Prenatal and intrapartum strategies to prevent prematurity: A case study

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Article purpose
The purpose of this article is to provide an overview of the risk factors, pathophysiology and management of preterm labor and premature birth.

Objectives
After reading this article, the learner will be able to:
1. Identify and outline the evidence of who is most at risk for preterm labor and premature birth.
2. Discuss the etiology of preterm labor and premature birth.
3. Analyze the state of the science to diagnose, manage and provide care for women experiencing preterm labor and premature birth.

Case study
This article reviews known risk factors for spontaneous or indicated premature birth. Given the presence of certain risk factors, the ability to predict who will experience a premature birth can help nurses effectively provide care for mothers and their infants.

The article presents a case study of Cynthia, a 41-year-old pregnant woman. The case study builds throughout the content to include Cynthia’s medical history as well as obstetric, demographic, sociobehavioral, biologic and physiologic risk factors that may contribute to her overall pregnancy health.

Questions in the study help readers apply module content to Cynthia’s condition to identify and help reduce her risk for premature birth and offer appropriate nursing interventions.

Premature birth
Premature or preterm birth, defined by the World Health Organization (WHO) as a live birth occurring before 37 weeks gestation, affects more than 15 million babies globally each year (WHO, 2014). The rate of premature birth in the United States has steadily declined from a high of 12.8 percent in 2006 to 11.5 percent in 2012 (Figure 1). However, it is still well above the March of Dimes (2014) goal of 9.6 percent by 2020.

Table 1 identifies sequelae associated with preterm birth. Because premature birth is a leading cause of perinatal mortality, it is imperative for health care professionals to understand the etiology behind it so they may adequately diagnose, manage and care for women and their babies.

<table>
<thead>
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<th>Table 1. Sequelae associated with preterm birth</th>
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Part of the challenge in identifying who is at risk for premature birth lies in the unclear etiology and the combination of maternal, fetal, physiological and environmental factors that are at play. Approximately 30 to 35 percent of premature births are medically indicated and result either from maternal or fetal health concerns (Goldenberg, Culhane, Iams & Romero, 2008). Another 40 to 45 percent of premature births are a result of spontaneous preterm labor, which is manifested by regular contractions of the uterus resulting in cervical change prior to 37 weeks gestation (American College of Obstetricians and Gynecologists [ACOG], 2012a, 2014b; Iams, Romero, Culhane & Goldenberg, 2008). The interval between preterm labor and premature birth can be days to weeks, with many women experiencing multiple episodes of preterm labor before giving birth. However, with appropriate management, as little as 10 percent of women who present with preterm labor experience a premature birth within 7 days (ACOG, 2012a), and up to 70 percent go on to deliver at term (McPheeters et al., 2005).

### Risk factors for premature birth

Table 2 identifies risk factors associated with premature birth.

#### Obstetric risks

One of the strongest risk factors for premature birth is a previous premature birth (ACOG, 2012b; Muglia & Katz, 2010). Women who have had a previous premature birth are up to 50 percent more likely than women who haven’t given birth prematurely to experience a recurrent preterm delivery (Goldenberg et al., 2008).

<table>
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<th>Table 2. Risk factors associated with preterm birth</th>
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<td>- Uterine abnormalities</td>
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Important factors in the rise of the preterm birth rate in the United States between 1989 and 2004 are non-medically indicated labor induction and cesarean delivery (Chang et al., 2013). Elective deliveries before 39 weeks are common and increase the risk for premature birth and infant morbidity and mortality. While there are specific indications for labor induction before 39 weeks gestation, ACOG and the Society for Maternal-Fetal Medicine (SMFM) (2013) strongly assert that a non-medically indicated early-term delivery is not appropriate, even with mature fetal lung studies. Approximately 10 to 15 percent of births in this country are the result of non-medically indicated elective early-term deliveries between 37 0/7 and 38 6/7 weeks gestation (Jensen, White & Coddington, 2013). Despite their size, infants born in this gestational range have a higher likelihood of respiratory distress syndrome (RDS), transient tachypnea of the newborn, pneumonia, hypoglycemia, admission to the neonatal intensive care unit (NICU) and death than infants born at 39 to 40 weeks gestation (ACOG & SMFM, 2013). In recent years, numerous strategies have been
employed to reduce rates of non-medically indicated inductions and cesarean births, including education for nurses, doctors, pregnant women and the general public about the avoidable risks of early elective deliveries, institutional policies that make it difficult to impossible to schedule a non-medically indicated near-term induction, insurance pressures and quality accrediting agencies.

Multiple gestations (twins, triplets or more) are at increased risk, almost 10-fold, for premature birth (Aboulghar & Islam, 2013; Goldenberg et al., 2008; March of Dimes, Partnership for Maternal, Newborn & Child Health, Save the Children & WHO, 2012.) This increased risk is believed to be caused by overdistention which leads to contractions and preterm premature rupture of membranes (PPROM). PPROM is rupture of membranes before 37 weeks of pregnancy.

