Prenatal care: Initial assessment

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INTRODUCTION

The three main components of prenatal care are: risk assessment, health promotion and education, and therapeutic intervention [1]. High-quality prenatal care can prevent or lead to timely recognition and treatment of maternal and fetal complications. Complications of pregnancy and childbirth are the leading cause of morbidity and mortality in females of reproductive age globally [2].

This topic will discuss the initial prenatal assessment (which may require more than one visit) in the United States. Most of these issues are common to pregnancies worldwide. Preconception care, ongoing prenatal care after the initial prenatal assessment, and issues related to patient counseling are reviewed separately.

- (See "The preconception office visit".)
- (See "Prenatal care: Second and third trimesters".)
- (See "Prenatal care: Patient education, health promotion, and safety of commonly used drugs".)
- (See "COVID-19: Overview of pregnancy issues".)

GOALS

The major goal of prenatal care is to help ensure the birth of a healthy newborn while minimizing maternal risk. There are several components involved in achieving this objective:

- Early, accurate estimation of gestational age
- Identification of pregnancies at increased risk for maternal, fetal, or subsequent pediatric morbidity and mortality
- Ongoing evaluation of maternal and fetal health status
- Anticipation of problems, with intervention (if possible) to prevent or minimize morbidity
- Health promotion, education, support, and shared decision-making
- Recognition of the impact of social and structural determinants of health and disparities in health care on pregnancy outcome
- Provision of respectful maternity care

Healthy pregnant people have described the following factors as those that matter most to them for a positive pregnancy experience [3]:

- Maintaining physical, social, and cultural normality
- Maintaining a healthy pregnancy, with appropriate intervention when indicated
- When labor begins, effectively transitioning to a positive labor and birth experience
- Achieving a positive mothering experience (eg, building self-esteem, competence, and autonomy)

The World Health Organization developed 39 recommendations on antenatal care for a positive pregnancy experience. The recommendations related to five types of interventions: nutritional interventions, maternal and fetal assessment, preventive measures, interventions for common physiological symptoms, and health system interventions to improve utilization and quality of antenatal care.

EFFECTIVENESS

There is evidence that prenatal care confers some health benefits, although how it does so and the types and magnitude of benefits appear to be complex and multifactorial [4,5]. Prenatal care has many components, including timing of initiation of care, number and spacing of visits, type and quality of content (eg, assessment of risk, conditions screened for, patient education/counseling), clinical provider type/training, setting for provision of prenatal care, ancillary services (eg, nutrition, management of substance use, psychosocial support services, economic support), and prenatal care systems issues [6]. The effectiveness of many of these components or packages of components generally has not been rigorously evaluated.

The following examples are findings from meta-analyses of randomized trials of one or more components of prenatal care:

- **Special assistance/support versus standard care** – Special assistance may include emotional support, tangible support (eg, direct assistance, home visits), and informational support. A meta-analysis of randomized trials found that programs offering special assistance for pregnant people at risk for giving birth to a low birth weight (LBW) infant may have favorable effects compared with routine prenatal care, but the confidence intervals suggest that a true effect, if present, would not be large [7]:

  - Birth weight less than 2500 g (120 out of 1000 versus 127 out of 1000 with routine care, risk ratio [RR] 0.94, 95% CI 0.86-1.04, 16 studies, >11,000 participants, moderate-quality evidence)

  - Birth <37 weeks of gestation (117 out of 1000 versus 128 out of 1000 with routine care, RR 0.92, 95% CI 0.84-1.01, 14 studies, >12,000 participants, moderate-quality evidence)

  Postnatal depression also appeared to be reduced slightly in the special assistance group, but meta-analysis could not be performed because of differences in reported outcomes. The risks for stillbirth and neonatal death were similar for both groups.

