CHAPTER 8: Preconceptional Care

Pregnancy may be associated with certain diseases that existed before the inception of pregnancy. As a rule, all diseases which subject the organism to a considerable strain are much more serious when occurring in a pregnant woman.

—J. Whitridge Williams (1903)

INTRODUCTION

The Centers for Disease Control and Prevention (CDC) (2015) defines preconceptional care as "a set of interventions that aim to identify and modify biomedical, behavioral, and social risks to a woman's health or pregnancy outcome through prevention and management." To achieve this goal, the CDC has developed an action plan for preconceptional health care in the United States (Johnson, 2006). The American College of Obstetricians and Gynecologists (2017e) and the Society for Maternal-Fetal Medicine (2014) also reaffirm the importance of preconceptional care, and the following objectives have been established for advancing it:

1. Improve knowledge, attitudes, and behaviors of men and women related to preconceptional health
2. Assure that all childbearing-aged women receive preconceptional care services—including evidence-based risk screening, health promotion, and interventions—that will enable them to enter pregnancy in optimal health
3. Reduce risks indicated by a previous adverse pregnancy outcome through interconceptional interventions to prevent or minimize recurrent adverse outcomes
4. Reduce the disparities in adverse pregnancy outcomes

To illustrate potentially modifiable conditions, data that describe the health status of women who delivered liveborn neonates in the United States in 2004 are reviewed. Table 8-1 demonstrates the high prevalence of many conditions that may be amenable to intervention during the preconceptional and interpregnancy periods. To be successful, however, strategies that mitigate these potential pregnancy risks must be provided before conception. By the time most women realize they are pregnant—usually 1 to 2 weeks after the first missed period—the embryo has already begun to form. Thus, many preventive steps—for example, folic acid to avoid neural-tube defects—will be ineffective if initiated at this time. Importantly, up to half of all pregnancies in the United States in 2008 were unplanned according to the Guttmacher Institute (2015), and often these are at greatest risk.

TABLE 8-1

Prevalence of Prepregnancy Maternal Behaviors, Experiences, Health Conditions, and Previous Poor Birth Outcomes[a]

Factor	Prevalence (%)
Tobacco use	23
Alcohol use	50
Multivitamin use	35
Contraceptive nonuse[b]	53
Dental visit	78
Health counseling	30
Physical abuse	4
Stress	19
Underweight	13
Overweight	13
Obesity	22
Diabetes	2
Asthma	7
Hypertension	2
Heart problem	1
Anemia	10
Prior low-birthweight neonate	12
Prior preterm neonate	12

[a]In the United States in 2004.

[b]Among women who were not trying to become pregnant.

Data from D'Angelo D, Williams L, Morrow B, et al: Preconception and interconception health status of women who recently gave birth to a live-born infant—Pregnancy Risk Assessment Monitoring System (PRAMS), United States, 26 reporting areas, 2004. MMWR 56(10):1, 2007.

Few randomized trials evaluate preconceptional counseling efficacy, in part because withholding such counseling would be unethical. Also, pregnancy outcomes are dependent on the interaction of various maternal, fetal, and environmental factors. Thus, ascribing a salutary outcome to a specific

intervention is difficult (Moos, 2004; Temel, 2014). However, prospective observational and case-control studies have demonstrated the successes of preconceptional counseling (American College of Obstetrics and Gynecologists, 2016b). Moos and coworkers (1996) assessed the effectiveness of a preconceptional counseling program administered during routine health care provision to reduce unintended pregnancies. The 456 counseled women had a 50-percent greater likelihood of subsequent pregnancies that they considered "intended" compared with 309 uncounseled women. Moreover, compared with another group of women who had no health care before pregnancy, the counseled group had a 65-percent higher rate of intended pregnancy. Interesting ethical aspects of *paternal* lifestyle modification were reviewed by van der Zee and associates (2013).

COUNSELING SESSION

Gynecologists, internists, family practitioners, and pediatricians have the best opportunity to provide preventive counseling during periodic health maintenance examinations. The occasion of a negative pregnancy test is also an excellent time for education. Jack and colleagues (1995) administered a comprehensive preconceptional risk survey to 136 such women, and almost 95 percent reported at least one problem that could affect a future pregnancy. These included medical or reproductive problems—52 percent; family history of genetic disease—50 percent; increased risk of human immunodeficiency virus infection—30 percent; increased risk of hepatitis B and illegal substance abuse—25 percent; alcohol use—17 percent; and nutritional risks—54 percent. Counselors should be knowledgeable regarding relevant medical diseases, prior surgery, reproductive disorders, or genetic conditions and must be able to interpret data and recommendations provided by other specialists (Simpson, 2014). If the practitioner is uncomfortable providing guidance, the woman or couple should be referred to an appropriate counselor.

Women presenting specifically for preconceptional evaluation should be advised that information collection may be time consuming, depending on the number and complexity of factors that require assessment. The intake evaluation includes a thorough review of the medical, obstetrical, social, and family histories. Useful information is more likely to be obtained by asking specific questions regarding each of these histories and each family member than by asking general, open-ended questions. Some important information can be obtained by questionnaires that address these topics. Answers are reviewed with the couple to ensure appropriate follow-up, including obtaining relevant medical records.

