant deaths of less than seven days of age and fetal deaths of 28 or more weeks gestation is preferred for international and region-to-region comparisons due to differences among countries/regions in completeness of reporting of fetal deaths of 20-27 weeks gestation.

Perinatal mortality rate (PNMR) is the total number of still births plus deaths in the first 7 days of postnatal life in a given time period over the total number of births multiplied by a thousand and is expressed as *number of deaths per 1000 births*. It is usually reported on an annual basis. It is a major marker to assess the quality of health care delivery in a community. Comparisons between regions/countries may be hampered by varying definitions, registration bias, and differences in the underlying risks of the populations.

$$PNMR = \left[\frac{(\text{Number of stillbirth} + \text{Number of early neonatal deaths})}{(\text{Number of live births} + \text{Number of stillbirth})} \right] \times 1,000$$

4. Epidemiology

Globally about 3 million of the 130 million babies born every year die in the first 4 weeks of life and another 2.65 million die even before their first breath of life, most often in the last 12 weeks of pregnancy [7]. Low income and middle income countries account for over 99% of these perinatal deaths. Unfortunately most of these fetuses and infants are unnamed and unrecorded, indicating the perceived inevitability of their deaths, and thus unaccounted for [5]. It is therefore not surprising that the reported mortality figures are only estimates and may just be a tip of the iceberg.

Three-quarters of neonatal deaths occur in the first week with the highest risk of death on the first day of life (figure 2).

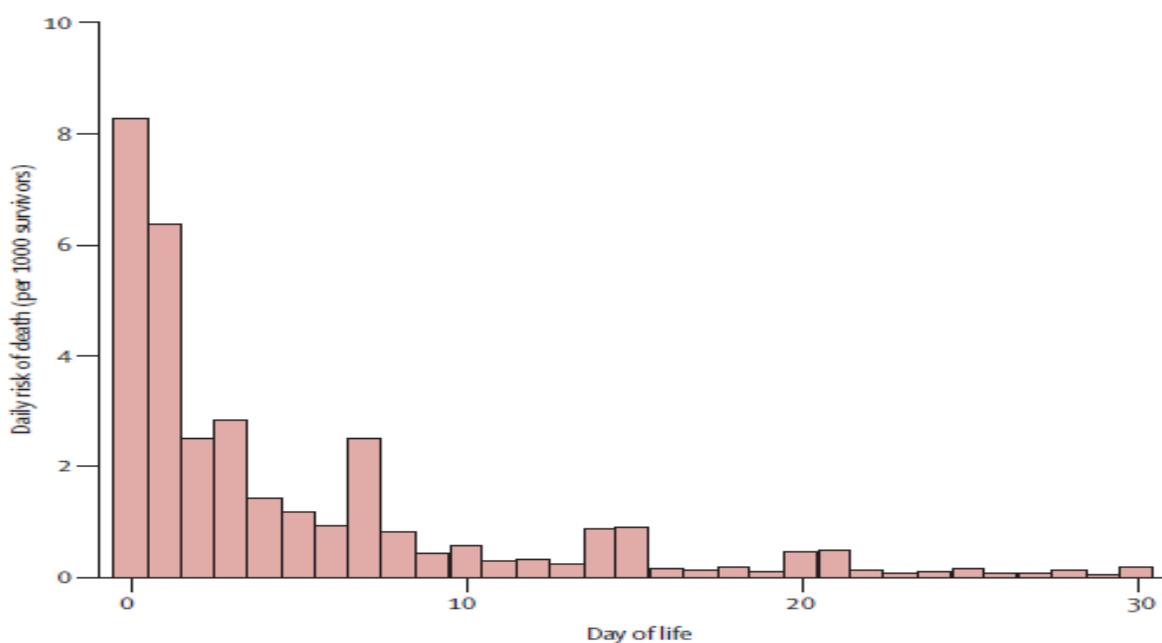


Fig. 2. Daily risk of death during first month of life (adapted from Lawn JE et al)[6]

While the south central Asian countries account for the highest numbers of neonatal deaths, the countries with highest rates are generally in sub-Saharan Africa. Ten countries account for 75% of all neonatal deaths, with India, China, Pakistan and Nigeria leading the pack (Table 1). Over 82% of all neonatal deaths occurs in South central Asia and sub-Saharan with sub-regional variations.