- **Reduced versus standard number of prenatal visits** – The number of visits for standard prenatal care varies among countries; therefore, what constitutes a reduced number of visits also varies. In a meta-analysis of trials of provision of prenatal care for low-risk pregnancies, patients in the reduced visit group in high-income countries had 8 to 12 prenatal visits, whereas many patients in the reduced visits group in low- and middle-income country trials had fewer than five prenatal visits. Major findings of the analysis were:

  - Perinatal mortality – When compared with standard care in low-risk pregnancies, reduced visits appeared to increase perinatal mortality (RR 1.14, 95% CI 1.00-1.31, five trials, >56,000 infants, moderate-quality evidence) [8].

    In the subgroup analysis, for high-income countries, the number of deaths was small (32 of 5108), with no clear difference between the groups (RR 0.90, 95% CI 0.45-1.80, two trials), whereas for low- and middle-income countries, perinatal mortality was significantly higher in the reduced visits group (RR 1.15, 95% CI 1.01-1.32, three trials).

  - Other outcomes

- There was no clear difference between groups for maternal death, hypertensive disorders of pregnancy, preterm birth, or small for gestational age (SGA).
- Patients in all settings were less satisfied with the reduced visits schedule and perceived the gap between visits as too long.
- Reduced visits may be associated with lower costs.

A limitation of the analysis is that the number of visits does not necessarily reflect the care provided. (See "Prenatal care: Second and third trimesters", section on 'Frequency of prenatal visits'.)

- **Group versus traditional one-on-one prenatal care** – In a meta-analysis of randomized trials comparing patients receiving group prenatal care with those receiving traditional one-on-one prenatal care, both groups had similar rates of [9]:
  - Preterm birth (RR 0.75, 95% CI 0.57-1.00)
  - LBW (RR 0.92, 95% CI 0.68-1.23)
  - SGA (RR 0.92, 95% CI 0.68-1.24)
  - Perinatal mortality (RR 0.63, 95% CI 0.30-1.25)

(See "Group prenatal care".)

- **Specialized clinics versus standard care for patients at high risk for preterm birth** – In a meta-analysis of randomized trials comparing patients who received care at a clinic to prevent the onset of preterm labor and facilitate its early identification and treatment with those who received usual care, the intervention did not significantly reduce rates of preterm birth, very preterm birth, or stillbirth [10]. There were many limitations to these data, including heterogeneity in outcome focus, target populations, study design, and specific intervention components.
- **Midwifery versus other types of obstetric care** – In a meta-analysis of randomized trials comparing pregnant patients assigned to midwife-led continuity models of care with those assigned to other models of care (15 trials, over 17,000 participants), patients in midwife-led continuity models of care were less likely to experience intrapartum intervention, more likely to be satisfied with their care, and had similar rates of adverse outcomes [11].

  Another systematic review that compared midwife-led models of care with other models of care reported similar findings [12]. The trials included both patients at low risk of complications and those at increased risk who were not currently experiencing problems.

- **Other evidence**

  - A summary of evidence from Cochrane systematic reviews on the effects of antenatal interventions for preventing stillbirth for low-risk or unselected pregnancies concluded that, while most interventions were unable to demonstrate a clear effect in reducing stillbirth or perinatal death, the following interventions were beneficial: balanced energy/protein supplements, midwife-led models of care, training versus not training traditional birth attendants, and antenatal cardiotocography [13].

    Possible benefits were observed for insecticide-treated antimalarial nets and community-based intervention packages, whereas a reduced number of antenatal care visits was harmful.

    There was variation in the effectiveness of interventions across different settings, highlighting the importance of assessing the context in which these interventions were tested.

  - Systematic reviews have supported the benefits of screening for and management of several conditions, including but not limited to: gestational diabetes mellitus, maternal Group B *Streptococcus* colonization, maternal RhD antigen and antibody status. (See "Gestational diabetes mellitus: Screening, diagnosis, and prevention" and "Prevention of early-onset group B streptococcal disease in neonates" and "RhD alloimmunization in pregnancy: Overview".)

    In addition, frequently monitoring blood pressure in the second half of pregnancy is essential for timely diagnosis and management of preeclampsia. (See "Preeclampsia: Clinical features and diagnosis" and "Preeclampsia: Antepartum management and timing of delivery".)