MEDICAL HISTORY

With specific medical conditions, general points include how pregnancy will affect maternal health and how a high-risk condition might affect the fetus. Afterward, advice for improving outcome is provided. Some chronic conditions that may affect pregnancy outcomes include treated or active cancer, prior peripartum cardiomyopathy, and systemic lupus erythematosus (Amant, 2015; Buyon, 2015; McNamara, 2015). Importantly, psychological health should be considered (Lassi, 2014). Detailed preconceptional information regarding a few exemplary conditions is found in the next sections and in the other topic-specific chapters of this text.

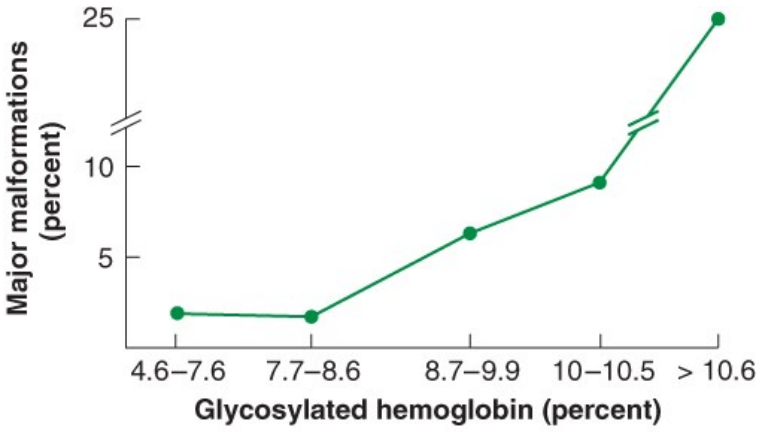
Diabetes Mellitus

Because maternal and fetal pathology associated with hyperglycemia is well known, diabetes is the prototype of a condition for which preconceptional counseling is beneficial. Diabetes-associated risks to both mother and fetus are discussed in detail in Chapter 57 (Impact on Pregnancy). Many of these complications can be avoided if glucose control is optimized before conception. Another important aspect of counseling pertains to the frequent use of teratogenic angiotensin-converting enzyme inhibitors in this population (Podymow, 2015).

The American College of Obstetricians and Gynecologists (2016a) has concluded that preconceptional counseling for women with pregestational diabetes is both beneficial and cost-effective and should be encouraged. The American Diabetes Association has promulgated consensus recommendations for preconceptional care for diabetic women (Kitzmiller, 2008). These guidelines advise obtaining a thorough inventory of disease duration and related complications and completing a clinical and laboratory examination for end-organ damage. Perhaps most essential, they encourage a preconceptional goal of the lowest hemoglobin A_{1c} level possible without undue hypoglycemic risk to the mother. In addition to assessing diabetic control during the preceding 6 weeks, hemoglobin A_{1c} measurement can also be used to estimate risks for major anomalies as shown in Figure 8-1. Although these data are from women with severe overt diabetes, the incidence of fetal anomalies in women who have gestational diabetes with fasting hyperglycemia is increased fourfold compared with that in normal women (Sheffield, 2002).

FIGURE 8-1

Relationship between first-trimester glycosylated hemoglobin values and risk for major congenital malformations in 320 women with insulin-dependent diabetes. (Data from Kitzmiller JL, Gavin LA, Gin GD, et al: Preconception care of diabetics. JAMA 265:731, 1991.)



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Such counseling in diabetic women has been shown to be effective. Leguizamón and associates (2007) identified 12 studies that included more than 3200 pregnancies in women with insulin-dependent diabetes. Of the 1618 women without preconceptional counseling, 8.3 percent had a fetus with a major congenital anomaly, and this compared with a rate of 2.7 percent in the 1599 women who did have counseling. Tripathi and coworkers (2010) compared outcomes in 588 women with pregestational diabetes in whom approximately half had preconceptional counseling. Those women who received counseling had improved glycemic control before pregnancy and in the first trimester. This group also had higher folate intake rates preconceptionally, and they experienced lower rates of adverse outcomes—defined as a perinatal death or major congenital anomaly. These cited benefits are accompanied by reduced health-care costs in diabetic women. From their review, Reece and Homko (2007) found that each $1 expended for a preconceptional care program saved between $1.86 and $5.19 in averted medical costs. Despite such benefits, the proportion of diabetic women receiving preconceptional care is suboptimal. In their study of approximately 300 diabetic women in a managed-care plan, Kim and colleagues (2005) found that only approximately one half had preconceptional counseling. Counseling rates are undoubtedly much lower among uninsured and indigent women.

Epilepsy

Compared with unaffected women, those with a seizure disorder carry an undisputed augmented risk of having neonates with structural anomalies (Chap. 12, Antiepileptic Medications). Some early reports indicated that epilepsy conferred an elevated a priori risk for congenital malformations that was independent of anticonvulsant treatment effects. Although more recent publications have largely failed to confirm this increased risk in untreated women, it is difficult to refute entirely because women who are controlled without medication generally have less severe disease (Cassina, 2013; Vajda, 2015). Fried and associates (2004) conducted a metaanalysis of studies comparing epileptic women, both treated and untreated, with controls. In this study, greater malformation rates could only be demonstrated in the offspring of women who had been exposed to anticonvulsant therapy. Veiby and coworkers (2009) used the Medical Birth Registry of Norway and identified an increased malformation risk only in women who were exposed to valproic acid (5.6 percent) or polytherapy (6.1 percent). Untreated women had anomaly rates that were similar to those of nonepileptic controls. Risks for miscarriage and stillbirths in exposed epileptic women do not appear elevated (Aghajanian, 2015; Bech, 2014).