Short interpregnancy intervals, especially intervals <6 months between pregnancies, are associated with up to 2 times the risk for premature birth (Conde-Agudelo, Rosas-Bermúdez & Kafury-Goeta, 2006; Smith, Pell & Dobbie, 2003). Goldenberg and colleagues (2008) postulated that this increased risk may be related to the time necessary for the uterus to return to normal size after delivery. The risk is even greater for women with complications, such as a premature birth or intrauterine growth restriction (IUGR), in a previous pregnancy coupled with demographic factors like age, education, marital status and race.

Demographic risks
Significant racial disparities in preterm birth exist, with black women in the United States experiencing the highest rate (Figure 2). While the mechanisms behind this phenomenon are unknown, researchers hypothesize that black women may be poorer, less educated and more likely to be unmarried, three characteristics that are linked to increased risk of premature birth (Gennaro, 2005; Goldenberg et al., 2008; Muglia & Katz, 2010). Minority women of low socioeconomic status are more likely to live in crowded, disadvantaged neighborhoods (Kent, McClure, Zaitchick & Gohlke, 2013) where air pollution is higher (Ponce, Hogatt, Wilhelm & Ritz, 2005; Wu, Ren, Delfino, Chung, Wilhelm & Ritz, 2009; Yorifuji, Naruse, Kashima, Murakoshi & Doi, 2015). Chronic stressors, like poverty and racism, may result in neuroendocrine changes that ultimately lead to premature birth (Lyndon, 2006).

Married women experience lower levels of premature birth compared to their unmarried counterparts. Being married and having a committed partner is associated with social and financial support and stability (El-Sayed, Tracy & Galea, 2012; Zain, Low & Othman, 2014); thus, these women experience less stress and anxiety than single women. Unmarried women with lower socioeconomic status and lower levels of education experience higher levels of psychological stress, depression and substance abuse, which may contribute to greater risk for premature birth (Masho, Chapman & Ashby 2010; Shiozaki et al., 2014; Zain et al., 2014).

Women younger than 17 are at higher risk for a premature birth than older women (Vaughan, Clearly & Murphy, 2013). Pregnant teenagers are more likely to be poor, less educated and unmarried (El-Sayed et al., 2012; Thomson, Bender, Lewis & Watkins, 2008). Poor pregnancy outcomes can be associated with physiologic immaturity of the uterine or cervical blood supply as a result of becoming pregnant at a young age (Al-Haddabi et al., 2014; Chen et al., 2007). Inadequate weight gain during pregnancy is a risk as the teenage mother’s growing body competes with the fetus for nutrients (Fraser, Brockert & Ward, 1995). The smaller size of the uterus and pelvic bones, due to physiologic immaturity, may play a part in the increased risk of premature birth in teenage mothers (Lao & Ho, 2000; Moerman, 1982). On the other end of the spectrum, women older than 40 are at significantly higher risk for premature birth than younger women (Laopaiboon et al., 2014; Seoud, Kazma, Khalil, Melhem, Nassar & Usta, 2002). Increased incidence of congenital fetal anomalies or comorbid chronic diseases in older mothers may be
related to the increased risk (Auger, Abrahamowicz, Wynant & Lo, 2014).

Premature birth is a global problem. An estimated 60 to 85 percent of premature births worldwide occur in Africa and Asia (Beck et al., 2010; Blencowe et al., 2012) due to higher frequency of premature birth among women of African descent and the large number of births in Asia. In lower-income countries, such as Pakistan and Indonesia and the sub-Saharan countries of Botswana, Zimbabwe and Mozambique, 11.8 percent of births are considered preterm, supporting that poorer families are at greater risk (Blencowe et al., 2012).

**Sociobehavioral risks**

Sociobehavioral characteristics are becoming increasingly important when assessing premature birth. Women who are underweight before pregnancy are at risk for premature birth caused by low blood volume and uterine blood flow, vitamin deficiencies and increased infection risks (Goldenberg et al., 2008). Overweight and obese women are at risk for pregnancy complications, including preeclampsia, gestational diabetes and fetal anomalies, all of which increase the risk of premature birth (ACOG, 2013c; Cnattingius et al., 2013). Obesity, which is associated with systemic inflammation, can significantly increase

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### Case study part 1: Cynthia

Cynthia (G5 T1 P2 A1 L3) is a 41-year-old African-American woman who presents on April 1 to the clinic for prenatal care. She is approximately 14 weeks pregnant by her last menstrual period (LMP).