  - Respectful maternity care is variably defined but broadly involves absence of disrespectful conduct toward the pregnant individual (eg, physical/verbal/sexual abuse, lack of confidentiality, unnecessary examinations/procedures, discrimination, neglect/abandonment, poor communication, physical constraints) and promotion of respectful conduct (eg, informed consent/shared decision-making; dignity, respect, and privacy in interactions; equitable care; quality care; safe environment). A systematic review found that validated tools to measure respectful maternity care were available but the optimal tool was unclear [14]. Furthermore, no high-quality studies have evaluated the effectiveness of respectful maternity care for improving any maternal or infant health outcome.

TIMING

Prenatal care should be initiated in the first trimester, ideally by 10 weeks of gestation since some prenatal screening and diagnostic tests can be performed at 10 to 11 weeks of gestation. Early initiation of care is also useful to establish gestational age and early baseline maternal measurements (eg, weight [body mass index], blood pressure, laboratory evaluation [in patients with chronic diseases]) and provide early social service support and intervention, when warranted.

The percentage of pregnant patients who initiate prenatal care in the first trimester is one of the standard clinical performance measures used to assess the quality of maternal health care. In the United States, approximately 57 percent of federally funded community health centers met the Healthy People 2020 baseline for patients initiating prenatal care in the first trimester (78 percent), and only 38 percent met the Healthy People 2020 target (85 percent) [15]. The World Health Organization (WHO) estimated that 60 percent of pregnant people worldwide initiated prenatal care before 12 weeks of gestation; however, regional and income disparities were identified [16]. Less than 50 percent of pregnant people in resource-limited regions received early antenatal care versus over 80 percent in resource-abundant regions; more than 80 percent of pregnant people in the highest income group received early antenatal care versus 25 percent of those in the lowest income group.

CARE PROVIDER

- **Standard one-on-one care** – Prenatal care is generally provided by midwives, obstetrician-gynecologists, family medicine physicians, and/or maternal-fetal medicine (MFM) subspecialists. Midwives and family medicine physicians generally provide prenatal care for patients with pregnancies in which major complications are not anticipated. Obstetrician-gynecologists are specialists who provide prenatal care for uncomplicated and some complicated pregnancies. MFM clinicians are subspecialist obstetrician-gynecologists with expertise for managing high-risk, complicated pregnancies.

  Midwifery-led care and collaboration between midwives and physicians are common models of prenatal care, influenced by the medical/obstetric needs and personal preferences of the pregnant person as well as local licensing regulations. (See 'Effectiveness' above.)

  Prenatal doulas and prenatal educators are ancillary providers who provide education and support. Prenatal educators tend to deliver information in a group setting. Prenatal doulas

work one-on-one with their patient and may serve as a coach. Birth doulas provide education, support, and advocacy during childbirth (see "Continuous labor support by a doula"). Postpartum and breastfeeding doulas also exist.

- **Group prenatal care** – Group prenatal care is an alternative means of providing prenatal care in which participants with the same month of expected delivery receive the majority of their care in a group setting. The only private times between patient and clinician are during the initial prenatal assessment, when health concerns involving need for privacy arise, and during cervical assessment late in pregnancy. The majority of the visit, which may last two hours, involves facilitated group discussion, education, and skills building to address explicit learning objectives in prenatal care, childbirth preparation, and postpartum and parenting roles.

  Group prenatal care appears to result in at least equivalent obstetric outcomes and high levels of patient satisfaction compared with traditional prenatal care. (See "Group prenatal care".)

- **Subspecialty obstetric care** – MFM subspecialists are obstetrician-gynecologists with additional training in the area of high-risk, complicated pregnancies. A high-risk pregnancy has been defined as one in which the mother, fetus, or newborn is at risk of death or residual injury and thus requires additional resources, procedures, or specialized care to optimize outcome [17,18].

  Referral to an MFM subspecialist is appropriate for individuals with chronic health conditions or serious acute disorders, those who have experienced pregnancy complications in the past, and those who develop complications during their current pregnancy; this decision depends on the obstetrician-gynecologist's level of expertise with the specific problem.

  Subspecialist care for high-risk pregnancies has not been studied extensively, except for specialty clinics that provide a prenatal care package for patients at high risk of preterm birth. (See 'Effectiveness' above.)