Ideally, seizure control is optimized preconceptionally. For example, Vajda and colleagues (2008) analyzed data from the Australian Register of Antiepileptic Drugs in Pregnancy. They found the seizure risk during pregnancy was 50- to 70-percent lower in women without a seizure in the year preceding pregnancy compared with a group experiencing seizures in this preceding year. No further advantages accrued if the seizure-free period exceeded a year.

Treatment goals attempt to achieve seizure control with monotherapy and with medications considered less teratogenic (Aguglia, 2009; Tomson, 2009). As discussed in detail in Chapter 60 (Preconceptional Counseling) and shown in Table 8-2, some one-drug regimens are more teratogenic than others. Valproic acid, in particular, is avoided if possible, as this medication has consistently been associated with a greater risk for major congenital malformations than other antiepileptic drugs (Jentink, 2010; Vajda, 2015). Trimethadione is contraindicated (Aghajanian, 2015). The American Academy of Neurology recommends consideration of antiseizure medication discontinuation before pregnancy in suitable candidates (Jeha, 2005).

These include women who satisfy the following criteria: (1) have been seizure-free for 2 to 5 years, (2) display a single seizure type, (3) have a normal neurological examination and normal intelligence, and (4) show electroencephalogram results that have normalized with treatment.

TABLE 8-2

First-Trimester Antiepileptic Monotherapy and the Associated Major Malformation Risk

Antiepileptic (n)	Malformations (%)	Relative Risk (95% CI)[a]
Unexposed controls (442)	1.1	Reference
Lamotrigine (1562)	2.0	1.8 (0.7–4.6)
Carbamazepine (1033)	3.0	2.7 (1.0–7.0)
Phenytoin (416)	2.9	2.6 (0.9–7.4)
Levetiracetam (450)	2.4	2.2 (0.8–6.4)
Topiramate (359)	4.2	3.8 (1.4–10.6)
Valproate (323)	9.3	9.0 (3.4–23.3)
Phenobarbital (199)	5.5	5.1 (1.8–14.9)
Oxcarbazepine (182)	2.2	2.0 (0.5–7.4)
Gabapentin (145)	0.7	0.6 (0.07–5.2)
Clonazepam (64)	3.1	2.8 (0.5–14.8)

[a]Risk compared with that of the unexposed reference population of nonepileptic women.

Data from Hernández-Díaz S, Smith CR, Shen A, et al: Comparative safety of antiepileptic drugs during pregnancy. Neurology 78:1692, 2012.

Epileptic women should be advised to daily take a 4-mg folic acid supplement. Even so, it is not entirely clear that folate supplementation reduces the fetal malformation risk in pregnant women taking anticonvulsant therapy. In one case-control study, Kjær and associates (2008) reported that the congenital abnormality risk was reduced by maternal folate supplementation in fetuses exposed to carbamazepine, phenobarbital, phenytoin, and primidone. Conversely, from the United Kingdom Epilepsy and Pregnancy Register, Morrow and coworkers (2009) compared fetal outcomes of women who received preconceptional folic acid with those who did not receive it until later in pregnancy or not at all. In this study, a paradoxical *increase* in the number of major congenital malformations was observed in the group who received preconceptional folate. These investigators concluded that folate metabolism may be only a part of the mechanism by which malformations are induced in women taking these medications.

Immunizations

Preconceptional counseling includes assessment of immunity against common pathogens. Also, depending on health status, travel plans, and time of year, other immunizations may be indicated as discussed in Chapter 9 (Table 9-7). Vaccines that contain toxoids such as tetanus are suitable before or during gestation. Also, those containing killed bacteria or viruses—such as influenza, pneumococcus, hepatitis B, meningococcus, and rabies vaccines—are not associated with adverse fetal outcomes and are not contraindicated preconceptionally or during pregnancy. Conversely, live-virus vaccines are not recommended during pregnancy. Examples are vaccines against varicella-zoster, measles, mumps, rubella, polio, chickenpox, and yellow fever. Moreover, 1 month or longer should ideally pass between vaccination and conception attempts. That said, inadvertent administration of measles,

mumps, rubella (MMR) or varicella vaccines during pregnancy should not generally be considered indications for pregnancy termination. Most reports indicate that the fetal risk is only theoretical. Immunization to smallpox, anthrax, and other bioterrorism diseases should be discussed if clinically appropriate (Chap. 64, Mycotic Infections).

With some infections, vaccines are unavailable. One recent example is the Zika virus (Brasil, 2016). For this virus, the CDC has issued travel advisories for pregnant women (Petersen, 2016; Schuler-Faccini, 2016).