Country	Number of neonatal (1000s)	Percentage of global neonatal deaths (n=3.99 million)	NMR (per 1000 live births)
India	1098	27%	43
China	416	10%	21
Pakistan	298	7%	57
Nigeria	247	6%	53
Bangladesh	153	4%	36
Ethiopia	147	4%	51
Democratic Republic of Congo	116	3%	47
Indonesia	82	2%	18
Afghanistan	63	2%	60
United Republic of Tanzania	62	2%	43
Total	2682	67%	

Table 1. Countries with largest number of global neonatal mortality (adapted from Lawn JE) [6]

Though most of the countries in south central Asia and sub Saharan African have made little progress in reducing perinatal deaths in the past decade, it is important to note that some progress has been made [9]. During the past decade, China has dropped from the second to fourth highest burden of stillbirths because of a rapid reduction in stillbirth rate and a reduced total fertility rate. Nigeria has moved up to the second highest as the national stillbirth rate and total fertility rate remain high [6].

There are also major differences in perinatal mortality rates within countries and regions . In India and Nigeria large variations exist between rural and urban communities. The rates in rural northern communities in Nigeria are higher than those for urban hospitals in southern Nigeria [6,10,11]. In high income countries and Latin America, rates are higher in urban than rural communities [65]. However two-thirds of all stillbirths occur in rural communities and families.

Unlike early neonatal deaths, stillbirths are not just a low-income country problem. Rates in the UK and USA have decreased by only 1% per year for the past 15 years and stillbirths now account for two-thirds of perinatal deaths in the UK [12, 13] .

4.1 Causes and determinants of perinatal mortality

Childhood mortality has been declining globally as a result of socioeconomic development and implementation of child survival interventions, yet approximately 6 million infants die every year before the end of their first week of life. The prevention of perinatal death is greatly dependent on ascertaining the causes of the deaths and the background factors associated with them. Across the globe the causes of perinatal deaths are strikingly similar, although their relative importance varies between countries, regions and income status.

Several important features about perinatal mortality are common globally. The same socioeconomic, biologic and health factors that influence maternal deaths are also at play in causing perinatal deaths and rates. For ease of comprehension, the causes and determinants of perinatal mortality will be discussed under two headings of direct and indirect. It is however important to note that often the causes are characterized by a chain of events leading to death making it impossible to single out one factor as the sole cause of the perinatal death. For example; an unbooked primigravida who presents in the hospital with prolonged labour and arrives the hospital with fetal heart present. Unfortunately the hospital requires a cash deposit to be paid before the woman can be attended to. By the time her relatives are able to make the cash deposit three hours later, the fetal heart has disappeared. What is the cause of still birth in this situation? Is it due to the background factors of unbooked status, primigravida status, late presentation, prolonged labour, phase three delay at the hospital due to hospital policy of user fee charges even in emergency situation, or poverty?. This scenario is a common finding in low income perinatology.

4.2 Direct causes

Causes of neonatal deaths are often difficult to decipher, because most of the births occur outside authorized health facilities unattended by health workers, or because the neonates present with non-specific signs and symptoms. However most neonatal deaths result from complications of preterm birth, asphyxia, birth trauma, infections and severe congenital malformations. The proportion of neonatal death due to each cause differs between areas

with high and low perinatal mortality rates. While in high and middle income countries with low rates, preterm births and malformations account for majority of the deaths, in south –central Asia and sub-Saharan Africa with high rates, asphyxia, tetanus, and infections are the leading causes [5].

Estimates from 2008 of the distribution of direct causes of neonatal death, indicate that preterm birth [29.3 %], severe infections (, including sepsis and pneumonia) [25%], tetanus [2.4%], and diarrhoea [2.4%]), and complications of asphyxia (22%) account for most neonatal deaths. Congenital anomalies account for 7.3% of the remaining 19.5% (figure 3).