- **Multidisciplinary care** – Pregnant patients with medical comorbidities benefit from collaborative multidisciplinary care by a team that includes their obstetric provider and appropriate medical or surgical subspecialists, and possibly specialists in genetics, anesthesia, and pediatrics.

COMPONENTS OF THE INITIAL PRENATAL VISIT

Appropriate historical information, physical examination, and laboratory evaluation can help identify pregnant people at increased risk of medical complications, pregnancy complications, or fetal abnormalities. Early identification of these patients gives the provider an opportunity to discuss these issues and their management with the patient and, in some cases, offer interventions to prevent or minimize the risk of an adverse outcome. Time constraints are an ongoing challenge [19,20].

History

- **Medical/obstetric history** – At or prior to the first prenatal visit, it is efficient for the patient to complete a questionnaire detailing their psychosocial, medical, obstetric, and family history. This information can be used to start an obstetric record that will document their prenatal, intrapartum, and postpartum course. Several paper and computerized obstetric record forms are available for this purpose. They help to ensure complete and systematic documentation of the pregnancy and often may be used for risk-assessment planning.

  The major elements of the patient history include:

  - Demographic information (including age, education/health literacy, occupation, race/ethnicity, religious concerns regarding blood transfusion and information about the patient's partner) (see "Approach to the patient who declines blood transfusion").

  - Past obstetric history (table 1).

    - If the patient has risk factors for ectopic pregnancy (table 2), early identification of the location of the pregnancy is important. (See "Ectopic pregnancy: Epidemiology, risk factors, and anatomic sites", section on 'Risk factors' and "Ectopic pregnancy: Clinical manifestations and diagnosis", section on 'Diagnostic evaluation' and "Approach to the patient with pregnancy of unknown location".)

    - An adverse outcome in a previous pregnancy increases the risk of an adverse outcome in the next pregnancy. (See "Spontaneous preterm birth: Overview of risk factors and prognosis" and "Stillbirth: Incidence, risk factors, etiology, and prevention" and "Fetal growth restriction: Evaluation" and "Acute placental abruption: Management and long-term prognosis".)

  - Personal medical history, including allergies, medications (prescription and nonprescription), and immunizations; risk assessment for heritable disorders and substance use (illicit drugs, recreational drugs, nonmedical use of medications,

alcohol); infection history/exposure; and toxic exposures in the workplace, home, or recreational activities (table 3).

In particular:

- Clinicians need to be attentive to the signs and symptoms of heart disease (fatigue, palpitation, dyspnea, or anginal pain), particularly in patients with risk factors, as failure to identify an underlying heart condition, failure to recognize a high-risk patient, delay in treatment or intervention, and late recognition of cardiac deterioration substantially contribute to the occurrence of serious cardiac events in pregnancy [21]. (See "Acquired heart disease and pregnancy" and "Pregnancy in women with congenital heart disease: General principles".)

- Use of validated screening tool for substance use is recommended (table 4). Screen-positive patients should be appropriately evaluated and treated. (See "Substance use during pregnancy: Screening and prenatal care", section on 'Screening for substance use' and "Substance use during pregnancy: Screening and prenatal care", section on 'Prenatal care of individuals with substance use disorder'.)

- Although rare, patients should be queried about a history of phenylketonuria, which is detected on newborn screening. If the patient does not volunteer the diagnosis because they are no longer on a restricted diet, asking about dietary restrictions during childhood might reveal the diagnosis. Elevated serum phenylalanine concentration during early pregnancy in a mother with phenylketonuria or hyperphenylalaninemia can result in phenylalanine embryopathy, which can be prevented by dietary restriction of phenylalanine intake. (See "Overview of phenylketonuria".)

- Family medical history (a tool is available online).

  - Findings in the family history that may suggest a heritable disorder impacting the fetus include known or suspected genetic disease, multiple malformations, multiple miscarriages, recurrence of the same or similar disorders, intellectual disability, autism spectrum disorder, and consanguinity.

