Advances in perinatal medicine and technology make it possible for women with high-risk medical conditions to get pregnant, for infertile couples to conceive, for expectant parents to see ultrasound images of the fetus, and for neonates to survive at lower gestational ages than ever before. Despite these advances, adverse outcomes continue to persist such as preterm delivery, low birth weight, congenital anomalies, and other factors that lead to increased neonatal morbidity and mortality. Pregnant women continue to be exposed to harmful physical, psychosocial, behavioral, or environmental conditions that make their pregnancies high risk. There is growing evidence of the genetic influence on some perinatal risk factors and of a link between exposure to environmental triggers and perinatal outcomes. Perinatal care providers must engage in continuous systematic assessment of potential maternal risk factors from preconception through the postpartum period in order to optimize perinatal outcomes. Patient education and assistance with lifestyle alterations necessary for healthy pregnancy are key components of prenatal care. This chapter will present an overview of high-risk factors that contribute to adverse outcomes in the prenatal, intrapartum, and postpartum periods.

**PERINATAL OUTCOMES**

Some of the adverse perinatal outcomes that are of concern related to maternal risk factors include low birth weight (LBW), intrauterine growth restriction (IUGR), preterm delivery, and perinatal death. These terms will be further defined. LBW is defined as a weight of less than 2500 g or less than 5 pounds 8 ounces at birth. LBW is further broken down into very low birth weight (VLBW) or extremely low birth weight (ELBW). VLBW is defined as a birth weight less than 1500 g or less than 3 pounds 4 ounces, and ELBW is defined as a birth weight less than 1000 g. LBW infants are at higher risk for neonatal and postnatal morbidity and mortality (see Table 37-1).

Low birth weight is one of the most important determinants of the infant’s future health and has been linked to obesity, hypertension, diabetes mellitus, and decreased fertility later in adult life (Okah et al, 2005).

Gestational age is estimated through evaluation of neonatal physical and neuromuscular characteristics using a scale such as the Ballard Maturational Assessment of Gestational Age. The neonate’s birth weight, frontal occipital head circumference, and length are plotted on graphs by gestational age. The infant is categorized as appropriate for gestational age (AGA) if birth weight falls between the 10th and 90th percentile for the infant’s gestational age; small for gestational age (SGA) if birth weight falls into the lower 10th percentile for weight based on gestational age; or large for gestational age (LGA) if birth weight is greater than 90th percentile for weight based on gestational age. SGA infants might be genetically small, but as many as 10% to 15% of SGA fetuses are actually IUGR fetuses (Mari, 2005). Some authors believe that the incidence of IUGR is underestimated by limiting the definition of IUGR to less than the 10th percentile. IUGR is commonly caused by changes in the maternal vasculature or the placenta due to conditions such as pre-eclampsia, history of smoking or taking drugs, low prepregnancy weight, low weight gain in pregnancy, or inadequate prenatal care (Steward & Moser, 2004). Many of these conditions cause progressive uteroplacental insufficiency that limits the normal exchange of oxygen and nutrients to the fetus. Lack of adequate nutrients interferes with normal growth potential. IUGR can also be caused by maternal genetic factors, fetal chromosomal problems, congenital infection, intrauterine crowding, cord pathology, Rh isoimmunization, or twin-to-twin transfusion (Harper et al, 2005).

There are two types of IUGR, symmetric and asymmetric. Symmetric growth restriction occurs early in pregnancy. The factors that restrict fetal growth are similar to a chronic condition. In this type of IUGR, the head, long bones, abdomen, and soft tissue growth are restricted. Symmetric IUGR is associated with a decreased number of fetal cells. Infants are born with fewer brain cells and tend to have poorer long-term outcomes. They tend to grow more slowly after they are born and their growth seldom catches up to other infants during the first year of life. In contrast, fetuses with asymmetric IUGR have normal fetal head and long bone growth; however, soft tissue and abdominal growth are restricted. The infant usually has a small liver. Infants with symmetric IUGR tend to catch up on the growth charts during the first year of life (Harper et al, 2005). IUGR is best detected prenatally with serial fundal height measurements or serial ultrasound that tracks when fetal growth is not progressing as expected. Severe uteroplacental insufficiency restricts blood flow to the fetus and affects fetal growth and oxygenation. It is a cause of fetal demise; therefore fetuses with IUGR must be identified and closely monitored with nonstress testing, biophysical profiles, or contraction stress tests. Early delivery is indicated if signs of fetal stress or distress are present. After birth, infants with
### TABLE 37-1
Live Births by Birth Weight and Percentage of Very Low and Low Birth Weight, by Period of Gestation and Race and Hispanic Origin of Mother: United States, 2003

<table>
<thead>
<tr>
<th>Birth Weight1 and Hispanic Origin of Mother</th>
<th>All Races3</th>
<th>Less than 500 g</th>
<th>500-999 g</th>
<th>1,000-1,499 g</th>
<th>1,500-1,999 g</th>
<th>2,000-2,499 g</th>
<th>2,500-2,999 g</th>
<th>3,000-3,499 g</th>
<th>3,500-3,999 g</th>
<th>4,000-4,499 g</th>
<th>4,500-4,999 g</th>
<th>5,000 g or more</th>
<th>Not Stated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>4,089,950</td>
<td>6,307</td>
<td>22,980</td>
<td>29,930</td>
<td>63,791</td>
<td>201,056</td>
<td>711,003</td>
<td>1,557,864</td>
<td>1,151,577</td>
<td>309,721</td>
<td>46,690</td>
<td>5,431</td>
<td>3,600</td>
</tr>
<tr>
<td>Preterm</td>
<td>499,008</td>
<td>6,132</td>
<td>22,319</td>
<td>27,759</td>
<td>53,171</td>
<td>105,163</td>
<td>133,242</td>
<td>100,835</td>
<td>39,471</td>
<td>7,721</td>
<td>1,243</td>
<td>211</td>
<td>1,741</td>
</tr>
<tr>
<td>Total Under 37 Weeks</td>
<td>30,061</td>
<td>5,857</td>
<td>16,587</td>
<td>3,905</td>
<td>9,57</td>
<td>612</td>
<td>908</td>
<td>100,835</td>
<td>2,461</td>
<td>3,805</td>
<td>577</td>
<td>98</td>
<td>1,235</td>
</tr>
<tr>
<td>Under 28 Weeks</td>
<td>49,545</td>
<td>247</td>
<td>5,172</td>
<td>16,085</td>
<td>12,259</td>
<td>4,193</td>
<td>4,162</td>
<td>4,827</td>
<td>1,751</td>
<td>3,058</td>
<td>577</td>
<td>98</td>
<td>1,235</td>
</tr>
<tr>
<td>28 to 31 Weeks</td>
<td>234,074</td>
<td>23</td>
<td>528</td>
<td>7,179</td>
<td>34,790</td>
<td>68,175</td>
<td>60,025</td>
<td>41,100</td>
<td>17,514</td>
<td>3,805</td>
<td>666</td>
<td>113</td>
<td>260</td>
</tr>
<tr>
<td>32 to 35 Weeks</td>
<td>185,328</td>
<td>5</td>
<td>32</td>
<td>590</td>
<td>5,165</td>
<td>32,183</td>
<td>68,147</td>
<td>54,908</td>
<td>19,496</td>
<td>3,916</td>
<td>666</td>
<td>113</td>
<td>107</td>
</tr>
<tr>
<td>Period of Gestation2</td>
<td>2005</td>
<td>43.5</td>
<td>76.8</td>
<td>47.3</td>
<td>20.5</td>
<td>3.0</td>
<td>39</td>
<td>1.4</td>
<td>1.4</td>
<td>2.4</td>
<td>77</td>
<td>604</td>
<td></td>
</tr>
<tr>
<td>Term</td>
<td>0.3</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.25</td>
<td>0.7</td>
<td>0.0</td>
<td></td>
</tr>
<tr>
<td>Percent</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.25</td>
<td>0.7</td>
<td>0.0</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**
- **Number:**
  - Quantities zero; 0.0, quantity more than zero but less than 0.05.
  - Equivalents of the gram weights in pounds and ounces are shown in the “Technical Notes” in original document.
  - All births are expressed in completed weeks.
  - Includes races other than white and black and origin not stated.
  - Birthweight of less than 1500 g (3 lb 4 oz).
  - Birthweight of less than 2500 g (5 lb 8 oz).

IUGR often have problems with thermoregulation due to a lack of subcutaneous fat. They also are at increased risk for necrotizing enterocolitis, thrombocytopenia, and renal failure because during fetal development, blood was shunted away from the gastrointestinal and renal system to the brain, heart, and other vital organs as a protective mechanism. As adults, those who were born with IUGR are more at risk to develop a metabolic syndrome with type 2 diabetes, obesity, hypertension, hypercholesterolemia, and heart disease (Harper et al, 2005).

Preterm infants require intensive medical and nursing care. The high cost of providing neonatal intensive care for these vulnerable infants adds a huge financial burden to the health care system. In 2003, the cost of caring for the estimated 4 million infants who were born in the United States was over $10 billion. Over half of that amount was spent on the 12.3% of infants who were born prematurely (delivery at <37 weeks’ gestational age). As infant birth weight decreases, the costs of the initial hospitalization increase (Cuevas et al, 2005). Preterm infants account for most neonatal deaths, and if they do survive, they have increased risks for morbidity. Prematurity and LBW places infants at an increased risk for disability, neonatal death, or the development of lifetime chronic health problems. More ELBW infants have survived over the past decade, with a corresponding increased risk for neurodevelopmental impairment (Wilson-Costello et al, 2005). Preterm infants are also more at risk for hospital readmission within 6 weeks of birth, adding to the financial burden (Martens et al, 2004). Prevention of preterm birth and LBW has the potential to save lives, to prevent long-term health problems associated with prematurity, and to provide significant savings of health care dollars.