GENETIC DISEASES

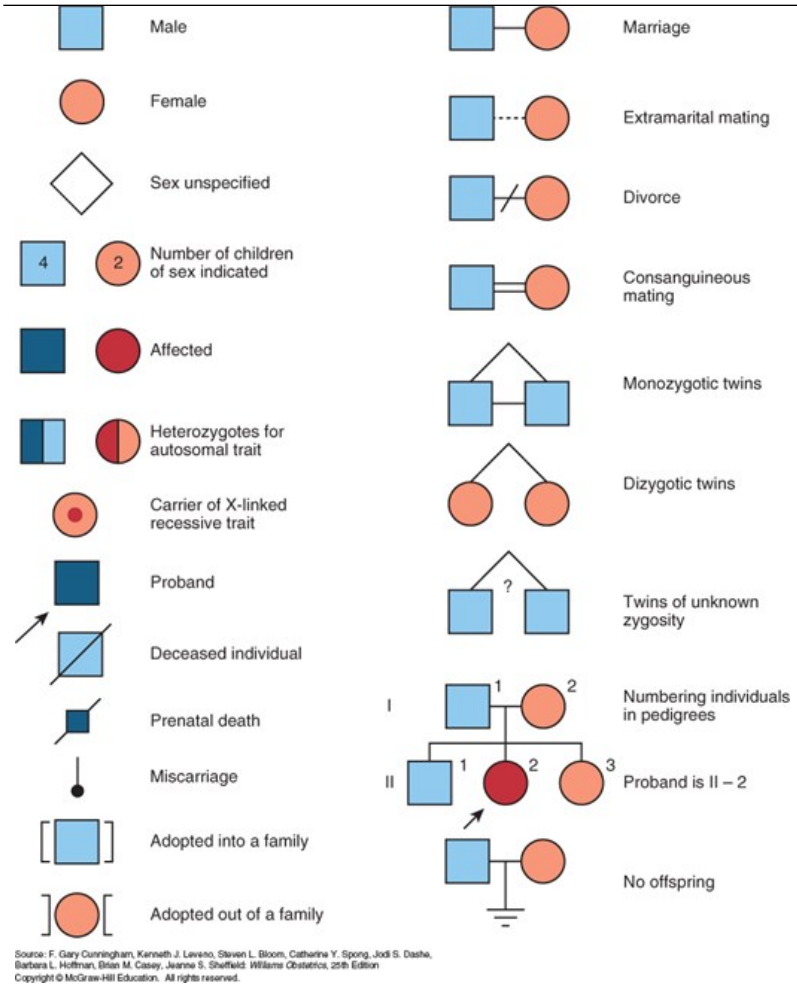
The CDC (2016) estimates that 3 percent of neonates born each year in the United States will have at least one birth defect. Importantly, such defects are the leading cause of infant mortality and account for 20 percent of deaths. The benefits of preconceptional counseling usually are measured by comparing the incidence of new cases before and after initiation of a counseling program. Congenital conditions that clearly benefit from patient education include neural-tube defects, phenylketonuria, thalassemias, and other genetic diseases more common in individuals of Eastern European Jewish descent.

Family History

Pedigree construction using the symbols shown in Figure 8-2 is the most thorough method for obtaining a family history as a part of genetic screening. The health and reproductive status of each “blood relative” should be individually reviewed for medical illnesses, mental retardation, birth defects, infertility, and pregnancy loss. Certain racial, ethnic, or religious backgrounds may indicate elevated risk for specific recessive disorders.

FIGURE 8-2

Symbols used for pedigree construction. (Modified with permission from Thompson MW, McInnes RR, Huntington FW (eds): Genetics in Medicine, 5th ed. Philadelphia, Saunders, 1991.)



Source: F. Gary Cunningham, Kenneth J. Leveno, Steven L. Bloom, Catherine Y. Spong, Jodi S. Dashe, Barbara L. Hoffman, Brian M. Casey, Jeanne S. Sheffield: *Williams Obstetrics*, 25th Edition

Although most women can provide some information regarding their history, their understanding may be limited. For example, several studies have shown that pregnant women often fail to report a birth defect in the family or they report it incorrectly. Thus, any disclosed defect or genetic disease should be confirmed by reviewing pertinent medical records or by contacting affected relatives for additional information.

Neural-Tube Defects

The incidence of neural-tube defects (NTDs) is 0.9 per 1000 live births, and they are second only to cardiac anomalies as the most frequent structural fetal malformation (Chap. 13, Genetic Tests). Some NTDs, as well as congenital heart defects, are associated with specific mutations. One example is the 677C → T substitution in the gene that encodes methylene tetrahydrofolate reductase. For this and similar gene defects, the trial conducted by the Medical Research Council Vitamin Study Research Group (1991) showed that preconceptional folic acid therapy significantly reduced the risk for a recurrent NTD by 72 percent. More importantly, because more than 90 percent of neonates with NTDs are born to women at low risk, Czeizel and Dudas (1992) showed that supplementation reduced the a priori risk of a first NTD occurrence. It is currently recommended, therefore, that all women who may become pregnant take daily 400 to 800 μg of folic acid orally before conception and through the first trimester (U.S Preventive Services Task Force, 2009). Folate fortification of cereal grains has been mandatory in the United States since 1998, and this practice has also resulted in decreased neural-tube defect rates (Williams, 2015). Despite the demonstrated benefits of folate supplementation, only half of women have taken folic acid supplementation periconceptionally (de Jong-van den Berg, 2005; Goldberg, 2006). The strongest predictor of use appears to be consultation with a health-care provider before conception.

Phenylketonuria

More than 600 mutations have been identified in the phenylalanine hydroxylase gene. The inherited defect in phenylalanine metabolism exemplifies diseases in which the fetus may not be at risk to inherit the disorder but may be damaged by maternal disease. Specifically, mothers with

phenylketonuria (PKU) who eat an unrestricted diet have abnormally high blood phenylalanine levels. This amino acid readily crosses the placenta and can damage developing fetal organs, especially neural and cardiac tissues (Table 8-3).

TABLE 8-3

Frequency of Complications in the Offspring of Women with Untreated Phenylketonuria

Complication	Frequency (%)
Spontaneous abortion	24
Developmental delays	92
Microcephaly	73
Congenital heart disease	12
Fetal-growth restriction	40

Data from American Academy of Pediatrics: Maternal phenylketonuria, Pediatrics 2008 Aug;122(2):445–449.