- Past surgical history, including bariatric surgery. (See "Fertility and pregnancy after bariatric surgery".)

- Menstrual and gynecologic history. (See "The gynecologic history and pelvic examination".)
- Current pregnancy history, including the patient's desire for the pregnancy.
- Potential exposure to infection (eg, malaria, tuberculosis, Zika virus, Chagas disease) because of travel.
- Exposure to potentially toxic environmental agents (table 3), including (see "Occupational and environmental risks to reproduction in females: Specific exposures and impact" and "Overview of occupational and environmental risks to reproduction in females" and "Diagnostic imaging in pregnant and lactating patients"):
  - Antineoplastic drugs
  - Air pollutants, including cigarette smoke
  - Heavy metals (lead, mercury, cadmium)
  - Radiation
  - Chemicals (eg, ethylene oxide, formaldehyde, flame retardants, solvents, perfluorochemicals, pesticides, endocrine-disrupting chemicals [bisphenol A, phthalates, polybrominated diethyl ethers])

- **Psychosocial history** – Psychosocial issues of potential concern that should be identified and discussed with the patient include [22,23]:
  - Planned or unintended pregnancy.
  - Potential barriers to care (eg, cognitive impairment, physical disability, language and other communication issues, lack of transportation, lack of childcare, economic constraints, work schedule, legal/immigration status, emotional stress/ family or personal problems/depression, negative perceptions or fear of health care providers or services).
  - Mental health and level of stress (including depression screening, access to interpersonal support, self-esteem/agency issues). The American College of Obstetricians and Gynecologists (ACOG) suggests screening patients for depression and anxiety at the initial prenatal visit, later in pregnancy, and at postpartum visits using a standardized, validated tool, such as the PHQ-9 or Edinburgh Postnatal Depression Scale (table 5 and figure 1A-B) [23]. Other tools are available, such as the PHQ-4, which screens for both anxiety and depression (table 6), and the GAD-7 scale (table 7), which assesses severity of anxiety. Practices may distribute

questionnaires at check-in for patients to complete or have staff distribute or verbally administer questionnaires along with measuring vital signs. The provider can further evaluate patients who screen positive. Systems should be in place to ensure timely access to assessment and diagnosis, effective treatment, and appropriate monitoring and follow-up based on severity.

If pharmacotherapy for depression is initiated, screening for bipolar disorder (table 8) should be performed first because misdiagnosis can lead to an inappropriate choice of depression treatment, which may precipitate mania, psychosis, or mixed states. A state-based Perinatal Psychiatry Access Program is a useful resource for managing patients with mental health conditions [24]. (See "Unipolar major depression during pregnancy: Epidemiology, clinical features, assessment, and diagnosis" and "Generalized anxiety disorder in adults: Epidemiology, pathogenesis, clinical manifestations, course, assessment, and diagnosis" and "Bipolar disorder in adults: Assessment and diagnosis" and "Bipolar major depression in adults: Choosing treatment" and "Bipolar mania and hypomania in adults: Choosing pharmacotherapy" and "Bipolar disorder in postpartum women: Epidemiology, clinical features, assessment, and diagnosis".)

- Presence/absence of stable housing and food security.

- Victim of violence (past history and future risk) – Clinicians should routinely assess all pregnant patients for past or current exposure to interpersonal violence [25-27]. Markers and characteristics of abuse include bruising, improbable injury, depression, late prenatal care (presentation in the late second or the third trimester), missed prenatal visits, and appointments cancelled on short notice.

  Exposure to intimate partner violence is associated with an increased risk of low birth weight (LBW) newborns and preterm birth [28]. In the United States, homicide during pregnancy or within 42 days postpartum exceeds maternal mortality from hemorrhage, hypertensive disorders, or infection [29]. Counseling and intervention can reduce intimate partner violence and improve pregnancy outcome [30]. (See "Intimate partner violence: Epidemiology and health consequences", section on 'Pregnancy' and "Intimate partner violence: Diagnosis and screening" and "Intimate partner violence: Intervention and patient management".)