The rate of preterm birth has remained basically unchanged over the past decade, although there was a slight rise from the 1990s (MacDorman et al, 2005). Preterm delivery accounts for 60% of all perinatal deaths (Tekesin et al, 2005). Multiple variables have been associated with increased risks for preterm delivery. Gene-gene interactions or gene-environment interactions might trigger the process of preterm birth. Recently researchers found a significant relationship between the tumor necrosis factor alpha gene (TNF) and preterm labor in mothers who also had presence of bacterial vaginosis (BV) as a postulated environmental trigger (Macones et al, 2004). The search for possible genetic causes of preterm labor is an exciting field for future investigations.

In 2002, infant mortality in the United States increased for the first time in over 40 years to 7.0 per 1000 deaths. Black infants had 2 to 3 times the rates of white infants in all categories of perinatal and infant death (National Center for Health Statistics, 2005). The top 10 causes of infant death during the first year of life were congenital anomalies, LBW, placenta/cord, congenital heart anomalies, SIDS, maternal complications, placenta/cord, necrosis of the umbilical cord, respiratory distress, bacterial sepsis, and circulatory disorders (see Figure 37-1).

Preterm birth increases the risk of poor pregnancy outcomes. More ELBW infants have survived over the past decade, with a corresponding increased risk for neurodevelopmental impairments (Wilson-Costello et al, 2005). Preterm infants are also more at risk for hospital readmission within 6 weeks of birth, adding to the financial burden (Martens et al, 2004). Prevention of preterm birth and LBW has the potential to save lives, to prevent long-term health problems associated with prematurity, and to provide significant savings of health care dollars.

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The largest increase was in neonatal deaths reported from 0 to 28 days of life, with most of them occurring in the first 7 days of life (Kochanek et al, 2004). In 2002, the infant mortality rate per 1000 births was significantly higher for LBW (59.5) and VLBW (250.8) infants than for infants who weighed over 2500 g (2.4). Singleton births accounted for about 75% of the increase and multiple births contributed about 25% of the increase (MacDorman et al, 2005).
**Prenatal Maternal Risk Factors**

Maternal risk factors consist of demographic, behavioral, and psychosocial factors, as well as maternal medical conditions and pregnancy-related conditions. Demographic risk factors include personal characteristics of mothers such as age or previous obstetric history that are associated with high-risk pregnancy or the delivery of a high-risk newborn. Behavioral risk factors include risky behaviors the mother has either prior to or during pregnancy that can harm the fetus, such as smoking or taking drugs. Psychosocial risk factors are variables that relate to the types of social interactions and support that the mother has during pregnancy. Maternal medical conditions include pre-existing or emergent medical conditions that can potentially be harmful to the fetus such as diabetes or pregnancy-induced hypertension (PIH). Pregnancy-related conditions are those conditions that only happen during pregnancy such as multiple gestation, pregnancy-induced hypertension, or gestational diabetes.

A variety of demographic factors are related to neonatal outcomes. A complete maternal history done at the first prenatal visit will help identify important demographic and medical risk factors that might influence the outcomes of the pregnancy. The presence of risk factors should serve as a warning. Many women with identifiable high-risk factors will give birth to healthy infants without problems. The potential influence of demographic risk factors of age, ethnicity, obstetric history, and the health compromising behaviors of nutrition, smoking, alcohol and drug use on pregnancy are further discussed in the following sections.

**Maternal Age**

The maternal childbearing age range has widened over the past decade, partially because of advances in assisted reproductive technology that have made it possible for women to achieve pregnancy, even into the fifth or sixth decade of life, if desired. Maternal age is considered to be a risk factor at either end of the childbearing age spectrum for poor perinatal outcomes (see Table 37-2).

Young adolescent and teenage mothers are considered high risk because they are biologically immature and their growing body is competing with the fetus for nutrient resources. They have not had the chance to complete their own physical growth and development. Many teenagers do not eat an adequate diet, even when they are not pregnant. If the young immature mother does not consume enough nutrients to maintain her own growth, then she is more at risk to achieve an LBW infant as compared to an older mother. If teens become pregnant within 2 years of menarche, they are considered reproductively immature (Fraser et al, 1995). Since the young mother's reproductive organs are more immature, she is more likely to have a fetal loss, preterm birth, or infant death. Younger mothers have an infant mortality rate (15.4 in 2002) 2 to 3 times higher than that for women between the ages of 20 and 44 (Menacker et al, 2004). After birth, infants of younger mothers (<19 years of age) had an increased risk for readmission to the hospital within the first 6 weeks after newborn discharge (Martens et al, 2004).

The birth rate for all teenagers declined in 2003 for most ethnic groups. The birth rate for adolescents between the ages of 10 and 14 reached a new low in 2003 at 0.6 per 1000, even despite the fact that this age group had an increase in growth during this time (Martin et al, 2005). Most births to young teens occurred in girls between the ages of 13 and 14. Girls of this age were also in the group that was least likely to seek early prenatal care. Only 47.1% of young teens sought prenatal care in the first trimester as compared with 78% of other age groups of women (Menacker et al, 2004). Teen mothers have fewer years of formal education. Education is known to be a factor related to promotion of positive pregnancy behaviors. Many teen mothers find it difficult to return to school full time once they assume the parenting role. Dropping out of school can destine them to a lifetime of working in low-paid menial jobs unless they have the parental support necessary to complete their education. Teen mothers are less likely to be married, and they need more financial support for the pregnancy from parents or social agencies. Teen mothers are also more likely to have a repeat teen pregnancy.

Advanced maternal age refers to childbearing by women who are over the age of 35 at estimated date of delivery. Advanced maternal age poses increased risks for decreased fertility, chromosomal abnormalities in the infant, spontaneous abortion, ectopic pregnancy, or stillbirth (Andersen et al, 2000; Cleary-Goldman et al, 2005; Heffner, 2004). Older pregnant women are at an increased risk for medical problems associated with aging such as diabetes or PIH. Diabetes increases the risk for delivery of a macromosomic infant. Advanced maternal age also increases the risks for placenta previa, preterm delivery, or delivery of an LBW infant (Aliyu et al, 2005; Ananth et al, 1996). Women over age 40 tend to gain less weight during pregnancy, a factor that could contribute to the increased risk of LBW (Menacker et al, 2004).

Advanced maternal age creates genetic risks because as the woman gets older, the genetic material contained within her ova ages. All females are born with all of the eggs that they will ever have, which contain the genetic material that each woman will pass on to her progeny. According to maternal aging theory, as the woman chronologically ages, her eggs and all of the genetic material they contain age, too. The genetic material within the aging ovum of a woman over age 35 has a higher chance of being defective because it is older. Aging genetic material is more likely to have errors occur during cell division during meiosis that can result in either a lack of or an excess of chromosomal material (Maternal Age Risks, 2001). This phenomenon most likely accounts for decreased fertility rates as women age and the increased risk of chromosomal abnormalities in their offspring (Heffner, 2004). Trisomy 21 (Down syndrome) and trisomies 18 and 13 are examples of genetic problems resulting from errors in cell division. Down syndrome is the most common chromosomal problem that is linked to advanced maternal age. Normally, a fetus has 23 pairs of chromosomes with half of each pair inherited from each parent. However, with Down syndrome the fetus has an extra chromosome located on chromosome 21 (i.e., three chromosomes instead of two chromosomes; hence the name trisomy 21). The risk for having an infant with Down syndrome increases with advanced maternal age. For example, a 30-year-old woman's risk to have an infant with Down syndrome is 1 in 885, at age 35 the risk is 1 in 365, and at age 40 the risk is 1 in 109 (Hook & Lindsjo, 1978).

Late fetal and early perinatal death rates are higher for pregnant women ages 45 and 54 than for any other age groups. Pregnant women ages 45 have a rate of spontaneous abortion that is nine times higher than that of pregnant women between the ages of 20 and 24 (Andersen et
### Selected Abnormal Conditions of the Newborn and Rates by Age and Race of Mother: Total of 48 States and the District of Columbia, 2003

<table>
<thead>
<tr>
<th>Abnormal Condition and Race of Mother</th>
<th>All Ages</th>
<th>0-20 Years</th>
<th>21-24 Years</th>
<th>25-29 Years</th>
<th>30-34 Years</th>
<th>35-39 Years</th>
<th>40-54 Years</th>
<th>Not Stated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal Condition</td>
<td>All races</td>
<td>All races</td>
<td>All races</td>
<td>All races</td>
<td>All races</td>
<td>All races</td>
<td>All races</td>
<td>All races</td>
</tr>
</tbody>
</table>

**Notes:**
- Rates are number of live births with specified abnormal condition per 1000 live births in specified group.
- Rate does not exceed 0.05.
- *Figure does not meet standards of reliability or precision; based on fewer than 20 births in the numerator.
- **Total number of births to residents of areas reporting specified abnormal condition.

alkal, 2000). Women over age 40 are at increased risk for placental abruption and perinatal mortality (Cleary-Goldman et al, 2005). Although fertility tends to decline with advanced maternal age, women between the ages of 35 and 39 actually have an increased risk of conceiving twins without the assistance of fertility treatments, another factor that increases their risk status (Andersen et al, 2000).