With appropriate preconceptional counseling and adherence to a phenylalanine-restricted diet before pregnancy, the incidence of fetal malformations is dramatically reduced (Camp, 2014; Vockley, 2014). Therefore, the phenylalanine concentration is ideally normalized 3 months before conception and then maintained throughout pregnancy (American College of Obstetricians and Gynecologists, 2017b). The target phenylalanine blood concentration is 120 to 360 µmol/L (Camp, 2014).

Thalassemias

These disorders of globin-chain synthesis are the most common single-gene disorders worldwide (Forget, 2013; Vichinsky, 2013). As many as 200 million people carry a gene for one of these hemoglobinopathies, and hundreds of mutations are known to cause thalassemia syndromes (Chap. 56, Thalassemia Syndromes). In endemic areas such as Mediterranean and Southeast Asian countries, counseling and other prevention strategies have reduced the incidence of new cases by up to 80 percent (Cao, 2013).

The American College of Obstetricians and Gynecologists (2015a) recommends that individuals of high-risk ancestry be offered carrier screening to allow them informed decision making regarding reproduction and prenatal diagnosis. One method of early prenatal diagnosis is *preimplantation genetic diagnosis (PGD),* which is coupled with assisted reproductive technologies. Described in Chapter 14 (Preimplantation Genetic Testing), PGD is available for patients at risk for certain thalassemia syndromes (Kuliev, 2011).

Individuals of Eastern European Jewish Descent

Most individuals of Jewish ancestry in North America are descended from Ashkenazi Jewish communities and are at increased risk for having offspring with one of several autosomal recessive disorders. These include Tay-Sachs disease, Gaucher disease, cystic fibrosis, Canavan disease, familial dysautonomia, mucolipidosis IV, Niemann-Pick disease type A, Fanconi anemia group C, and Bloom syndrome. The American College of Obstetricians and Gynecologists (2016c, 2017a) recommends preconceptional counseling and screening for these in this population. Carrier frequency and features of these conditions are discussed in Chapter 14 (Sickle Hemoglobinopathies).

REPRODUCTIVE HISTORY

During preconceptional screening, information is sought regarding infertility; abnormal pregnancy outcomes that may include miscarriage, ectopic pregnancy, and recurrent pregnancy loss; and obstetrical complications such as cesarean delivery, preeclampsia, placental abruption, and preterm delivery (Stubblefield, 2008). As discussed in Chapter 35 (Risk Factors), details involving a prior stillbirth are especially important. For example,

Korteweg and associates (2008) identified chromosomal abnormalities in 13 percent of stillborns who underwent karyotyping. Reddy and colleagues (2012) confirmed that chromosomal microarray analysis (CMA) yielded better detection of genetic abnormalities than did standard karyotyping, primarily because nonviable tissue can be used for the analysis. CMA is described and illustrated in Chapter 13 (Chromosomal Microarray Analysis). Identification of a genetic abnormality in a stillborn can help determine the recurrence risk and aid in the preconceptional or prenatal management in subsequent pregnancies.

PARENTAL AGE

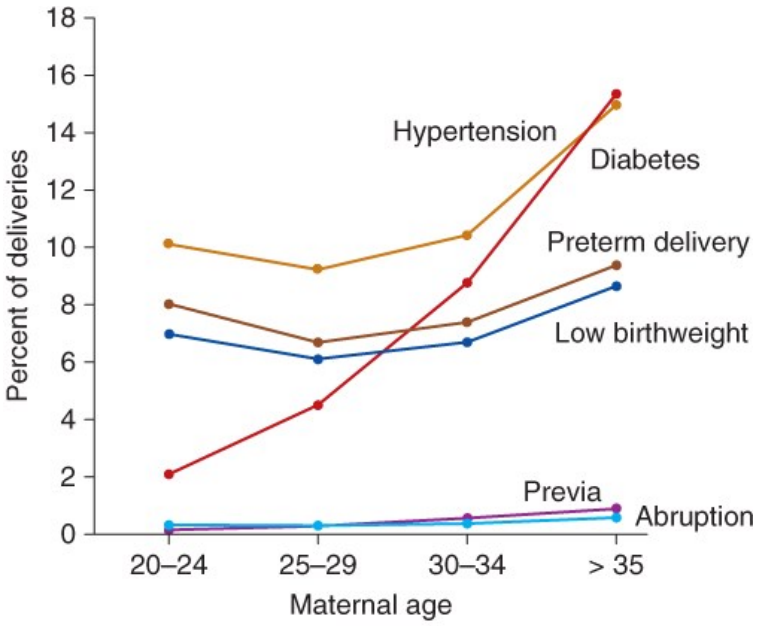
Maternal Age

Women at both ends of the reproductive-age spectrum have unique outcomes to be considered. First, according to the CDC, in 2010, 3.4 percent of births in the United States were in women between the ages of 15 and 19 years (Martin, 2012). These adolescents are at increased risk for anemia, preterm delivery, and preeclampsia compared with women aged 20 to 35 years (Usta, 2008). The incidence of sexually transmitted diseases—common in adolescents—is even higher during pregnancy (Niccolai, 2003). Unfortunately, because most of their pregnancies are unplanned, adolescents rarely seek preconceptional counseling.