| Past medical history | • Hypertension (HTN) diagnoses 2 years ago after the birth of her last child. Currently not medicated: “I keep it in control with my diet.”
| Past surgical history | None
| Obstetric history | • 2005 First-trimester termination of pregnancy
| | • 2009 Full-term vaginal delivery post induction of labor for preeclampsia, 3,400 g
| | • 2011 Preterm normal spontaneous vaginal delivery (NSVD) at estimated gestational age (EGA) 31 weeks, reported spontaneous contractions, hospitalized with cervical change and delivered within 2 days
| | • 2013 Preterm NSVD at EGA 35⁹/₇ weeks, reported spontaneous contractions with spontaneous rupture of membranes, hospitalized and delivered within 5 days
| Social history | • Smoked one pack per day (PPD) prior to pregnancy, “cut down dramatically” to 1/4 PPD when learned of this pregnancy
| | • Denies alcohol or drug use
| | • Denies domestic violence/intimate partner violence
| | • Works as a nurse’s aid at a local nursing home; worries because she heard facility is making cutbacks to the work force
| | • Recently separated from husband of 14 years
| | • Associate’s degree
| Family history | • Mother: Essential HTN, type 2 diabetes mellitus, obese
| | • Father: Deceased at age 70 from myocardial infarction
| | • Sister: History of preterm birth
| Evaluation | • Height 66 inches, weight 253 pounds
| | • BP 136/80 HR 102
| | • Uterine size 15 weeks consistent with LMP and singleton pregnancy
| | • + fetal heart rate
| | • + clue cells on wet mount

**Question for nurses:** Describe Cynthia’s risk factors for premature birth.
the likelihood of delivering a premature baby even in women who do not have chronic diseases, such as hypertension, that often are associated with obesity (Smith, Hulsey & Goodnight, 2008).

Insufficient and excessive intrapartum weight gain both are associated with premature birth (Wise, Palmer, Heffner & Rosenberg, 2010). Table 3 identifies guidelines for appropriate weight gain during pregnancy.

**Women who experience high levels of anxiety, stress and depression are at greater risk for premature birth than other women (Ding et al., 2014; Ibanez et al., 2012; Lobel, Cannella, DeVincent, Graham, Meyer & Schneider, 2008). The risk is exacerbated by associated behaviors, including smoking, using drugs and drinking alcohol, that increase the likelihood of premature birth (Goldenberg et al., 2008). Nicotine, a vasoconstrictor, is associated with placental damage and decreased uteroplacental blood flow, resulting in restrictions in fetal growth (Goldenberg et al., 2008). The relationship between alcohol consumption and premature birth is associated with elevated prostaglandins and initiation of labor. Maternal binge drinking accounts for 1.75 percent of premature births across all sociodemographic groups, with women age 40 to 44 experiencing the highest incidence (Truong, Reifsnider, Mayorga & Spitler, 2012).

Excessive physical workload and standing more than 8 hours a day have been linked to negative health symptoms, such as lower back pain, swelling of lower extremities and fatigue, as well as poor pregnancy outcomes (March of Dimes et al., 2012). Occupations, such as retail sales, nursing and hairdressing, that require prolonged periods of standing increase a woman’s risk for premature birth (Waters & Dick, 2014).

**Biologic risks**

Genetics may play a role in the risk of premature birth. Studies have shown an increased rate of premature birth among women who were born preterm themselves (Dizon-Townson, 2000) or whose sisters or other female family members have experienced premature birth (Mattison, Damus, Fiore, Petrini & Alter, 2001).

Women with infections, chronic diseases or uterine bleeding during pregnancy experience higher rates of premature birth than other women (ACOG, 2012b; Blencowe et al., 2012; Hossain, Harris, Lohsoonthorn & Williams, 2007). Intrauterine infections are associated with up to 40 percent of premature births (Goldenberg et al., 2008). Infection of the uterus, placenta, amniotic fluid, urinary tract and peritoneal cavity are all related to risk of premature birth (Hillier et al., 1995; Romero et al., 2007). Women with bacterial vaginosis (BV), an imbalance of vaginal flora, have a higher likelihood of delivering preterm (Donders et al., 2009). Additionally, systemic infections like malaria and periodontal infections are associated with an increased risk of premature birth (ACOG, 2012a; Espinoza, Erez & Romero, 2006). Chronic health conditions, such as diabetes, hypertension, rheumatoid arthritis and thyroid and autoimmune disorders, are associated with poor pregnancy outcomes, including premature birth (Dunlop, Jack, Botallico, Lu, Shellhaas & Prasad, 2008). Likewise, certain obstetric conditions, such as preeclampsia, pregnancy-induced hypertension, gestational diabetes and intrauterine growth restriction, can result in premature birth for maternal or fetal indications (Goldenberg et al., 2008).

Preeclampsia is an obstetrical condition experienced by 2 to 8 percent of pregnant women (Barton & Sibai, 2008; Duvekot, Pijnenborg, Steegers & von Dadelszen, 2010; Haedersdal et al., 2013). It is a systemic syndrome characterized by hypertension and other signs that a woman’s organ systems are not working normally (ACOG, 2013, 2014a) and is associated with an increase in premature birth (Duley, 2009). Preeclampsia in a previous pregnancy, in addition to other risk factors like obesity or advanced maternal age, increases the risk for preeclampsia and premature birth in subsequent pregnancies (Connealy et al., 2014; Hutcheon, Lisonkova & Jospeh, 2011).