Advanced paternal age has been associated with increased risk of miscarriage, especially if the man is over age 40 or if both partners are of advanced age (de la Rochebrochard & Thonneau, 2002). Advanced paternal age should also be considered when evaluating prenatal risks, as it is associated with rare congenital anomalies in offspring due to dominant mutations such as neural tube defects, congenital cataracts, upper limb reduction defects, and Down syndrome (Macintosh et al, 1995). Older fathers are more likely to have offspring with such autosomal dominant genetic conditions as Marfan syndrome, achondroplasia, Huntington's chorea, and von Willebrand's disease (Helffer, 2004). A careful assessment of family history of both parents will help alert the health care provider to these potential risks.

**Ethnicity**

Even though birth outcomes have dramatically improved over the past 25 years for all ethnic groups, serious ethnic disparities continue to exist. Black mothers are 2 to 3 times more likely to die from pregnancy-related causes, have a fetus or infant who dies, have preterm labor, have an LBW infant, or have an infant with congenital anomalies than mothers of other ethnic groups. Black women are more likely to have a spontaneous abortion, an ectopic pregnancy, or a cesarean section than white women (Gennaro, 2005; Hogue & Bremner, 2005; Rich-Edwards et al, 2003). Although black mothers are more likely to be socially disadvantaged and live in poor neighborhoods with higher levels of poverty (Rich-Edwards et al, 2003), even infants of college-educated black women who seek first-trimester prenatal care are at increased risk to die as a result of prematurity or VLBW.

Black and white interracial couples also have an increased risk for stillbirth, SGA, and neonatal mortality. Preterm and SGA births are more common in pregnancies with mixed white mother–black father (WB) or black mother–black father (BB) parent combinations than for white mother–white father (WW) parent combinations. WW parents have more LGA infants. Infant death rate is higher for infants of WB parents (6.0), black mother–white father (BW) parents (5.9), and BB parents (7.6) than for those of WW parents (3.9). There are differences in socioeconomic factors, with more teen parents, unmarried women, and failure to seek prenatal care in the BW, WB, and BB groups. Paternal genetic factors might influence some of these outcomes; this needs further study (Getahun et al, 2005).

**Weathering and Stress Age**

Racial disparities in birth outcomes cannot be totally explained by the presence of maternal risk factors. Even special programs developed in attempts to address ethnic disparities in birth outcomes have not been able to make much of a difference. The effects of lifetime stress were proposed as a possible reason for continued ethnic disparities in birth outcomes for black infants. Geronimus (1992) noted that infants of teenaged African American women had a survival advantage over infants of older African American women. Maternal "weathering" was proposed as a possible explanation for these disparities. Weathering is a term for premature aging that is caused by stress. The weathering hypothesis proposes that socioeconomic disadvantage contributes to an earlier decline in the health of African-American women (Geronimus, 1996). This early decline affects the entire body, including the reproductive system. Theoretically, the reproductive system functions most optimally during the time of a woman's life that would maximize her chances to reproduce a healthy child. If women delay childbearing past this optimal time, then their aging reproductive systems do not function as efficiently (Geronimus, 1996). Furthermore, prepregnancy chronic stress might lead to accelerated physiologic aging of the female reproductive system and thus to poor pregnancy outcomes. Therefore, women who are under stress have increased risks for delivery of preterm or LBW infants because of the decreased efficiency of their reproductive systems. Maternal age is a marker for how long the woman has endured exposure to stressful hardships (Rich-Edwards et al, 2005).

According to the theory of stress age, a term synonymous with weathering, the cumulative effects of lifetime exposure to acute stress and experiences of chronic day-to-day stress increase the risk of stress-related disease during pregnancy (Hogue & Bremner, 2005). Additional stress experienced during pregnancy can add to the mother's cumulative lifetime stress, therefore elevating her risk for preterm labor or an LBW infant. Many African American women experience more than the usual level of lifetime stressors because of their encounters with racial and gender discrimination and violence throughout their lifetimes. Racial discrimination can be a source of chronic stress and can alter the individual's stress reactivity (Patrick & Bryan, 2005). Because of increased lifetime stress, women may experience increased stress age that could influence pregnancy outcomes that are stress sensitive. Researchers have established links between some pregnancy-related diseases and later chronic illness; for example, women with gestational diabetes have an increased risk for type 2 diabetes later in life. A possible explanation is that poor pregnancy outcomes represent initial signs of aging of the endocrine, immune, and reproductive systems (Rich-Edwards & Grizzard, 2005). Hardiness, resilience, and social support might act as stress buffers in some women, lessening the impact of stress (Patrick & Bryan, 2005). The "weathering hypothesis" offers an interesting explanation for the increased incidence of preterm delivery and LBW infants for older childbearing women or women who are under stress.

Hogue and Bremner (2005) proposed an epidemiologic model demonstrating some of the possible mediators and moderators of stress age (Figure 37-2). Stress age is affected by lifetime exposure to acute or chronic personal stressors (such as violence or racism). The social, cultural, and physical environment, such as underlying health problems, anemia, hypertension, lifestyle choices, and exercise, add additional stressors that influence acute and personal stressors. Stress is mediated as it enters the host organism through mechanisms that help provide immunity to the effects of incoming stress. Stress mediators include (1) blame reflection (i.e., how much the host attributes the stressor to external or internal causes); (2) stress reducers (actions the host takes to reduce stress such as exercise or diet); (3) spiritual strength (use of prayer or faith); (4) social resources (support network available); (5) economic...
resources (availability of resources to provide for needs such as prenatal care, food, or medication); and (6) resilience. The host is susceptible to the effects of stress through the influence of the following factors: (1) stress reactivity (how the host reacts to stress); (2) self-assessment (the host’s perception of stress); (3) personality or trait environment of the host (including a tendency toward anxiety or anger); and (4) the genetic environment that could influence susceptibility to stress. Exposure to high levels of stress compromises the host’s ability to withstand stress and increases susceptibility to stress-related diseases such as hypertension, as well as increasing the likelihood of infections. Maternal stress can affect immune, endocrine, and vascular function; any one of these factors may trigger preterm labor or cause LBW.

The exact mechanism by which maternal stress causes preterm labor is not fully understood, but it is thought to occur by one of two mechanisms. Corticotropin-releasing hormone (CRH) released as a byproduct of maternal stress could stimulate neuroendocrine pathways within the maternal-fetal-placental unit that trigger labor; or maternal stress could cause increased maternal and fetal susceptibility to stress-related diseases such as hypertension, as well as increasing the likelihood of infections. Maternal stress can affect immune, endocrine, and vascular function; any one of these factors may trigger preterm labor or cause LBW.

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Differences in LBW and preterm delivery are not totally explained by race or sociodemographic factors. Mexican women who immigrate to the United States have demographic and socioeconomic risk factors comparable to those of African American women have better perinatal outcomes than expected, including less LBW and fewer neonatal deaths than white women. Asian Indian women have higher incidences of prematurity, LBW, SGA, and fetal death than white women. This “epidemiologic paradox” suggests that there are other factors that give foreign-born women either a perinatal advantage or disadvantage, such as environmental factors, diet or lifestyle factors, or genetic factors (Gould et al, 2003). It is possible that ethnic differences in LBW might be a factor of ethnically determined differences in weight by gestational age. For example, based on a given gestational age, white infants will generally weigh more than Hispanic infants, and Hispanic infants will weigh more than black infants (Chung et al, 2003).

Obstetric Factors

Obstetric history is a good indicator of the presence of maternal risk factors. Women with previous obstetric complications are more at risk for problems with the current pregnancy. History of infertility, previous stillbirth, preterm infant, infant with IUGR, infant with genetic problems, complications during pregnancy or birth, or other poor outcomes are clues indicating that the pregnancy must be closely monitored. Prepregnancy health status is another factor associated with the risk of preterm delivery. Women who are in poor physical condition prior to conception (i.e., underweight, having poor prepregnancy physical function, chronic hypertension, or smoking before pregnancy) have an increased risk for preterm delivery (Haas et al, 2005). Important obstetric factors that can compound pregnancy risk are the adequacy of prenatal care,
CHAPTER 37  Prenatal, Antenatal, and Postpartal Risk Factors

the number of previous pregnancies, interpregnancy level, the use of assisted reproductive technology, and postterm pregnancy.

**Prenatal Care**

Prenatal care that begins in the first trimester of pregnancy and continues until birth helps promote good birth outcomes. Most women seek prenatal care during the first trimester of pregnancy. Only a small percentage of women start prenatal care during the last trimester or have no prenatal care. Native American/Alaskan Native, non-Hispanic black, and women of Mexican origin have higher rates of late or no prenatal care. The decision to seek prenatal care is influenced by the woman’s attitudes toward pregnancy, cultural preference, or lifestyle factors. Inadequate prenatal care increases the risk for LBW, preterm birth, and perinatal death (Fraser et al., 1995; Vintzileos et al., 2002). Higher postneonatal death rates seen in infants of women who did not have prenatal care might be associated with lack of access to care providers or lack of use of pediatric medical care (Vintzileos et al., 2002).

**Parity**

Parity, or number of previous deliveries, is another perinatal risk factor to consider. The risk for having an LBW infant, a preterm delivery, abruptio placenta, or placenta previa increases as parity increases (Aliyu et al., 2005). Women with five or more previous births are more likely to have inadequate prenatal care and are at an increased risk for having a macrosomic infant. Women with high parity are usually older and are more likely to have aging-associated diseases such as diabetes or hypertension that can affect pregnancy outcomes.