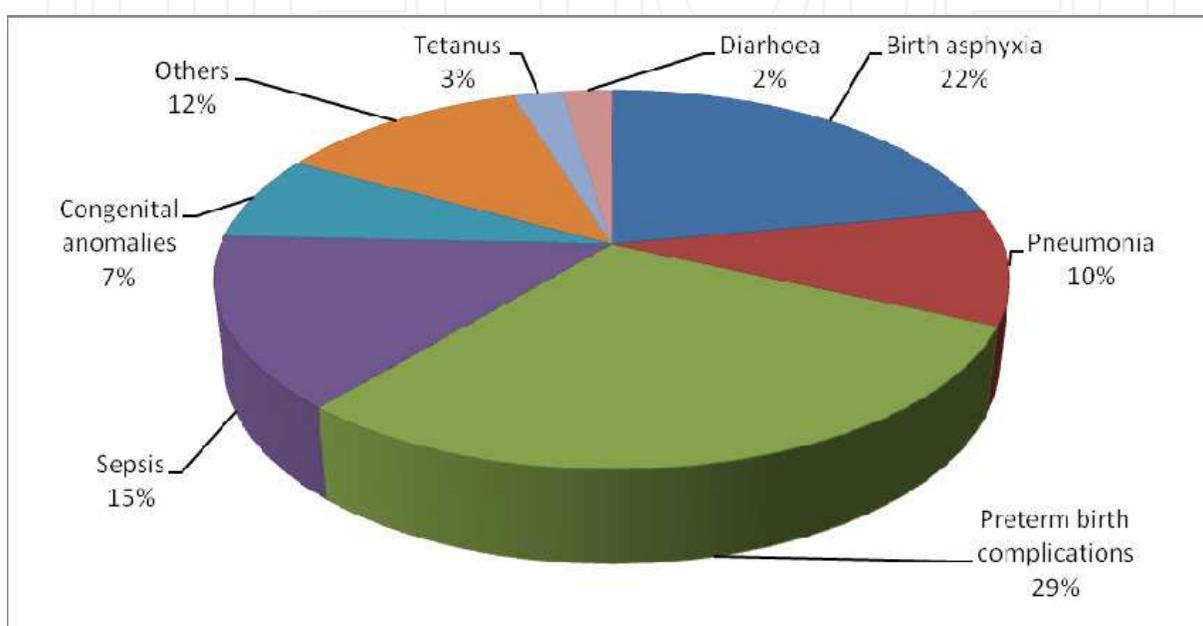


Fig. 3. Causes of neonatal deaths (adapted from Black RE et al 2008) [14].

Low birth weight is associated with the death of many newborn infants, but is not considered a direct cause. The complications stemming from preterm delivery, rather than low birth weight are the direct cause of early neonatal death. Around 15% of newborn infants weigh less than 2500 g, the proportion ranging from 6% in developed countries to more than 30% in some parts of the world [2].

The events leading to the delivery of a baby “still” may occur either before onset of labour (antepartum death) or during labour (intrapartum death). These deaths may be as a result of pregnancy complications or maternal illness. Often no identifiable cause could be found for many antepartum fetal deaths. Complications arising during delivery are the major cause of death among fetuses, who were alive when labour started. Such complications include cord accidents, malpresentation, deep transverse arrest and uterine rupture.

4.3 Indirect causes

Several maternal, obstetric, health system and socioeconomic factors and conditions indirectly contribute to perinatal deaths.

Inadequate nutrition and poor maternal education have been linked to the unacceptably high stillbirth and neonatal deaths in low income countries. Poorly fed mothers either early

in childhood or later in life may lead to low birthweight which is one of the significant contributors to perinatal mortality. Poor maternal education is not only associated with poor nutrition but poor health seeking behaviour and poor perinatal outcome.

Certain maternal health conditions such as pregnancy-induced or essential hypertension, diabetes mellitus, anaemia and infections (Malaria, HIV and tuberculosis) predispose to intrauterine growth retardation (IUGR), low birth weight and perinatal death. Poor birth spacing with inter birth interval of less than 2 years leading to poor maternal nutritional reserves predisposes women to low birth weight infants and perinatal death. Maternal status of high parity and extremes of age (less than 18 years and greater than 45 years) are associated with poor birth outcomes and perinatal morbidity and mortality. Low socioeconomic status of the mother has been shown to be associated with higher perinatal mortality rate.

Effective and appropriate maternal interventions such as micronutrient supplementation, intermittent presumptive treatment (IPTp) of malaria and tetanus toxoid vaccination cannot be offered if women do not avail themselves of antenatal services. Several studies in low income countries has shown that a large proportion of perinatal deaths occur in women who did not receive antenatal care during pregnancy [15].

Poorly supervised labour either in a hospital setting or conducted outside a health facility by persons ill equipped to manage labour and delivery is a major cause of stillbirth and early neonatal death. Unskilled attendance at delivery and inadequate resuscitation of the newborn predispose to birth asphyxia and death. Unsanitary conditions when deliveries are conducted in inappropriate places pave the way for early neonatal sepsis and eventual death.

Prenatal complications such as antepartum haemorrhage secondary to placenta praevia or abruptio placenta; pre eclampsia or eclampsia all predispose to fetal loss. In addition complications during labour and delivery such as cord prolapse and uterine rupture may lead to still births or birth asphyxia.

Multiple pregnancies are associated with preterm delivery and low birth weight which are leading causes of perinatal morbidity and mortality.

The real causes of adverse fetal and early neonatal outcomes in the low income countries of sub Saharan Africa and South central Asia are inadequate obstetric and neonatal care, and harmful home care practices, such as the discarding of colostrum, the application of unclean substances to the umbilical cord stump, and the failure to keep babies warm [3].