Light first-trimester bleeding can be normal during pregnancy; it occurs in up to 24 percent of pregnancies that deliver at term (Edwards, Baird, Hasan, Savitz & Hartmann, 2012). However, first- or second-trimester vaginal bleeding, characterized by long duration, heavy flow or deep red color,
### Case study part 2: Cynthia

Cynthia is at significant risk for premature birth in her current pregnancy. Her previous preterm births, African-American race and advanced maternal age are her greatest risk factors. Additional factors that increase Cynthia’s risk for early birth include:

- Being separated from her husband
- Her job as a nurse’s aid that requires standing for extended periods of time
- Stress from potential layoffs at work
- Smoking, obesity, hypertension and BV
- Family history of premature birth

At her initial prenatal visit, Cynthia’s provider prescribes a 7-day course of Flagyl® to treat her BV and tells her that a follow-up is not necessary if her symptoms resolve (Centers for Disease Control and Prevention [CDC], 2010).

Nurse Anne explains to Cynthia that BV is a bacterial imbalance in the vagina, and though it is not a sexually transmitted disease (STD), it frequently develops after intercourse with new or multiple sex partners. However, routine treatment of sexual partners is not recommended (CDC, 2014). Nurse Anne talks with Cynthia about her separation from her husband, and reviews the importance of having safe sex with new partners, especially using condoms to protect against STDs that can have adverse effects on her baby.

At her 18-week prenatal care visit, Cynthia has an ultrasound that confirms her dates. Given her history, she is worked up for her hypertension with labs and gets an EKG. The attending obstetrician recommends weekly 17P injections for her risk of recurrent preterm labor and birth. She is set up with a visiting nurse who will administer the injections at Cynthia’s home for convenience and compliance. The nurse can rotate injection sites to minimize Cynthia’s pain.

### Question for nurses: What nursing assessments do you consider for Cynthia? What follow-up would you offer at Cynthia’s next visit?

Women of short stature experience premature birth at significantly higher rates than women of average height (Han, Lutsiv, Mulla & McDonald, 2012). The measurement that defines short stature varies across studies but is generally characterized between 153 to 157 centimeters, or 5 feet to 5 feet 2 inches. The mechanism behind premature birth in short-stature women may be related to small pelvic structure or limited nutritional intake leading to restricted fetal growth.

#### Physiologic risks

A short cervix, measured by transvaginal ultrasound, is linked to an increased risk of premature birth. Cervical length <25mm any time before 34 weeks gestation signifies higher risk, with the shorter the cervix the greater the risk (Moroz & Simham, 2012). Other abnormalities, such as scar tissue or adhesions due to trauma, uterine surgery or certain gynecological procedures (loop electrosurgical excision procedure and dilation and curettage), can cause cervical insufficiency or incompetency, also associated with premature birth (ACOG, 2012a; Goldenberg et al., 2008).

#### Etiology of premature birth

Identifying women at risk for premature birth is crucial because its etiology is not fully understood. While we continue to investigate the mechanisms that underlie preterm labor and birth, nurses are responsible for the challenging task of providing appropriate care to patients. Understanding what triggers the cascade of events that leads to preterm labor and birth helps health care providers target interventions and treatment strategies effectively.
The first step in thinking about targeted interventions is identifying whether a premature birth is spontaneous or indicated. Spontaneous premature birth results from preterm labor or preterm premature rupture of membranes (PPROM); indicated premature birth is medically initiated as a result of maternal or fetal complications. Preterm birth is classified as early preterm (before 32 weeks gestation) (ACOG, 2011a) or late preterm (34 to 36 weeks gestation) (ACOG, 2013b).

The most common cause of early preterm birth is infection (chorioamnionitis or urogenital) (Simhan & Krohn, 2009). Infections lead to an immune cascade where proinflammatory cytokines increase, triggering increased prostaglandins which lead to cervical changes and the onset of contractions. Inflammation occurs as a result of biologic or psychosocial stress and is a major cause of early preterm birth (Kramer et al., 2012; Shapiro, Fraser, Frasch & Seguin, 2013). Stress, like infection triggers the proinflammatory cascade (Muglia & Katz, 2010; Shapiro et al., 2013; Simmons et al., 2010) resulting in increased prostaglandins, cervical changes and contractions. Infection and inflammation both cause increased production of stress hormones, including corticotrophin releasing hormone (CRH) by the placenta and brain, which has been associated with premature birth (Holzman, Jetton, Siler-Khodr, Fisher & Rip, 2001; Wadhwa, Garite, Porto, Glynn, Chicz-DeMet, Dunkel-Schetter, 2004).