**Interpregnancy Level**

Interpregnancy level is defined as the amount of time between delivery of a baby and the subsequent conception of another child. A short interpregnancy level of less than 6 months increases the risk for maternal complications including third-trimester bleeding, premature rupture of membranes, puerperal endometritis, anemia, and maternal death. Women with longer interpregnancy levels have the highest risk for pre-eclampsia, eclampsia, and gestational diabetes, again probably related to older maternal age. The risk for prematurity is increased when the interpregnancy level is 18 months or less or greater than 59 months (Fuentes-Afflick & Hessol, 2000).

**Assistive Reproductive Technology**

Assistive reproductive technology (ART) is any procedure or medical treatment used to assist a woman in achieving pregnancy. ART is an option for many couples who have a history of infertility. ART methods include use of medications to stimulate ovulation and release of eggs, or procedures where eggs and sperm are removed and mixed outside of the body to achieve fertilization. Some techniques require that the fertilized egg remain outside the body for a few days before being implanted back into the woman’s body. In some cases, the eggs, sperm, or embryos might be frozen for later use or manipulated with instrumentation during the earliest stages of cell formation.

ART increases the risk for a multiple pregnancy, preterm labor, cesarean delivery, and LBW and provides one explanation for the increase in number of LBW and preterm infants over the past few years. The risk for congenital anomalies doubles for infants conceived with ART, including sex and autosomal chromosomal anomalies such as Beckwith-Wiedemann and Angelman’s syndromes. Infants conceived by ART have a fourfold to sevenfold increased risk for retinoblastoma (Green, 2004).

Couples who electively conceive through ART with a large number of embryos may have to make tough ethical decisions, including options for selective reduction later in the pregnancy, in order to protect the health of compromised fetuses. The risk for prematurity and LBW increases as the number of fetuses increases, increasing risks of poor outcomes for the infants. The decision to maintain a pregnancy with a large number of fetuses can be economically and emotionally catastrophic for the family. Outcomes for the babies who survive depend in part on the number of fetuses and gestational age at delivery. Some countries have set mandatory limits on the numbers of embryos that can be implanted during ART procedures to help address some of these issues (Green, 2004).

**Postterm Pregnancy**

Postterm pregnancy is defined as a pregnancy that continues past 42 weeks (294 days) or 14 days past the estimated due date (ACOG Committee on Practice Bulletins [ACOG], 2004). Incidence is in about 7% of all pregnancies. The cause of postterm pregnancy is not known, but it occurs more often with male fetuses and may have a genetic basis. Some cases of postterm pregnancy can be attributed to inaccurate dates used to calculate the estimated date of confinement. Ultrasound dating of pregnancy is considered to be accurate if done during the first trimester; however ultrasound dating of pregnancy has a margin of error.

Postterm infants are more likely to have macrosomia, with increased risks for prolonged labor or cephalopelvic disproportion (CPD). Macrosomia increases the risk for cesarean section or shoulder dystocia that leads to increased risks of possible musculoskeletal injury (i.e., fractured clavicle or brachial plexus injury). Postmaturity also predisposes to uteroplacental insufficiency in about 20% of cases. Postmature infants who have been exposed to uteroplacental insufficiency present with chronic IUGR and are more at risk for cord compression due to oligohydramnios or presence of thick meconium (Morantz & Torrey, 2004). Adverse outcomes are more likely in the presence of oligohydramnios (ACOG, 2004). Postterm pregnancy has also been related to lower umbilical artery pH levels and lower Apgar scores (Caughey et al., 2005). ACOG recommends surveillance of postterm pregnancies between 41 and 42 weeks because of increased risks of fetal complications as gestational age advances. Postterm fetuses should be evaluated by nonstress testing or biophysical profiles. Delivery is not indicated as long as the results of these tests are reassuring (ACOG, 2004). When the amniotic membranes rupture and if meconium is present, measures must be taken to prevent meconium aspiration at birth. Meconium aspiration increases the risk of death for postterm infants. At birth the nose, mouth, and hypopharynx must be suctioned thoroughly prior to delivery of the shoulders and the cords should be visualized and suctioned of any meconium prior to initiation of the first breath. If the infant with meconium is breathing
spontaneously, then intubation is not necessary for cord visualitization.

After delivery postterm neonates will need careful assessment for possible birth injuries. Infants with meconium aspiration will need intensive treatment for respiratory complications. All postterm infants should be monitored for possible hypoglycemia and temperature instability.

**Environmental Influences**

Every individual is conceived with a unique genetic makeup called a genotype. The phenotype, or the person’s ultimate physiologic and psychologic makeup, is determined during the postconceptual period until after birth. The expression of the genetic inheritance (i.e., actual physiologic and psychologic makeup of the person) is the result of complex gene-gene interactions and environmental influences on genes that occur at the molecular level. Exposure to environmental toxicants during pregnancy can precipitate gene-environment interactions that can alter these molecular interactions, especially if the exposure to the harmful substance occurs at critical periods of fetal development. Two critical periods when gene-environmental interactions can be most harmful are during organogenesis (when fetal organs are being formed during the first trimester of pregnancy), and during the fetal period (after the eighth week of pregnancy) when there is rapid growth of all systems. Spina bifida is an example of a gene-environment interaction. At conception a fertilized egg might inherit the genes to have an intact neural tube. Neural tube defects occur when there is a lack of adequate folic acid at a critical stage of development while in utero. Exposure to teratogens, substances that are known to cause birth defects, during these times can result in birth defects or other adverse outcomes. Two pregnant women could be exposed to the same toxicants at the same point during pregnancy and could have infants with different outcomes. For example, two infants could inherit the genetic trait for sickle cell disease, yet when they are born they could have different expressions of the disease based on other complex molecular interactions that happen within genes and that could be influenced by the environment. The study of epigenetics is an evolving science that examines the potential for gene expression to be altered by the environment at the molecular level. Exposure to environmental toxicants or chemicals as they are more likely to work on farms or as migrant workers. In fact, fetal congenital anomalies and death were noted in the offspring of male agricultural workers who worked where pesticides were used. More fetuses died in seasons when pesticide usage was highest (Regidor et al, 2004). The disadvantaged might be more likely to reside on land that once served as a hazardous waste dumpsite (Silbergeld & Patrick, 2005). Cultural practices such as pica place some pregnant women at increased risk for exposure to environmental pollutants including heavy metals.

**Health-Compromising Behaviors**

Health-compromising behaviors (HCBs) such as smoking and drug or alcohol use can affect overall maternal health during pregnancy and can negatively influence fetal well-being. Prepregnancy maternal health status and health behaviors may play a role in preterm labor risk. Babies born to mothers who smoke, drink alcohol, or take drugs weigh less than babies of mothers who do not smoke, drink, or take drugs (Okah et al, 2005; Reichman & Teitler, 2003).

Cigarette smoking is a major predictor of LBW, possibly because of impaired oxygen delivery (hypoxia) and nutrient delivery from the mother to fetus (Chiriboga, 2003). Infants of mothers who smoke have an increased risk of spontaneous abortion, late fetal death, preterm delivery, and neonatal mortality. Women who smoke are more likely to use alcohol or illicit drugs during pregnancy than those who do not smoke.

Substance abuse is a concern for childbearing women of all ages. More teenagers are experimenting with drugs, alcohol, and smoking cigarettes and marijuana than in the past (AAP, 2001a). Marijuana smoking results in carbon monoxide levels five times higher than those from cigarette smoking, another factor that limits fetal growth and oxygenation (Chiriboga, 2003). Women under the influence of mind-altering substances are more likely to make poor choices and increase the risk of engaging in promiscuous behavior resulting in an unplanned pregnancy.

Maternal alcohol ingestion during pregnancy can result in fetal alcohol syndrome (FAS). Incidence of FAS may be related to both environmental exposure and genetic susceptibility. Alcohol is believed to have a direct teratogenic effect that limits fetal growth and brain growth. The fetal effects of drinking are most pronounced if the fetus is exposed during the first trimester of pregnancy. The minimum amount of alcohol that is harmful to the fetal brain is not known. It is known that binge drinking (ingestion of more than five drinks at one occasion) leads to higher levels of blood alcohol. Binge drinking is a special concern in early pregnancy when the fetal brain is developing and women may not yet even realize that they are pregnant (Maier & West, 2001; Okah et al, 2005).

Pregnant women who abuse illicit drugs such as cocaine have higher levels of LBW and IUGR infants than women who do not use cocaine and are less likely to seek or receive adequate prenatal care (Brady et al, 2003). Individual health-compromising behaviors such as smoking, alcohol, and drug abuse are discussed elsewhere in this text. The influence of nutrition, illicit drug consumption, and environmental factors are further discussed here as health-compromising behaviors.

**Nutrition**

Adequate nutrition prior to conception and during pregnancy is important for maternal and fetal health. The pregnant woman needs to consume enough calories and nutrients to meet her own physiologic needs as well as those of the developing fetus. Nutritional risks to consider include inadequate or excessive weight gain, medical conditions that...
complicate pregnancy such as hyperemesis gravidarum, dental conditions that compromise the ability to take in food, or inadequate resources to access food. Lack of adequate nutrients prior to or during early pregnancy can lead to birth defects. It has been well established that it is important for all women of childbearing age (between 15 and 45) to consume at least 400 mcg of folic acid daily to help prevent neural tube defects. The Centers for Disease Control and Prevention (CDC) estimates that 50% to 70% of all birth defects could be prevented by this simple measure! Another important nutritional consideration is prevention of maternal anemia during pregnancy. Maternal anemia during the first half of pregnancy has been associated with an increased risk for preterm labor at less than 37 weeks’ gestation (Scholl & Reilly, 2000).