Conceptions after age 35 currently comprise approximately 15 percent of pregnancies in the United States (Martin, 2012). By contrast, these older women are more likely to request preconceptional counseling, either because of postponed pregnancy with a desire to optimize outcomes or because of plans to undergo infertility treatment. Some studies—including data from Parkland Hospital presented in Figure 8-3— indicate that after age 35, the risks for obstetrical complications and for perinatal morbidity and mortality rise (Cunningham, 1995; Waldenström, 2015). The older woman who has a chronic illness or who is in poor physical condition usually has readily apparent risks. For the physically fit woman without medical problems, however, the risks are much lower than previously reported.

FIGURE 8-3

Incidence of selected pregnancy complications in relation to maternal age among 295,667 women delivered at Parkland Hospital.



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Overall, the maternal mortality rate is higher in women aged 35 and older. Compared with women in their 20s, women aged 35 to 39 are 2.5 times more likely and women aged 40 or older are 5.3 times more likely to suffer pregnancy-related mortality (Geller, 2006). Creanga and coworkers (2015) analyzed pregnancy-related deaths in the United States for 2006 through 2010. Although women older than 35 years contributed less than 15 percent of all live births, they constituted 27 percent of maternal deaths. For the fetus, maternal age-related risks primarily stem from: (1) indicated preterm

delivery for maternal complications such as hypertension and diabetes, (2) spontaneous preterm birth, (3) fetal growth disorders related to chronic maternal disease or multifetal gestation, (4) fetal aneuploidy, and (5) pregnancies resulting from assisted reproductive technology.

Assisted Reproductive Technologies

Recall that older women have subfertility problems. And although the incidence of dizygotic twinning increases with maternal age, the more important cause of multifetal gestation in older women follows the use of assisted reproductive technology (ART) and ovulation induction. Indeed, according to the CDC, 30 to 40 percent of all multifetal gestations in the United States in 2012 were conceived with the use of ART (Sunderan, 2015). Morbidity and mortality with multifetal pregnancies stem from preterm delivery. Other obstetrical morbidities, such as placenta previa, abruption, and preeclampsia, are also risks associated with these conceptions (Lukes, 2017; Qin, 2016).

Finally, experience has accrued that links ART to higher major congenital malformation rates. Davies and colleagues (2012) reported that of 308,974 births in South Australia, 8.3 percent of neonates conceived by ART had major birth defects. In this analysis, after adjustment for maternal age and other risk factors, intracytoplasmic injection continued to be associated with a significantly elevated risk for malformations, but in vitro fertilization did not.

Paternal Age

Parental history and experiences—paternal and maternal—can exert effects through epigenomic information not contained in the DNA sequence. Examples include variations in sperm and oocyte cytosine methylation and other mechanisms (Cedars, 2015; Lane, 2014). Perhaps one example is the possible link between increasing paternal age and complex neuropsychiatric conditions (Malaspina, 2015). Finally, the incidence of genetic diseases in offspring caused by new autosomal-dominant mutations in older men is increased. Still, the incidence is low (Chap. 13, Autosomal Dominant Inheritance). Accordingly, targeted sonographic examination performed solely for advanced maternal or paternal age is controversial.

SOCIAL HISTORY

Recreational Drugs and Smoking

Fetal risks associated with alcohol, marijuana, cocaine, amphetamines, and heroin are discussed in Chapter 12 (Known and Suspected Teratogens). The first step in preventing drug-related fetal risk is an honest assessment of use by the patient (American College of Obstetricians and Gynecologists, 2017c). Toward this end, questioning should be nonjudgmental. Screening for at-risk drinking can be accomplished using several validated tools. One is the well-studied TACE questions (American College of Obstetricians and Gynecologists, 2013). This is a series of four questions concerning *tolerance* to alcohol, being *annoyed* by comments about their drinking, attempts to *cut down*, and a history of drinking early in the morning—the *eye opener*.

In a Canadian study of more than 1000 postpartum patients, Tough and coworkers (2006) found that a high percentage of women reported alcohol use concurrent with conception attempts. Specifically, nearly half of those planning for pregnancy reported a mean of 2.2 drinks daily during early gestation and before they recognized their pregnancy. Of note, Bailey and associates (2008) found that rates of binge drinking and marijuana use by men were unaffected by their partner's pregnancy. The frequency and pattern of such behaviors clearly underscore the opportunity for preconceptional counseling.

Currently 20 million women in the United States smoke cigarettes (Centers for Disease Control and Prevention, 2014). Smoking in pregnancy has been consistently associated with numerous adverse perinatal outcomes, listed in Chapter 12 (Tobacco). These risks are largely mitigated by cessation before pregnancy, highlighting the importance of screening for tobacco use in the preconceptional period and during prenatal care as outlined in Chapter 9 (Normal Pregnancy Duration).

Environmental Exposures

Contact with environmental substances is inescapable. Thus, it is fortunate that only a few agents have been shown to cause adverse pregnancy outcomes (Windham, 2008). Exposures to infectious diseases have myriad deleterious effects, and these are detailed in Chapters 64 and 65. Likewise, contact with some chemicals may impart significant maternal and fetal risks. As discussed in Chapters 9 and 12 (Common Concerns and Immunosuppressant Medications), excess exposure to methyl mercury or lead is associated with neurodevelopmental disorders.

In the past, some concerns were raised over common everyday exposure to *electromagnetic fields* such as those emanated by high-voltage power lines, electric blankets, microwave ovens, and cellular phones. Fortunately, no human or animal evidence links these and adverse fetal outcomes (Robert, 1999). The effects of *electrical shock* are discussed in Chapter 47 (Thermal Injury).