With many chronic diseases, such as diabetes and hypertension, and with obstetric conditions, such as preeclampsia, placenta previa and other hemorrhagic disorders, the uterus can become a hostile environment in which preterm birth is a better alternative than continuation of the pregnancy. Late preterm birth often is a result of indicated delivery for maternal complications (Loflin, Habli, Snyder, Cormier, Lewis & DeFranco, 2010). Late spontaneous preterm birth may result from chronic diseases that cause vascular changes that cause problems with placental function. When the fetus becomes stressed, either because of inadequate oxygen or nutrition (both sequeli of inadequate placental function), the fetus produces hormones that begin the inflammatory cascade leading to preterm labor (Mattison et al., 2001). When the fetus contracts an infection later in pregnancy, the same inflammatory cascade can lead to late spontaneous preterm birth. Uterine distension as a result of multifetal pregnancies often is a leading cause of late preterm birth (Simmons et al., 2010).

One of the difficulties in adequately managing premature birth is that the etiology often is multifactorial, leaving no single intervention strategy as best effective. For example, a woman with a short cervix and increased stress hormones is more likely to deliver prematurely than a woman with a normal-length cervix and increased stress hormones (Moroz & Simhan, 2014). Uterine size and subsequent stretching play a role in premature birth in multiples but are of greater concern in a woman with a smaller uterus and pelvic girth. Marriage has been shown to be protective for preterm birth due to the added social support; however, an 18-year-old married woman is at greater risk for premature birth due to her young age than a married woman at age 34 (El-Sayed, et al., 2012), once again demonstrating the complexity of preterm birth etiology. Like all multifactorial conditions, preventing and treating premature birth can only be accomplished with multiple solutions.

Preventing premature birth

Preconception care

Preconception care focuses on a helping a woman achieve a healthy lifestyle and manage chronic conditions before conception. This includes, but is not limited to, ensuring a woman is up-to-date with immunizations, maintains a healthy pre-pregnancy weight through a nutritious food and exercise regimen, gets adequate sleep and takes appropriate steps for smoking and alcohol cessation (Atrash, Johnson, Adams, Cordero & Howse, 2006). Family planning is an important part of preconception care, as short interpregnancy intervals have been associated with an increased risk for premature birth. Preconception care also encompasses maternal psychosocial factors, such as psychological well-being, family support and counseling. Preconception care can help reduce prenatal risk factors and decrease adverse pregnancy outcomes; however, preconception care is not provided to all women (Atrash et al., 2006; Chandranipapongse & Koren, 2013).

Prenatal care

Prenatal care helps decrease premature birth by identifying women with medical or obstetric problems that, when undiagnosed, often lead to premature birth, such as infections, hemorrhagic conditions and chronic medical conditions (Alexander & Kotelchuck, 2001; Moos, 2006; Van Dijk, Anderko & Stetzer, 2011). Unfortunately, prenatal care that addresses demographic and sociobehavioral factors that lead to
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Predicting premature birth
Given the variety of risk factors, mechanisms and etiology behind premature birth, it is essential to have diagnostic criteria and preventative measures to combat its occurrence. Because it is difficult to pinpoint one specific causative agent, it is challenging to determine the best mode of diagnosis and management.

Cervical length
One of the most frequently used and clinically reliable methods of predicting premature birth is determining cervical length via transvaginal ultrasound. The predictive value of this measurement varies by gestational age. When measured between 20 and 23 weeks, a cervical length of ≤25mm indicates a strong predictive risk of premature birth; a cervical length measuring <25mm at any point in gestation before 34 weeks indicates a high predictive risk of premature birth (Goya et al., 2012). Bolt and colleagues (2011) state that a cervix of ≤15mm is indicative of a 50-percent chance of premature birth before 32 weeks. However, false-positives are common, and many women classified as having a short cervix deliver at term. Serial measurements, starting in the second trimester and continuing every 2 weeks, are suggested to increase sensitivity (Moroz & Simhan, 2012). Every 1mm of cervical length shortening correlates with a 3-percent increase in the risk of premature birth (Moroz & Simhan, 2012).

Fetal fibronectin (fFN)
fFN is a protein found in cervical and vaginal secretions from the uterus when there is separation between the fetal membranes and the maternal decidua. It is collected by sterile speculum exam, is most useful between 22 and 35 weeks gestation and should only be considered in the absence of bleeding, semen and ruptured membranes. fFN is most clinically useful for its high negative predictive value. A negative result, a concentration of <50ng/mL, indicates that the risk for impending preterm birth is <1 percent (Bolt et al., 2011). This is an important factor in assessing patients and ruling out those who are not at imminent risk for premature birth who can be sent home without further intervention.

When used together, cervical length and fFN can provide a clear picture of women at risk for premature birth. A woman with an fFN result of ≥50ng/mL is 30 percent more likely to give birth before 30 weeks gestation; when this result is coupled with a short cervix of <25mm, her chances of delivering preterm increase to 50 to 60 percent (Bolt et al., 2011). When both cervical length measurement and fetal fibronectin results are used, the two positive results are notably more reliable. When only one of the two methods is positive, fFN is more sensitive than cervical length for predicting premature birth (DeFranco, Lewis & Odibo, 2013).