Maternal eating disorders prior to or during pregnancy increase the risk for LBW or SGA infants. These infants are more likely to have a smaller head circumference with a reduced brain size. A decreased food intake with less availability of nutrients to the fetus is the most likely cause of LBW, decreased head circumference is attributed to increased maternal stress level (Kouba et al., 2005). Prolonged periods of time without food can lead to increased maternal corticotropin-releasing hormone and can subsequently increase the risk for preterm delivery (Gennaro, 2005). Women living on low incomes do not get adequate nutrition during pregnancy. Nutritional support during pregnancy including basic and specialized nutrition education, and participation in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) have been demonstrated to increase the mean birth weight and reduce the odds for LBW infants. These infants are more likely to have a smaller head circumference with a reduced brain size. A decreased food intake with less availability of nutrients to the fetus is the most likely cause of LBW; decreased head circumference is attributed to increased maternal stress level (Kouba et al., 2005).

Maternal obesity is another nutritional concern. Infants of obese women (defined as body mass index [BMI] >30.0 kg/m<sup>2</sup>) have more than twice the risk for stillbirth and neonatal death after adjusting for other factors including smoking, alcohol, maternal age, parity, hypertension, and diabetes (Kristensen et al., 2005).

The increased use of bariatric surgery to correct obesity in the United States creates a new maternal risk factor with implications for pregnancy. There are two types of bariatric surgery: restrictive and malabsorptive (Edwards, 2005). The complications for the fetus and neonate appear to be secondary to maternal and fetal malnutrition, particularly deficiencies in vitamin B<sub>12</sub>. Infants are more likely to be SGA. Breastfed infants may have continued nutritional deficiencies such as organic failure to thrive or megaloblastic anemia; however, breastfeeding should not be discouraged in these mothers (Edwards, 2005). Most experts recommend that women wait at least 18 months to get pregnant following either type of bariatric procedure. Infants need to receive good follow-up care focusing on nutritional needs, weight gain, and growth patterns.

Maternal food-borne illness or ingestion of toxic substances during pregnancy can be harmful to the fetus. *Listeria monocytogenes* is a special concern in pregnancy, because about one third of all cases occur in pregnant women. Women who ingest food contaminated with *Listeria* do not usually feel ill; however, the fetus can be significantly affected. Eating food contaminated by microorganisms such as *Listeria* or substances such as heavy metals can cause abortion, stillbirth, preterm delivery, neonatal infections, fetal brain or kidney problems, or even maternal death. The “Food Safety for Moms-to-Be” program from the U.S. Food and Drug Administration (2005) educates pregnant women about prevention of food-borne illness. Teach pregnant women simple basic precautions such as handwashing, separating meats from other foods during storage, cooking food to proper temperatures, and placing food in the refrigerator to help prevent food-borne illness during pregnancy.

Pica is an interesting dietary practice seen more often in African American women during pregnancy. Women ingest substances such as starch, ice, clay, or dirt. Ingestion of these substances might be an attempt to increase iron or calcium in the diet and is not generally harmful to the fetus. Women who practice pica tend to be more underweight at the start of their pregnancy, have lower hematocrit levels, and smoke less than other women (Corbett et al., 2003). One concern is if the mother eats dirt that is contaminated with lead or other heavy metals. These heavy metals could be harmful and possibly cause anemia or lead poisoning (Silbergeld & Patrick, 2005).

Cultural dietary practices cannot be ignored as possible risk factors and must be assessed. Asian women who ingest betel nuts, which contain arecoline, are at higher risk for spontaneous abortion, LBW, preterm birth, and placental changes, and their infants are at risk for neonatal substance withdrawal (Garcia-Algar et al., 2005). The health care practitioner must become familiar with the food and complementary medicine cultural practices of local ethnic groups as they may affect pregnancy outcomes.

### Over-the-Counter and Complementary Drugs

Drugs taken during pregnancy can have harmful effects on the fetus whether they are controlled substances or over-the-counter medications. Despite warnings not to take any medications without consulting with their health care provider, many pregnant women take over-the-counter or nonprescribed medications during pregnancy, including complementary therapies that they might not consider as harmful. About 44% of women of childbearing age between the ages of 18 and 34 report taking at least one prescription drug within the past month and 10% report taking three or more drugs in past month (National Center for Health Statistics, 2005). Many women regularly take over-the-counter drugs such as cold remedies, aspirin, nonsteroidal anti-inflammatory drugs (NSAIDs), or herbal teas. In some cases women might take medications that could be harmful to the fetus before they know that they are pregnant. Even vitamins and dietary supplements taken in excessive dosages can be harmful to the fetus. Pregnant women with pre-existing medical problems such as asthma, arthritis, heart problems, diabetes, or epilepsy will usually have to continue to take their prescribed medications. In some cases, the prescribed medication will need to be changed to one that is less harmful to the fetus.

Health care providers must be cognizant of Food and Drug Administration (FDA) pregnancy categories and drugs that must be used with caution or that are contraindicated in pregnancy (Table 37-3). One concern is that thalidomide received FDA approval for treatment of leprosy in 1998 and is currently being evaluated in clinical trials for renal cell cancer, AIDS, and tuberculosis. Thalidomide was withdrawn from the market in the 1960s after it was linked to fetal limb-shortening birth.

### Table 37-3

<table>
<thead>
<tr>
<th>FDA Pregnancy Category</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Aspirin</td>
</tr>
<tr>
<td>B</td>
<td>Ibuprofen</td>
</tr>
<tr>
<td>C</td>
<td>Thalidomide</td>
</tr>
<tr>
<td>D</td>
<td>Doxycycline</td>
</tr>
<tr>
<td>X</td>
<td>Methotrexate</td>
</tr>
</tbody>
</table>
hemoglobin levels (HbA1c) should be maintained as close to glucose levels during pregnancy are not controlled. Glycosylated birth, or an infant with a congenital birth defect if blood diabetes have increased risks for having a miscarriage, a still-
change with each trimester. Women with pregestational pregnancy. This is sometimes difficult since insulin needs euglycemia for several months prior to pregnancy and during pregnancy. Ideally the woman with diabetes should maintain hypoglycemics should be changed to human insulin prior to lifestyle changes needed for a healthy pregnancy. Oral can teach the woman how to implement the dietary and team approach with a diabetes nurse educator and dietician retinopathy, and evaluation of the presence of neuropathy. A intestinal system, an eye exam to check for diabetic blood glucose levels, cardiovascular and renal health, gastro-
include a complete physical examination with evaluation of care prior to getting pregnant. The preconceptual visit should About 0.3% to 0.5% of all pregnancies in the United States complications increase with maternal age (Salihu et al, 2003).

MATERNAL MEDICAL AND OBSTETRIC CONDITIONS
Diabetes, hypertension, and bleeding disorders are some of the most common maternal complications of pregnancy. These complications can lead to preterm delivery or perinatal death, or can influence fetal morbidity. Rates of maternal complications increase with maternal age (Salihu et al, 2003).

Diabetes
About 0.3% to 0.5% of all pregnancies in the United States are complicated by pregestational diabetes (Bernasko, 2004). Women with pregestational diabetes should seek preconceptual care prior to getting pregnant. The preconceptual visit should include a complete physical examination with evaluation of blood glucose levels, cardiovascular and renal health, gastro-intestinal system, an eye exam to check for diabetic retinopathy, and evaluation of the presence of neuropathy. A team approach with a diabetes nurse educator and dietitian can teach the woman how to implement the dietary and lifestyle changes needed for a healthy pregnancy. Oral hypoglycemics should be changed to human insulin prior to pregnancy. Ideally the woman with diabetes should maintain euglycemia for several months prior to pregnancy and during pregnancy. This is sometimes difficult since insulin needs change with each trimester. Women with pregestational diabetes have increased risks for having a miscarriage, a still-birth, or an infant with a congenital birth defect if blood glucose levels during pregnancy are not controlled. Glycosylated hemoglobin levels (HbA1c) should be maintained as close to

<table>
<thead>
<tr>
<th>TABLE 37-3 Drug Safety Pregnancy Categories</th>
<th>Examples of Drugs in This Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Tested and were found to be safe during pregnancy</td>
</tr>
<tr>
<td>B</td>
<td>Used by many women during pregnancy and do not appear to have risks</td>
</tr>
<tr>
<td>C</td>
<td>No human studies to show that they are harmful to the fetus although there might be animal studies, or no animal studies conducted. May be used if the benefits outweigh the risks</td>
</tr>
<tr>
<td>D</td>
<td>Have evidence of harmful fetal effects from studies done after the drug was approved for use in pregnant women, but they can be used if there is a favorable benefit-to-risk ratio</td>
</tr>
<tr>
<td>X</td>
<td>Contraindicated during pregnancy because they have known teratogenic effects</td>
</tr>
</tbody>
</table>

Accutane, diethylstilbestrol (DES), thalidomide, and drugs for psoriasis such as Tegison (no longer marketed in the United States) or Soriatane, statins used for treatment of diabetes (discontinue before conception).
Hypertension in Pregnancy

Approximately 5% to 10% of pregnancies are complicated by hypertensive disorders. The National High Blood Pressure Education Working Group (NHBPWEG) Report on High Blood Pressure in Pregnancy (2000) recently updated the classification of hypertensive disorders in pregnancy (Table 37-4). Chronic hypertension exists when there is a history of hypertension prior to the pregnancy, but it can also be diagnosed during pregnancy for the first time. About 20% of women with pre-existing hypertension develop superimposed pre-eclampsia during their pregnancy (Seely & Solomon, 2003). Women with chronic hypertension who develop proteinuria are at increased risks for fetal complications, especially if serum creatinine levels are above 1.4 mg/dl at conception. They are also at increased risk for placental abruption. Gestational hypertension is diagnosed during pregnancy and usually disappears within 12 weeks after delivery. Pre-eclampsia is a pregnancy-specific disease that usually occurs after 20 weeks of pregnancy. It is characterized by hypertension and proteinuria. As the condition progressively worsens, maternal lab work indicates elevations in liver enzymes and low platelets.