  Patients with past histories of sexual trauma may have psychological distress triggered by the normal process of prenatal care, labor, and delivery; discussion of these issues with the patient and modifications in some aspects of care may alleviate some of this

distress (table 9) [31,32]. Health care issues specific to female patients with trauma exposure, challenges in providing prenatal care, and techniques to reduce retraumatization (ie, trauma-informed care) are discussed in detail separately. (See "Health care for female trauma survivors (with posttraumatic stress disorder or similarly severe symptoms)".)

- Status of previous children (eg, living with the parent and/or partner, foster care, adoption)

Calculating the estimated date of delivery — Calculators are available for determining the estimated date of delivery (EDD) and gestational age (calculator 1 and calculator 2) from the date of the last menstrual period. Accurate dating is crucial for managing the pregnancy, especially with regard to timing interventions and monitoring fetal growth. Sonographic estimation of the EDD before 20 weeks of gestation is desirable in all pregnancies. (See 'Ultrasound examination' below.)

Physical examination — Baseline blood pressure [33,34], weight, and height should be recorded. Calculating body mass index (calculator 3) facilitates counseling about the appropriate amount of weight gain over the course of pregnancy (table 10). Patients who are underweight or have obesity are counseled about their specific risks in pregnancy. (See "Gestational weight gain" and "Obesity in pregnancy: Complications and maternal management".)

If the initial blood pressure is elevated, the clinician should attempt to find records of prepregnancy blood pressures to document whether the patient has chronic (preexisting) hypertension (ie, elevated blood pressure: systolic 120 to 129 mmHg and diastolic <80 mmHg, stage 1 hypertension: systolic 130 to 139 mmHg or diastolic 80 to 89 mmHg, stage 2 hypertension: systolic ≥140 mmHg or diastolic ≥90 mmHg). This information can be important in establishing the correct diagnosis (chronic hypertension versus preeclampsia versus gestational hypertension) if blood pressure increases in the second half of pregnancy. If blood pressure is measured using an automated device, it should have been properly validated in a pregnant population [35]. Management of chronic hypertension in pregnancy is discussed separately. (See "Chronic hypertension in pregnancy: Prenatal and postpartum care".)

A complete physical examination is performed, with special attention to uterine size and shape and evaluation of the adnexa. The size-gestational age correlation is learned by experience and is often described in terms of fruit (eg, for singleton pregnancies: 6 to 8 week size = plum, 8 to 10 week size = orange, 10 to 12 week size = grapefruit), despite the imprecision of this terminology. When the uterine size on physical examination differs from that predicted by

menstrual dating, early sonographic assessment is indicated. Causes for a discrepancy between the actual uterine size and that predicted by the last menstrual period include uterine fibroids, uterine malposition (eg, retroverted uterus), multiple gestation, and incorrect last menstrual date. (See "Prenatal assessment of gestational age, date of delivery, and fetal weight" and "Uterine fibroids (leiomyomas): Issues in pregnancy".)

When fetal heart activity is present, the fetal heart can usually be heard by 12 weeks of gestation using a hand-held Doppler ultrasound device. Transvaginal ultrasound scanners can identify fetal cardiac motion as early as 5.5 weeks.

Ultrasound examination

- **Gestational age** – Ultrasound examination in the first trimester to determine gestational age is particularly important when menses are irregular, the last menstrual period is unknown or uncertain, in patients who conceive while using hormonal contraception, and when the uterine size is discordant with menstrual dates. Routine early (before 20 weeks of gestation) ultrasound examination provides a better estimation of gestational age than menstrual dates, resulting in significant reductions in the frequency of labor induction for postterm pregnancy and tocolysis for suspected preterm labor. More accurate estimation of EDD may also reduce planned cesarean birth before 39 weeks of gestation resulting from misdiagnosis of gestational age. These data are reviewed separately. (See "Prenatal assessment of gestational age, date of delivery, and fetal weight".)