Interventions
While no single method has been found to be effective in preventing premature birth, providers use a number of interventions that show promise in delaying birth and improving outcomes.

Preterm labor
Educating at-risk pregnant women about the signs and symptoms of preterm labor (Table 4) can...
Case study part 3: Cynthia

Cynthia presents to the prenatal clinic for routine care at 22 weeks gestation. At this visit, her cervical length measures 35mm. She confirms that she continues to receive her weekly progesterone injections from the visiting nurse without incident. Midwife Maggie reviews her health and medical record and is concerned about her history of smoking and the presence of multiple stressors in her life.

Midwife Maggie uses the 5A’s with Cynthia and learned that she smoked one pack per day before pregnancy but has cut down to ¼ pack per day. She advises Cynthia that her continued smoking can be harmful to her baby and that she is exposing her other children to harmful secondhand smoke. Cynthia admits that she would like to try to quit (because cigarettes are expensive), but she is not confident she can give it up completely. Midwife Maggie provides Cynthia with a list of support groups and resources for smoking cessation, and they discuss goals and an ideal time for Cynthia to quit smoking. Midwife Maggie assures Cynthia that she will follow up with her in 4 weeks to see how she is managing.

Midwife Maggie also asks Cynthia about how she is coping with life at home with three small children now that she is separated from her husband. Cynthia admits she feels overwhelmed at times by the demands of her kids. She is concerned about money and how to afford caring for a new baby. She has heard that her company has been making cutbacks and that a number of employees have been laid off. Midwife Maggie recommends that Cynthia meet with a social worker to discuss these concerns and to learn about community resources that may be available for financial and social support groups. Other women have praised the Mom’s Group offered at the local community center for helping them meet other mothers facing similar challenges.

When Cynthia confides that she often feels sad when thinking about how different life is without her husband, Midwife Maggie encourages her to consider speaking with a therapist to discuss her feelings and help her develop coping mechanisms to deal with them.

Questions for nurses: What nursing assessments do you consider for Cynthia? What follow-up would you offer at Cynthia’s next visit?

facilitate timely assessment and care. Nurses can talk to women about the importance of seeking medical care if they experience signs or symptoms of preterm labor, as early care provides the opportunity for caregivers to intervene appropriately (Stringer, Gennaro, Deatrick & Founds, 2008).

Table 4. Signs and symptoms of preterm labor

- Contractions that make your belly tighten up like a fist every 10 minutes or more often
- Change in the color of your vaginal discharge, or bleeding from your vagina
- The feeling that your baby is pushing down. This is called pelvic pressure
- Low, dull backache
- Cramps that feel like your period
- Belly cramps with or without diarrhea

March of Dimes, 2013

Admission to the hospital and thorough evaluation are essential for a woman experiencing preterm labor and PPRO. Preterm labor and PPRO must be managed efficiently; hospitalization allows for constant monitoring and the administration of tocolytics, antibiotics and/or corticosteroids. Staff can notify the NICU if labor cannot be halted and premature birth is inevitable.

Progestrone

Prophylactic treatment with progesterone is a therapeutic intervention that has been used antenatally to delay delivery and prevent premature birth due to its ability to decrease inflammation and soothe uterine activity (Dodd & Crowther, 2009; Society for Maternal-Fetal Medicine Publications Committee & Berghella, 2012). While we do not completely understand how progesterone works, it may have an anti-inflammatory effect on the uterus.

Recommendation for progesterone’s mode of administration and dose depend on the level of
identifed risk. Vaginal progesterone, 90-100mg gel or 200 mg capsule, is the preferred administration for a woman with a clinically diagnosed short cervix and has been frequently used in high-risk pregnancies, including multiple gestation (Romero et al., 2012). Cetingoz and colleagues (2011) found that 100mg of micronized progesterone administered daily by vaginal suppository significantly reduced the rate of premature birth as compared to placebo. In the same study, the rate of preterm birth for women who received progesterone was lower for those with a history of premature birth and with a twin pregnancy, as compared to a placebo group.

ACOG (2012b) guidelines recommend that women with a history of premature birth be given progesterone supplementation to prevent recurrent preterm birth. Intramuscular administration of 17-hydroxyprogesterone caproate (17P) at a dose of 250mg per week has demonstrated a decrease in recurrent premature birth and the associated negative infant outcomes but has not been proven effective when used with multiple gestations (Society for Maternal-Fetal Medicine Publications Committee & Berghella, 2012). Nursing care is essential in facilitating this intervention. The use of visiting nurse services can help with adherence to this regimen by allowing a woman to receive injections in the comfort and convenience of her own home.