PIH causes vasoconstriction with subsequent poor maternal circulation and placental perfusion. Decreased uteroplacental circulation compromises the fetus; therefore it is more likely to be growth restricted, SGA, or at increased risk for stillbirth. Women with PIH are also at increased risk for abruptio placentae. Delivery is the definitive treatment for PIH; however, it might not be appropriate if the fetus is immature. Early delivery will be based on stability of the mother and outcomes of fetal testing. A serious risk for the pre-eclamptic mother is eclamptic seizures due to cerebral edema and central nervous system excitability. Seizures increase the risk for a placental abruption. Therefore, if the mother’s condition worsens, early delivery will be elected as the definitive treatment. However, the ability of the fetus to survive must be considered. Corticosteroid administration is advised at 33 to 34 weeks’ gestational age and may be beneficial for promotion of fetal lung maturity (NHBPWEG, 2000). Patients with preeclampsia tend to have infants with lower gestational ages at delivery and lower birth weights than do patients with gestational hypertension alone (Barton et al, 2001). Women with severe gestational hypertension (defined as BP >160/110) without proteinuria tend to have higher rates of preterm delivery and are more likely to have a baby who is SGA as compared to mothers who are normotensive or have mild gestational hypertension or mild pre-eclampsia (Buchbinder et al, 2002). The earlier that hypertensive disease occurs in pregnancy, the more likely it is that proteinuria will develop. The development of proteinuria in women with gestational hypertension increases the chances for adverse maternal and neonatal outcomes (Barton et al, 2001).

If pre-eclampsia worsens, the pregnant woman is admitted to the hospital for stabilization and delivery. If the woman has a seizure, oxygen should be provided during and immediately following the seizure and the fetus should be monitored for signs of distress. Magnesium sulfate is the drug of choice to prevent central nervous system excitability from cerebral edema. Infants rarely have harmful effects from in utero exposure to magnesium sulfate prior to delivery, but should be monitored for signs of respiratory depression or hypotonia.

Ethnic differences in the progression of hypertensive disorders in pregnancy have been noted. African American women were hospitalized earlier in the pregnancy for treatment of PIH. Their babies had lower gestational age and birth weight. African American women also had a higher incidence of abruptio placentae, stillbirths, and neonatal deaths than

<table>
<thead>
<tr>
<th>Type</th>
<th>BP Parameters</th>
<th>Proteinuria</th>
<th>Other Manifestations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic hypertension</td>
<td>140 mm Hg systolic; 90 mm Hg diastolic</td>
<td>Not present</td>
<td>Hypertension that is present before pregnancy or within first 20 weeks of gestation.</td>
</tr>
<tr>
<td>Gestational hypertension</td>
<td>&gt;140 mm Hg systolic; &gt;90 mm Hg diastolic in a woman who was previously normotensive</td>
<td>Not present</td>
<td>BP returns to normal within 12 weeks of delivery.</td>
</tr>
<tr>
<td>Pre-eclampsia</td>
<td>&gt;140 mm Hg systolic; &gt;90 mm Hg diastolic</td>
<td>&gt;0.3 g in 24 hours</td>
<td>Headache, blurred vision, abdominal pain, Low platelet count, Hemolytic elevated liver function tests, Eclamptic seizures, Disseminated intravascular coagulation, Platelet count &lt;100,000/mm³, Increase of alanine aminotransferase (ALT) or aspartate aminotransferase (AST) to abnormal levels</td>
</tr>
</tbody>
</table>

Pre-eclampsia superimposed on chronic hypertension

<table>
<thead>
<tr>
<th>BP Parameters</th>
<th>Proteinuria</th>
<th>Other Manifestations</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;140 mm Hg systolic; &gt;90 mm Hg diastolic or a sudden increase in BP that has been previously well controlled</td>
<td>&gt;0.3 g during 24 hours</td>
<td></td>
</tr>
</tbody>
</table>

other ethnic groups. More Hispanic women developed proteinuria during pregnancy, and their disease was more likely to progress to severe pre-eclampsia (Barton et al., 2002).

**Premature Rupture of Membranes**

Premature rupture of membranes (PROM) is a cause of preterm delivery and occurs in about 3% of all births. Once the membranes rupture, the fetus is at high risk for problems related to oligohydramnios, cord compression, chorioamnionitis, and abruptio placentae. Women with PROM may report that they are leaking fluid from the vagina or may have experienced a gush of fluid. Sterile speculum exam, nitrazene testing, and microscopic examination of fluid for ferning are methods to evaluate if membranes have ruptured. The decision of whether to deliver or to use expectant management must weigh the advantage of postponing delivery until gestational age increases against the risk for maternal or fetal sepsis. About 13% of pregnancies complicated with PROM develop chorioamnionitis (Ramsey et al., 2005). Signs of intrauterine infection include fever greater than 100.4°F (38.0°C), uterine tenderness, and maternal or fetal tachycardia. Results of the white blood cell count tests should be used judiciously as indicator of infection, especially if steroids have been given within the previous 5 to 7 days.

Fetal outcomes after PROM are related to gestational age at time of membrane rupture and whether the infant is delivered without complications of infection or asphyxia from cord compression or prolapse. Prior to 23 weeks’ gestation, if the fetus is delivered after PROM it will not survive. As gestational age increases from 23 to 32 weeks’ gestation, outcomes after PROM improve. Preterm PROM near term occurs between 32 to 36 weeks’ gestation, and infants who are delivered at this time are more likely to survive if they do not have other complications. Sometimes in the absence of other indications, a wait-and-see approach might be taken where delivery is not expedited. Maternal monitoring for signs of infection (i.e., fever, uterine tenderness, maternal and fetal tachycardia) and initiation of antibiotics have been shown to prolong the interval from PROM to delivery and improve fetal outcomes. A single course of corticosteroids should be administered to the mother to promote fetal lung maturity if PROM occurs prior to 32 weeks or up to 34 weeks if fetal immaturity is suspected (Mercer, 2003). If PROM occurs at earlier gestational ages, the risk for chorioamnionitis increases. At delivery, infants of women with chorioamnionitis tend to be of younger gestational age and to weigh less than infants of women who do not have chorioamnionitis. Neonatal morbidity is increased when chorioamnionitis occurs as a complication of PROM. The use of prophylactic antibiotics given to the mother when chorioamnionitis is present does not prevent poor neonatal outcomes (Ramsey et al., 2005). However, antibiotic therapy has been demonstrated to lower the number of infants with respiratory distress syndrome, death, early sepsis, severe intraventricular hemorrhage, and severe necrotizing enterocolitis. Antibiotics also reduced the incidence of group B streptococcus sepsis, amnionitis, and pneumonia (Mercer, 2003).

**Maternal Infections**

Maternal infections can be transmitted to the infant in utero, during the birth process, or even during the postpartum period. Fetal infections can cause congenital anomalies, LBW, respiratory illness after birth, or even death. Infectious agents include protozoal infections, helminthic infections, sexually transmitted infections, viruses, and bacterial organisms. Hepatitis and HIV/AIDS can be passed to the fetus during pregnancy, during the birth process, or during breastfeeding. In the United States about 280 to 370 infants a year still contract HIV from their mothers (March of Dimes, 2005b). In 2002 the CDC made the recommendation that all pregnant women be offered universal screening for HIV/AIDS because of the effectiveness of the antiretroviral medications in prevention of vertical transmission from mother to baby. A protocol that includes preconceptional HIV/AIDS testing, initiation of zidovudine (ZDV) as early as 14 weeks’ gestation and throughout pregnancy, and continued administration of ZDV to the newborn for 6 weeks after birth decreases the risk of transmission to the infant by 66%. In cases where the pregnant woman in labor has not been treated during pregnancy, giving a combination of ZDV and nevirapine has been demonstrated to help reduce the risk to the baby. Delivery by cesarean section prior to rupture of membranes is recommended as another way to decrease transmission risks.

Every pregnant woman must be screened for risk factors for infection. Early identification and treatment of women with STDs or blood-borne infections will improve neonatal outcomes. Infectious conditions are discussed elsewhere in this book.