5. Strategies to reduce perinatal mortality

In many parts of the world up to half of deliveries still take place at home without adequate supervision. This is even higher in the developing countries especially of sub-Saharan Africa and could be due to cultural practices that stipulate that certain births must take place in the home. Poor access to health facilities as a result of unavailability or financial constraints; lack of faith in health systems because of inadequate facility, manpower or poor attitude of health care workers, or just plain ignorance of the benefits of skilled attendance at deliveries all contribute to adverse prenatal outcome [15,16,17]. Also in some deeply religious settings such as are found in many African countries, a significant proportion of births occur in spiritual/mission homes with unskilled or poorly skilled attendants. All these practice predispose to perinatal mortality [15,16,17].

Reducing perinatal mortality is a prerequisite for attaining MDG 4. Increased investment in health by various governments is necessary to tackle the factors predisposing to the unacceptably high perinatal mortality rates in low income countries. Strengthening of Health Systems includes provision of sufficient number of well-equipped health facilities and with proportional spread to meet local needs. Health facilities for the management of uncomplicated pregnancies and deliveries should be within the reach of every woman in every community. The peripheral centres should be linked to centrally-located secondary level health facilities with capacity for assisted or operative deliveries and some advanced care for the newborns. Regional tertiary centres with facilities to manage high risk pregnancies and deliveries as well as special care baby units with facilities for neonatal intensive care should also be established. There should be well established 2-way referral system between one level of health facility and the next.

In most low income countries like Nigeria, though these three levels of care exist, appropriate referral linkages from one level of healthcare to the next are lacking making the health system inefficient and dysfunctional [16,17]. The roads linking these facilities, as well as appropriate transport systems are in terrible disrepair or non-existent. In most low income countries, most deliveries are supervised by unskilled birth attendants. Efforts over the years have been devoted to training these unskilled attendants with no appreciable success [17]. If the MDG 4 must be achieved by 2015, investment should be directed at training a critical mass of health workers with sufficient basic education to understand the science and techniques of perinatology. The capacity of health workers in this setting with high perinatal mortality should be strengthened to meet the needs of women during pregnancy and delivery as well as provide appropriate care for newborns. All doctors, nurses and midwives should be trained on basic neonatal resuscitation. In low income countries where traditional birth attendants supervise a large proportion of deliveries they should be retrained as community liaisons officers- with the responsibility to link the women and their families to health facility. Specialist skills in obstetrics and neonatology need to be built among healthcare workers to care for high risk pregnancies, deliveries and newborns. Specialist skills acquisition is particularly urgent in the low income countries to man the regional referral centres. Mal-distribution of the specialized care needs to be addressed in some countries like Nigeria where there is concentration of highly skilled staff and health care workers in city centres where less than 20% of the population resides.

Access to maternal and child health facilities should be improved by either the removal of user fees at these facilities or by introducing affordable and accessible community based health insurance schemes that ensure that the poorest of the poor have access to these facilities.

Women empowerment through education of the girl child and the introduction of poverty alleviation programmes are long term strategies that though may not have immediate impact on perinatal mortality are essential for sustaining the rate once achieved with some quick win interventions.

Finally abolition of harmful cultural practices detrimental to fetal and neonatal survival and early detection and treatment of malformations and genetic diseases will all in no mean measure contribute to reduction in perinatal mortality.

6. Conclusion

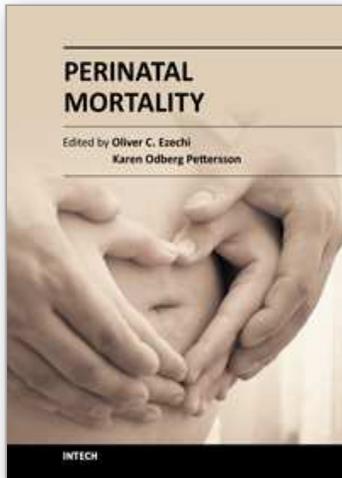
Low income countries account for 97-98 percent of reported global perinatal deaths. This accounts for 68-70% of annual global under five mortality. It is therefore not possible to achieve the stated MDG 4 goal of reducing infant mortality rate by two thirds of 1990 rates by 2015 without addressing the causes and determinants of perinatal mortality especially in these low income countries. Many useful interventions can be implemented in resource-poor settings, but weak health care delivery systems remain a major challenge.

Urgently required are alternative approaches to deploy the evidence proven strategies that had led to the reduction of perinatal mortality in high and medium income countries.

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This book is a compendium of important topics related to perinatal mortality. It has been written for anyone who is interested in perinatal medicine and wishes to be part of the global strategy for prevention and control of perinatal mortality. It covers variety of subjects using simple language that can easily be understood by most health workers and those interested in quality health care. Postgraduate students in midwifery, obstetrics and paediatrics will also find it a very useful companion.

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