**Tocolytics**

Tocolytic agents are administered in attempt to halt symptoms and slow progression of preterm labor. Though they do not prevent premature birth, they can delay delivery anywhere from 48 hours up to 7 days (ACOG, 2014b; Rozenberg et al., 2012). Table 5 identifies classes of tocolytics and their agents.

### Table 5. Tocolytics and their agents

- Betamimetics (terbutaline)
- Prostaglandin inhibitors (indomethacin)
- Calcium channel blockers (nifedipine)
- Magnesium sulfate

Before selecting a specific tocolytic agent, it is important to consider gestational age, current risk factors and side effects. While several agents are currently approved by ACOG and used for acute tocolytic purposes, there are no agents approved by the FDA solely for tocolytic use. Therefore, the preferred course of treatment varies by facility, with no single agent identified as the gold standard. In addition to progesterone and magnesium sulfate, nifedipine and indomethacin have been shown to have favorable responses in regards to delayed delivery and maternal and fetal outcomes (Conde-Agudelo, Romero & Kusanovic, 2011; Haas, Caldwell, Kirkpatrick, McIntosh & Welton, 2012; Markham & Klebanoff, 2014).

Tocolytic agents are given so that other medications, like corticosteroids or magnesium sulfate, can be administered for lung function and neuroprotection in infants. By delaying delivery, tocolytics provide time for the mother to be transferred to a facility that has the resources to care for a premature birth, including a NICU. Though proven effective in inhibiting uterine contractions, some tocolytic agents (nifedipine, for example) should be discontinued once labor has subsided as long-term administration does not show any effect on fetal outcomes (ACOG, 2012a). Other agents (progesterone, for example) can be continued for maintenance tocolysis.

**Magnesium sulfate**

Magnesium sulfate has been used for its tocolytic effect as a means to halt labor, though it is imperative to monitor for negative side effects like nausea, headaches, flushing and respiratory depression. Magnesium sulfate has not been found to be an effective tocolytic in preventing premature birth (Han, Crowther & Moore, 2013), but it does seem to be neuroprotective for infants when given antenatally to women in preterm labor.

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**Case study part 4: Cynthia**

At EGA 29 weeks, Cynthia presents to the labor and delivery unit with complaints of episodic pelvic pressure, a change in her vaginal discharge and lower back pain. She denies vaginal bleeding and reports ++ fetal movements. She is placed on an electronic fetal monitor and over an hour-long interval has 10 uterine contractions. The fetal heart rate is within normal parameters for a fetus at 29 weeks gestation. Midwife Mary determines it is not necessary to repeat a cervical length measurement at this time as Cynthia’s midpregnancy measurement of 35mm indicated low risk, and she has no history of cervical insufficiency. Her fetal fibronectin is positive, and her exam reveals her to be dilated 2cm, 50 percent effaced, fetal station -3.

**Question for nurses:** What additional assessments do you recommend for Cynthia at this time?
Premature birth can cause deficiencies or damage to a baby’s brain, resulting in deafness, blindness, physical or mental impairments and cerebral palsy (Doyle, Crowther, Middleton, Marret & Rouse, 2010). Magnesium sulfate is commonly administered to women at risk for premature birth to reduce damage to a premature baby’s brain and the risk of cerebral palsy. Doyle and colleagues (2010) found an absolute risk reduction of 1.6 percent for cerebral palsy in infants whose mothers were treated antenatally with magnesium sulfate compared to those who were not. Given intravenously with a loading dose of 4 to 6g followed by hourly doses of 1 to 3g for up to 24 hours, magnesium sulfate demonstrates a significant reduction in cerebral palsy (ACOG, 2010). ACOG (2013b) supports the use of magnesium sulfate as both a tocolytic and a neuroprotective agent.

Calcium channel blockers
Nifedipine, a calcium channel blocker, is a commonly used tocolytic agent that has the capability to delay delivery up to 7 days and prevent premature birth before 34 weeks (Wisanskoonwong, Fahy & Hastie, 2011). Nifedipine is relatively well tolerated and has been shown to improve infant outcomes, including RDS, necrotizing enterocolitis (NEC) and intraventricular hemorrhage (IVH) (Conde-Agudelo et al., 2011). Nifedipine is initially administered orally at a dose of 20mg, followed by another 20mg orally if contractions persist after 30 minutes. Additional 20-mg doses can be given orally every 3 to 8 hours for 2 to 3 days.

Prostaglandin inhibitor
Indomethacin is a nonsteroidal anti-inflammatory drug used as a tocolytic agent. It is recommended only for women who present with preterm labor before 32 weeks (ACOG, 2012a). Its use is not to exceed 48 hours due to its potential for negative fetal side effects (Haas, Caldwell, Kirkpatrick, McIntosh & Welton, 2012).