Diet

Pica is the craving for and consuming of ice, laundry starch, clay, dirt, or other nonfood items. It should be discouraged due to its inherent replacement of healthful food with nutritionally empty products (Chap. 9, Caffeine). In some cases, it may represent an unusual physiological response to iron deficiency. Many *vegetarian diets* are protein deficient but can be corrected by increasing egg and cheese consumption. *Anorexia* and *bulimia* increase maternal risks of nutritional deficiencies, electrolyte disturbances, cardiac arrhythmias, and gastrointestinal pathology (Becker, 1999). As discussed in Chapter 61 (Schizophrenia Spectrum Disorders), pregnancy-related complications with these disorders include greater risks of low birthweight, smaller head circumference, microcephaly, and small-for-gestational-age newborns (Kouba, 2005).

In contrast to these perinatal morbidities, *obesity* is linked with several maternal complications. As discussed in Chapter 48 (Maternal Morbidity), these include preeclampsia, gestational diabetes, labor abnormalities, cesarean delivery, and operative complications (American College of Obstetricians and Gynecologists, 2015b). Obesity also appears to be associated with a range of structural fetal anomalies (Stothard, 2009).

Exercise

Conditioned pregnant women usually can continue to exercise throughout gestation (American College of Obstetricians and Gynecologists, 2017d). As discussed in Chapter 9 (Common Concerns), no data suggest that exercise is harmful during pregnancy. One caveat is that as pregnancy progresses, balance problems and joint relaxation may predispose to orthopedic injury. A woman is advised not to exercise to exhaustion, and she should augment heat dissipation and fluid replacement. Further avoidances include prolonged supine position, activities requiring good balance, and extreme weather conditions.

Intimate Partner Violence

Pregnancy can exacerbate interpersonal problems and is a time of elevated risk from an abusive partner. According to the American College of Obstetricians and Gynecologists (2012), approximately 324,000 pregnant women are abused each year. As discussed in Chapter 47 (Trauma), intimate partner violence has been associated with greater risk for several pregnancy-related complications, including hypertension, vaginal bleeding, hyperemesis, preterm delivery, and low-birthweight neonates (Silverman, 2006). Because domestic violence can escalate during pregnancy, even to the point of homicide, the preconceptional period provides an ideal time for screening and if indicated, intervention (Cheng, 2010). As detailed in Chapter 9 (Alcohol), the American College of Obstetricians and Gynecologists (2012) provides recommendations and resources for screening both pregnant and nonpregnant women for domestic violence.

SCREENING TESTS

Certain laboratory tests may help assess the risk for and prevent some pregnancy complications. These include basic tests that are usually performed during prenatal care and are enumerated in Chapter 9. More specific tests may assist evaluation of women with certain chronic medical diseases. Examples of some chronic diseases that ideally would be assessed before conception are highlighted in Table 8-4. With several of these, optimizing maternal condition before conception will improve pregnancy outcomes. Cox and coworkers (1992) reviewed pregnancy outcomes in 1075 high-risk women who received such evaluation. They reported that the 240 women with hypertension, asthma, or renal, thyroid, or cardiac disease had better outcomes compared with the outcomes from their prior pregnancies.

TABLE 8-4

Selected Preconceptional Counseling Topics

Condition	Reference Chapter	Recommendations for Preconceptional Counseling
Environmental exposure	Chap. 9, Common Concerns Chap. 12,	*Methyl mercury:* Avoid shark, swordfish, king mackerel, and tile fish. Ingest no more than 12 ounces or 2 servings of canned tuna and no more than 6 ounces of albacore per week.

	Immunosuppressant Medications	*Lead:* Blood lead testing if a risk factor is identified; treat if indicated according to recommendations.
Abnormal weight	Chap. 48, General Considerations Chap. 61, Schizophrenia Spectrum Disorders	Calculate BMI yearly from Figure 48-1 $BMI \geq 25\ kg/m^2$: Counsel on diet. Test for diabetes and metabolic syndrome if indicated. Consider weight loss prior to conception. $BMI \leq 18.5\ kg/m^2$: Assess for eating disorder.
Cardiovascular disease	Chap. 49, Peripartum Management Considerations Chap. 12, Angiotensin-Converting Enzyme Inhibitors and Angiotensin-Receptor Blocking Drugs, Warfarin	Counsel on cardiac risks during pregnancy; discuss situations in which pregnancy is contraindicated. Optimize cardiac function. Discuss medication teratogenicity (warfarin, ACE inhibitor, ARB) and, if possible, switch to less dangerous agent when conception planned. Offer genetic counseling to those with congenital cardiac anomalies (Table 49-4).
Chronic hypertension	Chap. 50, Definition and Classification	Counsel on specific risks during pregnancy. Assess those with long-standing HTN for ventricular hypertrophy, retinopathy, and renal disease. Optimize blood pressure control. If medications indicated, select or switch to an agent appropriate for pregnancy.
Asthma	Chap. 51, Asthma	Counsel on asthma risks during pregnancy. Optimize pulmonary function preconceptionally. Treat women with pharmacological step therapy for chronic asthma.
Thrombophilia	Chap. 52, Inherited Thrombophilias	Question for personal or family history of thrombotic events or recurrent poor pregnancy outcomes. If a thrombophilia is found or known, counsel and offer appropriate anticoagulation regimen.
Renal disease	Chap. 53, Pregnancy-Induced Urinary Tract Changes Chap. 12, Angiotensin-Converting Enzyme Inhibitors and Angiotensin-Receptor Blocking Drugs	Counsel on specific risks during pregnancy. Optimize blood pressure control before conception. Counsel women taking ACE inhibitors and ARBs about teratogenicity and the need to switch agents before pregnancy.
Gastrointestinal disease	Chap. 54, Inflammatory Bowel Disease and Fertility Chap. 12, Antimicrobial Drugs, Immunosuppressant Medications	*Inflammatory bowel disease:* Counsel affected women on subfertility risks and risks of adverse pregnancy outcomes. Discuss teratogenicity of methotrexate and the other immunomodulators. Offer effective contraception during their use and switch agents, if possible, before conception.
Hepatobiliary disease	Chap. 55, Pregnancy and Hepatitis B	*Hepatitis B:* Vaccinate all high-risk women before conception (Table 9-7). Counsel chronic carriers on transmission prevention to partners and fetus. Treat if indicated. *Hepatitis C:* Screen high-risk women. Counsel affected women on risks of disease and transmission. If treatment indicated, discuss ramifications and appropriateness of pregnancy.
Hematological disease	Chap. 56, Anemias	*Iron-deficiency anemia:* Iron supplementation. *Sickle-cell disease:* Screen all black women. Counsel those with trait or disease. Test partner if desired. *Thalassemias:* Screen women of Southeast Asian or Mediterranean ancestry.
Diabetes	Chap. 57, Diabetic Neuropathy	Optimize glycemic control to minimize teratogenicity of hyperglycemia. Evaluate for end-organ damage such as retinopathy, nephropathy, hypertension, and others. Discontinue ACE inhibitors.