**Abruptio Placentae**

Abruptio placentae, or premature separation of the placenta prior to delivery, is a leading cause of stillbirth and neonatal mortality. Placental separation is thought to be due to changes in placental vasculature, thrombosis, and reduced placental perfusion. It has been speculated that there is a genetic basis for abruptio placentae that causes these changes. Placental separation occurs in several ways. In marginal separation, the edges of the placenta separate and bright red bleeding is present. Occult or hidden abruptio placenta occurs when the edges of the placenta are intact but the central part of the placenta detaches from the uterus, allowing blood loss to accumulate behind the placenta without any outward signs of bleeding. Complete abruptio placenta occurs when the placenta totally detaches, a situation that is incompatible with fetal survival. Over half of neonatal deaths complicated by abruptio placentae are because the infant was born prematurely. Infants of mothers with abruptio placentae who survive must be closely monitored for signs of blood loss and shock.

Risk factors for abruptio placentae include smoking, multiple pregnancy, and maternal age greater than 50. Increased risk in older women could be related to increased rates of chronic hypertensive disorders or aging of the uterine blood vessels. Although the risk of abruptio placentae increases with a multiple pregnancy as the number of fetuses increases from singleton to triplet pregnancies, perinatal death from abruptio placentae is higher for singletons than for multiples. IUGR might play a factor in this finding, because singleton infants delivered in abruptio placentae cases weigh less than other infants of the same gestational age, indicating IUGR. The increased stillbirth rate in singletons might be related to chronic fetal compromise, LBW, or blood loss from the abruptio, whereas in multiples a different etiology could be a factor (Salihu et al., 2005).
POSTPARTUM RISK FACTORS

After birth the five leading causes of infant death are complications of congenital anomalies, complications of prematurity and LBW, SIDS, result of maternal complications, and placental-cord complications. Congenital anomalies account for most neonatal deaths in the first month of life. Infants who are LBW are more likely to die from complications of prematurity (respiratory distress, infections, or anemia), maternal complications in pregnancy, or placenta or cord conditions. In addition to these leading causes of death, other risk factors could affect the health of the neonate or cause injury such as maternal smoking or drug usage. Providing information and anticipatory guidance to the parents to increase awareness of some of these factors might be enough to protect the infant and to promote positive outcomes.

Drugs Excreted in Maternal Milk

Maternal medications taken while lactating are a concern as they may alter the milk supply or cross to the infant through the milk supply. Although many medications have been demonstrated to be safe, there are still others that have not been reported about in the literature. Psychotropic drugs pose a special concern since there has been an increase in their use. These drugs and their metabolites have long half-lives and are detectable in infant tissues and the developing brain. The long-term consequences of this exposure have not been thoroughly studied. As new drugs are placed on the market, their safety for the infant must be evaluated. Some untoward effects on the infant from use of prescribed maternal drugs include possible immune suppression; neutropenia; skin rash; central nervous system changes including irritability, restlessness, sleepiness, lethargy, or convulsions; or gastrointestinal effects such as feeding problems, vomiting, diarrhea, slow weight gain, blood in stool, jaundice, or dark urine. A comprehensive list of drugs, foods, and environmental agents that are excreted in human milk and that could be potentially harmful to neonates is available from the American Academy of Pediatrics (AAP).

The AAP Committee on Drugs (2001b) recommends that whenever drugs are prescribed for lactating women, the following factors be considered. When a medication is absolutely necessary, the baby’s pediatrician and mother’s physician should consult together to select the most appropriate drug for the mother with minimal effects on lactation and minimal transfer to the infant. Select the safest drug when there are several to choose from. Consider measuring the infant’s blood concentration of the drug if there are potential risks from the drug for the infant. Advise the nursing mother to take the medication immediately after breastfeeding the infant or after a feeding that will be followed by an expected infant sleep period, to minimize infant drug exposure (AAP, 2001b).

Sudden Infant Death Syndrome (SIDS)

SIDS is the leading cause of death in infants after the neonatal period despite dramatic reductions in the SIDS death rate since 1992. That was the year when the American Academy of Pediatrics implemented the “Back to Sleep” campaign. Parents were encouraged to place their infants on their backs instead of prone for sleeping. This change in practice lowered the SIDS death rate by 50%, from 1.2 per 1000 live births in 1992 to 0.56 per 1000 live births in 2001 (AAP, 2005b).

Although this decrease has been a dramatic improvement, SIDS still is one of the leading causes of infant death. More than 70 causes of SIDS have been proposed. SIDS has been blamed on environmental factors such as soft bedding, overheating, entanglement in blankets, immunizations, smoke exposure, or bed sharing with parents. Genetic factors have also been blamed for findings. Prolonged QT interval has been found in up to 30% to 35% of SIDS cases. The diminished arousal response that precedes death in infants with SIDS might be explained by possible structural defects in the brain that control cardiac and respiratory function. SIDS is not always sudden; some infants have evidence of chronic hypoxia on autopsy (Burnett & Adler, 2004). In reality the cause of SIDS is most likely multifactorial. The triple risk theory proposes that multiple complex factors (including genetics, prenatal risk factors, and environmental risk factors) might make some babies more vulnerable to environmental triggering events and unable to respond to these events through usual homeostatic mechanisms (AAP, 2005b; Burnett & Adler, 2004).

Infants at risk for SIDS have many of the same risk factors seen with prematurity and LBW. Preterm or LBW infants and infants with a history of apnea are at increased risk for SIDS. The peak age at death from SIDS is between 2 to 4 months. SIDS is unusual after the age of 6 months. Ethnic disparities exist with SIDS. It is more common in African Americans and Native Americans, with death rates in black infants 2.5 times that of white infants. Maternal risk factors include young, single mothers with a history of prenatal smoking or substance abuse. Environmental risk factors for SIDS include maternal smoking, soft bedding or sleeping surfaces, thermal stress or overheating, and bed sharing with parents or siblings, especially if a bed partner consumes alcohol (AAP, 2003b; Hunt, 2005). Term infants who have had apparent life-threatening events with apnea, cyanosis, choking and gagging are at increased risk for SIDS (Burnett & Adler, 2004). No definitive link between SIDS and immunizations has been established.

Sleeping in the prone position has been highly associated with SIDS and is one reason the “Back to Sleep” campaign has been so successful in reducing SIDS death rates. The rate of SIDS increases for preterm infants who are placed in the prone position. Many parents of premature infants place their infant to sleep on their stomachs or sides once at home. It is possible that new parents are learning the practice of putting their baby in either the prone position or side-lying position by watching caregivers in the NICU. Neonatal care practices that place preterm infants in the prone or side-lying positions are providing poor role models for parents. Every time parents see their baby in a prone or side-lying position while in the hospital, they are getting reinforcement of a poor practice about how to provide care to their baby at home. Infants become habituated to the prone position for sleeping, especially if they have had a prolonged hospitalization, which makes it more difficult for parents to change the baby’s sleeping position to the back-lying position (Burnett & Adler, 2004). Another concern is that about 20% of SIDS deaths occur while the infant is in the home of a child-care provider. Placing the infant in an unaccustomed prone position for sleep increases the risk for SIDS. Many child-care providers are not knowledgeable of newer recommendations for supine sleep positions. Nurses need to educate parents to share information
with their childcare providers about placing the baby on the back to sleep (AAP, 2005b). Neonatal nurses must continue to educate each parent about the risk factors for SIDS and remind parents that the safest place for a baby is in its own crib in the parents’ room for the first 6 months.

**Child Abuse**

Child abuse in infants is sometimes difficult to identify. Parents of an injured infant arrive for emergency treatment and are severely distraught and worried about their child's injuries. They often offer reasonable explanations for the injury that must be ruled out with medical tests. The victims, the babies, cannot speak for themselves to describe what happened. New parents are subject to many stressors that could trigger child abuse, such as lack of sleep, financial strain, and dealing with inconsolable infants. Health care providers have a legal and ethical duty to report cases of suspected child abuse to child protective services (Smith, 2003). Two forms of child abuse are discussed further: shaken baby syndrome and Munchausen syndrome by proxy.

Shaken baby syndrome (SBS) describes a serious form of head trauma caused by abusive shaking of an infant causing a whiplash-type injury. When the infant is shaken, the head flops back and forth, causing rapid acceleration, deceleration, and/or rotational forces of the brain within the skull, stretching, shearing, and tearing the blood vessels of the brain. Infants are more at risk for severe injury from SBS because of their weak neck muscles, proportionately large head size with soft skull and open fontanelles, and immaturity of brain development (King et al, 2003).

Several types of injuries occur with SBS. Intracranial injuries cause direct brain injury and damage to the axons. Shearing forces exerted on the veins that bridge from the dura to the brain cause intracranial bleeding. During shaking there is a lack of oxygen to the brain that is further compounded by chemical processes that occur in the damaged cells. These injuries lead to swelling of the brain and increased intracranial pressure that further compromises brain oxygenation. At least half of all SBS children also have retinal hemorrhages (Reece & Kirschner, 2005). Whereas external signs of injury to the face or head are uncommon, injuries or bruising of the long bones, thorax, or abdomen may occur as a result of firmly grasping the infant during the shaking episode (Reece, 2005).

SBS most often results when a parent becomes frustrated with an infant who is crying and inconsolable. Parents who are stressed with the parenting role, parents of premature infants, those who are sleep deprived, or parents who do not have support or help to care for their baby's needs may have low tolerance of infant crying. In frustration they may pick up the baby and shake it to try to quiet the baby. Newborns are more susceptible to the forces of shaking and may sustain injury even if not shaken as roughly as an older child. Once a parent shakes the child and gets a response, the parent might shake the child again over time, causing the infant to be injured repeatedly. Because the intracranial bleeding can be slow initially, the child might not manifest symptoms until 48 to 72 hours after the injury.