Bed rest
Evidence does not support the use of bed rest for prevention of premature birth. Bed rest has been associated with negative adverse effects, such as increased incidence of thromboembolism, a decrease in maternal muscle mass and low birthweight (Biggio, 2013; Maloni, 2011; McCall, Grimes, Lylery, 2013; McCarty-Singleton & Sciscione, 2014). Additionally, neither pelvic rest nor intravenous fluids have demonstrated any statistically significant results in reducing the rate of premature birth in women who experience preterm labor (McCarty-Singleton & Sciscione, 2014; Stan, Boulvain, Pfister & Hirshbrunner-Almagbaly, 2013). However, while no formal guidelines have been established, other behavioral interventions, such as limiting strenuous activities and reducing the number of hours spent standing (March of Dimes et al., 2012) are thought to be beneficial. Saurel-Cubizolles and colleagues (2004) found that women who spent more than 6 hours a day standing are at significantly higher risk for premature birth.

Antibiotics
Intervention for women experiencing PPROM includes antibiotic administration as the first line of defense against infection. Though PPROM may be the result of maternal infection, the use of antibiotics has demonstrated success in preventing or reducing the risk of neonatal infections. Antibiotics are recommended for women who test positive for group B streptococcus (GBS), to prevent transmission to the infant during delivery (ACOG, 2011b). Antibiotics do not decrease the risk of premature birth (except in women who have had a previous premature birth or women who have BV in their current pregnancy) (Wisanskoonwong et al., 2011). They do, however, improve outcomes for women with PPROM or infections, such as GBS. Evidence suggests that this low-cost, efficacious intervention is effective in preventing infections and reducing complications, such as sepsis, RDS, IVH, NEC and neonatal death (Cousens, Blencowe, Gravett & Lawn, 2010). Frequently used agents include ampicillin, erythromycin, clindamycin, penicillin and amoxicillin with varying doses and duration of therapy.

Antenatal corticosteroids (ACS)
ACS are given to women starting as early as 24 weeks gestation (ACOG, 2012a), when the risk for premature birth is high and early delivery is expected. These medications cross the placenta to augment development and maturation of the baby’s lungs, brain and other organs. The two most commonly used corticosteroids are betamethasone and dexamethasone. Betamethasone is given intramuscularly in two 12-mg doses 24 hours apart, and dexamethasone is given intramuscularly in 6-mg doses 12 hours apart for a total of four doses in each course of treatment (ACOG, 2012a).

Cerclage
Cervical cerclage is an intervention used to prevent premature birth in singleton pregnancies before 34
weeks gestation in women diagnosed with a short cervix (Wisankoonwong et al., 2011). Studies show that the use of a cerclage, coupled with the administration of 17P, may reduce the rate of premature birth in women with high-risk pregnancies (Temming, Kirkland, Kullstam, Rozario, Mitra & Joy, 2013). The use of a cerclage is not without risks, however, and women may experience increased rates of premature rupture of membranes or infections, such a chorioamnionitis (Wisankoonwong et al., 2011).

**Case study part 5: Cynthia**

Cynthia is admitted to the hospital and started on the tocolytic agent nifedipine to halt her labor. She is set up for a consult with an attending maternal fetal medicine physician. She is given magnesium sulfate intravenously with a loading dose of 6g and an hourly dose of 2g for 24 hours for neuroprotection. She receives two 12-mg intramuscular doses of betamethasone 24 hours apart for fetal lung maturity.

Cynthia’s labor subsides and she is discharged from the hospital 2 days later. Her obstetrician assures her that bed rest is not neccesary and will not prevent her from experiencing another episode of preterm labor. Her doctor tells her that she may return to her normal activities, including work; however she should assume a reduced workload, limiting her heavy lifting and reducing time standing on her feet. Her doctor tells her to re-start her weekly progesterone injections with the visiting nurse and to contact her midwife if she starts experiencing signs of early labor again.

**Question for nurses:** The doctor’s recommendations may increase Cynthia’s stress. How can you help Cynthia incorporate the recommendations into her day?

**Conclusion**

Health care providers prefer to prevent preterm labor and birth rather than treat their consequences. The multifactorial etiology of premature birth contributes to the extensive list of risk factors that nurses need to be aware of when caring for pregnant women; it also provides challenges for prevention.

Coordinated nursing care identifies women at risk for preterm labor, and nurses seek to help decrease a woman’s risk factors whenever possible. Nurses are responsible for teaching women to recognize the signs and symptoms of preterm labor and emphasizing the importance of seeking care promptly when if they have signs or symptoms. Early care of these women allows for appropriate interventions to be administered to reduce the sequelae of preterm labor and premature birth.

In many cases, with appropriate antepartum care and labor management, delivery can be delayed. Seeking care promptly after the onset of preterm labor signs and symptoms allows providers time to enhance lung development with corticosteroid administration and ensure neuroprotection with magnesium sulfate, if appropriate. However, in scenarios where premature birth is imminent, appropriate resources must be available, such as a NICU or antibiotics, to reduce perinatal mortality.

**References**