Thyroid disease	Chap. 58, Thyroid Disorders	Screen those with thyroid disease symptoms. Ensure iodine-sufficient diet. Treat overt hyper- or hypothyroidism. Counsel on risks to pregnancy outcome.
Connective tissue disease	Chap. 59, Immune-Mediated Connective Tissue Diseases Chap. 12, Angiotensin-Converting Enzyme Inhibitors and Angiotensin-Receptor Blocking Drugs	*RA:* Counsel on flare risk after pregnancy. Discuss methotrexate and leflunomide teratogenicity, as well as possible effects of other immunomodulators. Switch these agents before conception. Stop NSAIDs by 27 weeks' gestation. *SLE:* Counsel on risks during pregnancy. Optimize disease before conception. Discuss mycophenolate mofetil and cyclophosphamide teratogenicity as well as possible effects of newer immunomodulators. Switch these agents before conception.
Psychiatric disorders	Chap. 61, Treatment Considerations	*Depression:* Screen for symptoms of depression. Counsel on risks of treatment and of untreated illness and the high risk of exacerbation during pregnancy and the puerperium.
Neurological disorders	Chap. 60, Preconceptional Counseling	*Seizure disorder:* Optimize seizure control using monotherapy if possible.
Dermatological disease	Chap. 12, Selective Serotonin- and Norepinephrine-Reuptake Inhibitors	Discuss isotretinoin and etretinate teratogenicity and effective contraception during their use; switch agents before conception.
Cancer	Chap. 63, Fertility and Pregnancy after Cancer Therapy	Counsel on fertility preservation options before cancer therapy and on decreased fertility following certain agents. Discuss appropriateness of pregnancy balanced with need for ongoing cancer therapy and prognosis of the disease state.
Infectious diseases	Chap. 64, Maternal and Fetal Immunology	*Influenza:* Vaccinate all women who will be pregnant during flu season. Vaccinate high-risk women prior to flu season. *Malaria:* Counsel to avoid travel to endemic areas during conception. If unable, offer effective contraception during travel or provide chemoprophylaxis for those planning pregnancy. *Zika virus:* See travel restrictions by CDC. *Rubella:* Screen for rubella immunity. If nonimmune, vaccinate and counsel on the need for effective contraception during the subsequent month. *Tdap: tetanus, diphtheria, pertussis*: Update vaccination in all reproductive-aged women. *Varicella:* Question regarding immunity. If nonimmune, vaccinate.
STDs	Chap. 65, Syphilis	*Gonorrhea, syphilis, chlamydial infection:* Screen high-risk women and treat as indicated. *HIV:* Screen at-risk women. Counsel affected women on risks during pregnancy and on perinatal transmission. Discuss initiation of treatment before pregnancy to decrease transmission risk. Offer effective contraception to those not desiring conception. *HPV:* Provide Pap smear screening per guidelines (Chap. 63, Epithelial Neoplasia). Vaccinate candidate patients. *HSV:* Provide serological screening to asymptomatic women with affected partners. Counsel affected women on risks of perinatal transmission and on preventative measures during the third trimester and labor.

ACE = angiotensin-converting enzyme; ACOG = American College of Obstetricians and Gynecologists; ARB = angiotensin-receptor blocker; BMI = body mass index; CDC = Centers for Disease Control and Prevention; HIV = human immunodeficiency virus; HPV = human papillomavirus; HSV = herpes simplex virus; HTN = hypertension; NSAID = nonsteroidal antiinflammatory drug; RA = rheumatoid arthritis; SLE = systemic lupus erythematosus; STD = sexually transmitted disease.

Data from Jack BW, Atrash H, Coonrod DV, et al: The clinical content of preconception care: an overview and preparation of this supplement, Am J Obstet Gynecol. 2008 Dec;199(6 Suppl 2):S266–S279.

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