When parents seek medical attention for the infant, the history of events that preceded the infant's symptoms is often vague. The father or boyfriend is more likely to be the person responsible for the injury, and the mother may be unaware that the shaking incident occurred (King et al, 2003). Signs of SBS vary based on extent of the injury and are sometimes subtle, such as feeding difficulties, vomiting, lethargy, hypothermia, failure to thrive, and increased somnolence. More life-threatening signs include seizures, bulging fontanelle, apnea, coma, bradycardia, or complete cardiovascular collapse. Outcomes are poor for children who present with coma; approximately 60% will die. Sequelae for survivors of SBS include severe neuromotor impairment, visual impairment, and developmental delay. They may require shunting for hydrocephalus. Long-term occupational therapy, physical therapy, and speech therapy will be needed to help the child achieve his or her maximum potential (Wallis & Goodman, 2000). Approximately 20% of infants might die as a result of the shaking abuse. A small percentage of children will have no outward ill effects from the shaking. The remaining children have long-term sequelae including ongoing neurologic injuries and visual impairment. A delay of 12 to 18 months might occur before symptoms are evident (King et al, 2003).

New parents need to be taught not to shake their infant at any time. Prior to discharge, time should be spent exploring parents’ concerns about taking a newborn home, their sources of support, and their coping strategies under stress. Referral for stress management techniques, anger management, and provision of a parenting hotline number might help prevent this devastating injury.

**Munchausen Syndrome by Proxy**

Munchausen syndrome by proxy (MSBP) is a form of child abuse where a parent, usually a mother, fabricates illness in a dependent child in order to draw attention to herself as the parent of a sick child. Four criteria are required for a diagnosis: (1) A parent or guardian fabricates illness in the child; (2) the child is presented for medical care; (3) the perpetrator denies knowledge of the cause of the child’s illness; and (4) the signs and symptoms subside if the child is separated from the perpetrator (Barber & Davis, 2002). The diagnosis of MSBP includes two diagnoses, one for the child and one for the parent. The parent response might range from exaggerating symptoms of the sick child to actually inducing the symptoms in the child by attempts to suffocate or poison the child. About 1200 new cases of MSBP occur each year (Schreier, 2002). Some of the most common types of fabrications include gastrointestinal (diarrhea), neurologic (seizures), infections (fevers), dermatologic (strange rashes), and cardiopulmonary (acute life-threatening events). Some children will die as a result of the parent’s abuse or ministrations. Unwittingly, physicians or health care workers can be drawn into the situation, attempting to help the child based on the parent’s descriptions of what is occurring. Health care professionals might prescribe unnecessary diagnostic tests or treatments for the child (Yonge & Haase, 2004). Health care professionals need increased awareness of MSBP and should question cases where children are seen constantly for parentally reported conditions not witnessed by anyone else. Cases where children who are not gaining weight begin to gain during hospitalization are also suspect. The child may need to be placed into a protective environment if the parent is approached and refuses to get psychologic help, or if the child has been subjected to a major illness because of the parent. MSBP has long-term psychologic implications for the child, and when older, the child is at risk to develop MSBP (Barber & Davis, 2002).
PERINATAL CARE IN DEVELOPING NATIONS

Pregnant women in developing nations have many of the same risk factors for prematurity and LBW as women in the United States such as poor prepregnancy physical condition, inadequate spacing between pregnancies, inadequate nutrition, low weight gain during pregnancy, maternal anemia, and lack of access for perinatal care. They also have to contend with other risk factors not even seen in the United States, such as malaria (Tucker & McGuire, 2004). Poverty and lack of education about pregnancy health are sometimes compounded by lack of skilled care providers, lack of transportation to health care centers, problems of war, civil unrest, and low status of women (USAID, 2005).

Maternal and neonatal death rates in developing nations are much higher than in the United States. Countries in sub-Saharan Africa and Asia have some of the highest rates of maternal death and neonatal death. The U.S. maternal death rate ranged from 8 to 12 per 100,000. In the same year in Africa it was 1080 per 100,000. According to the World Health Organization (WHO, 2005), each year more than 500,000 mothers worldwide die during pregnancy, and 4 million babies will die during the first 3 weeks of life; most of these are from developing nations (Mavalankar & Rosenfeld, 2005). Each day 11,000 infants under the age of 4 weeks of age dies and another 11,000 are stillborn (USAID, 2005). The primary causes of neonatal death globally are estimated to be prematurity (28%), severe infection (26%), and asphyxia (23%) (Lawn et al, 2005). Many more die because of the unavailability of basic obstetric and pediatric care services.

Many neonates worldwide die from preventable conditions. Some congenital anomalies could have been prevented with maternal folic acid supplementation. Death from birth asphyxia might have been prevented with timely neonatal resuscitation at delivery. Deaths from prematurity could have been prevented with adequate prenatal care or a system of neonatal care for premature infants. Death from infections could have been prevented with immunizations, antibiotics, patient teaching about cord care, or maternal treatment for HIV during pregnancy.

Infections kill more women and babies in developing nations because basic immunization practices that are taken for granted in the United States, such as tetanus or rubella vaccination, may be unavailable to women or infants in developing nations. Tetanus, a disease that can be easily prevented, accounts for about 10% of neonatal deaths in developing nations. Tetanus develops in newborns because of living in remote village locations, a lack of basic transportation, or poor infrastructure making it difficult to transport women or infants with problems to specialized centers. Sometimes the policies of developing nations interfere with the provision of safe obstetric care. For example, some countries limit the type of health care providers who can perform cesarean sections or administer anesthesia, thereby limiting access to these services (Mavalankar & Rosenfeld, 2005).

Third, basic training and equipment for infant resuscitation at birth will help prevent some of the poor birth outcomes related to birth asphyxia. Many facilities in developing nations are working with antiquated equipment as they attempt to provide care for neonates. Textbooks are often outdated or are not written in the native language of the health care provider. The American Academy of Pediatrics (AAP) Neonatal Resuscitation Program (NRP) has been demonstrated to be an effective method to provide immediate resuscitative care to neonates. This program has been translated into at least 20 languages and is being taught in other countries through formally organized courses through the AAP or by independent efforts of NRP instructors (AAP, 2005a). Countless infant lives can be saved worldwide through implementation of the neonatal resuscitation guidelines (Contributors and Reviewers, 2000). Neonatal mortality is lower when the mother has received professional care during the antenatal period and during childbirth.

The fourth recommendation is to provide postpartum care that includes parent teaching about infant care and family planning services to help prevent close interpregnancy levels. Strategies for successful breastfeeding, proper cord care, recognition of signs of illness, and promotion of psychosocial well-being are all skills that parents need to have in order to promote optimal newborn health. Women of childbearing age need to learn the importance of being in optimal physical condition prior to and during pregnancy. Family planning services will help women become empowered to make choices about when to have children and will help prevent unnecessary abortions.

There have been some inroads made to improve maternal and child health internationally. There are still many barriers affecting about half of pregnant women worldwide. It is more prevalent in nonindustrialized nations because of poor nutrition, iron-deficient diets, presence of parasitic disease, and incidence of HIV/AIDS. Women who are anemic are less likely to withstand blood loss during delivery and have increased risks of perinatal death, LBW, stillbirths, and prematurity (WHO, 2005). Optimal timing and spacing of pregnancy is another important part of perinatal care to promote mothers who are in the best physical condition prior to conception. Prevention and control of infection are also important during the prenatal period. Proper medical treatment of women who are infected with sexually transmitted diseases or HIV/AIDS during pregnancy will increase the infant’s chances of healthy survival.

Antenatal screening alone cannot predict or prevent most problems during pregnancy or delivery; therefore the second intervention is that all pregnant women should be considered high risk and must have access to skilled birth attendants and timely emergency obstetric care. Nations with the highest rates of neonatal and maternal mortality are those that have the lowest number of births attended by a skilled birth attendant. In some countries access to medical care is difficult because of living in remote village locations, a lack of basic transportation, or poor infrastructure making it difficult to transport women or infants with problems to specialized centers. Sometimes the policies of developing nations interfere with the provision of safe obstetric care. For example, some countries limit the type of health care providers who can perform cesarean sections or administer anesthesia, thereby limiting access to these services (Mavalankar & Rosenfeld, 2005).

Fourth, family planning services to help prevent close interpregnancy levels. Strategies for successful breastfeeding, proper cord care, recognition of signs of illness, and promotion of psychosocial well-being are all skills that parents need to have in order to promote optimal newborn health. Women of childbearing age need to learn the importance of being in optimal physical condition prior to and during pregnancy. Family planning services will help women become empowered to make choices about when to have children and will help prevent unnecessary abortions.

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for many nations, including creation of the infrastructure needed to support the WHO recommendations and training of adequate health care professionals to provide care. Some countries are beginning to see successes in reducing their maternal and infant mortality. A sustained worldwide effort is needed to continue to improve these outcomes.

SUMMARY

This chapter has presented an overview of prenatal, intrapartal, and postpartal risk factors that influence neonatal health. The perinatal nurse must be aware of potential risk factors in order to screen pregnant women and provide counseling and support. Presence of risk factors can point to an increased chance that a baby will be born with problems; however, many more babies will be born without problems even though they have mothers with risk factors. Prediction of which neonates will be at risk helps ensure that adequate personnel and equipment are available at birth to manage problems, should they occur. Patient education about modifiable risk factors and support for altering health-compromising behaviors during pregnancy can help prevent some adverse neonatal outcomes.

REFERENCES