  The assessment of appropriate fetal/neonatal size is based upon the expected weight for gestational age. If gestational age is overestimated, then an appropriately grown fetus/neonate may be incorrectly classified as growth restricted or small for gestational age (SGA) and receive inappropriate intervention. However, in a 2015 Cochrane review of trials of routine/revealed ultrasound versus selective/concealed ultrasound before the 24th week of pregnancy, routine use of early ultrasound did not result in a significant reduction in diagnosis of SGA (relative risk 1.05, 95% CI 0.81-1.35; three trials, >17,000 pregnancies) [36].

- **Multiple gestation** – First-trimester ultrasound examination can lead to early detection of a multiple gestation and determination of chorionicity and amnionicity. (See "Twin pregnancy: Overview", section on 'Sonographic diagnostic evaluation'.)

- **Congenital anomalies** – First-trimester ultrasound examination can lead to early detection of fetal anomalies and anatomic markers associated with common aneuploidies [36-38]. (See 'Aneuploidy screening and diagnosis' below and 'Fetal anomaly screening' below.)

Discussion of screening and diagnostic testing for genetic and anatomic abnormalities — Patients undergoing any screening test should understand the difference between a screening test and diagnostic test. This is particularly important in genetic screening, in which couples need to understand what is and is not being screened for, the interpretation of screen-positive and -negative results, the possibility of false-positive and -negative results, possible follow-up invasive or noninvasive testing, and possible reproductive choices.

Aneuploidy screening and diagnosis — We believe that all pregnant patients should be offered prenatal genetic screening (serum biomarker screening with or without nuchal translucency or cell-free DNA screening) and should have the option of having an invasive procedure for diagnostic testing instead of noninvasive screening (regardless of maternal age), in agreement with ACOG guidance [39].

Diagnostic testing involves performing genetic studies on samples (eg, chorionic villi or amniocytes) obtained by an invasive procedure, typically chorionic villus biopsy or amniocentesis, to identify fetuses who are aneuploid. (See "Chorionic villus sampling" and "Diagnostic amniocentesis".)

Screening tests identify fetuses at high risk of aneuploidy and fall into two major categories:

- Assessment of cell-free DNA in the maternal circulation to screen for trisomy 21, trisomy 18, trisomy 13, and sex chromosome aneuploidies is an increasingly popular option. (See "Prenatal screening for common aneuploidies using cell-free DNA".)

- Assessment of maternal serum levels of specific biochemical markers associated with trisomy 21 (Down syndrome) and trisomy 18 (Edwards syndrome), with or without assessment of specific ultrasound markers, is another option. This approach may lead to detection of fetal conditions beyond the primary targets. (See "Down syndrome: Overview of prenatal screening", section on 'Tests integrated across the first and second trimesters' and "Down syndrome: Overview of prenatal screening", section on 'First-trimester combined test' and "Down syndrome: Overview of prenatal screening", section on 'Second-trimester quadruple test'.)

Either approach is acceptable if the patient receives appropriate pretest genetic counseling to make an informed choice, including no screening or testing. The cost can differ substantially depending on the approach and is another factor for the patient to consider.

Fetal anomaly screening — Increasingly, a first-trimester fetal anatomy scan is performed before, in conjunction with, or after first-trimester aneuploidy screening. Detection of fetal anomalies in the first trimester is limited by small fetal size, ongoing fetal development, and

maternal habitus. Nevertheless, ultrasound technology is rapidly progressing and assessment of fetal anatomy in the first trimester is becoming more widely available. In a 2017 systematic review of 30 studies from 1991 to 2014, the sensitivity of first-trimester ultrasound screening for detection of fetal anomalies in low-risk or unselected populations was 32 percent (95% CI 22-43 percent) and, in high-risk populations, 61 percent (95% CI 38-82 percent) [37]. When only major anomalies were considered, sensitivity in low-risk or unselected populations was 46 percent. An anomaly of any type was present in 1.8 in 100 fetuses in low-risk pregnancies and 6.6 in 100 fetuses in high-risk pregnancies; a major anomaly was present in 1 in 100 fetuses in low-risk pregnancies. No information was available on specific anomalies. Although there was considerable heterogeneity among these studies and sonographic equipment and expertise improved over the 23-year study period and since the study was done, the findings affirm both the potential benefits and limitations of the first-trimester fetal anatomic survey. Most patients will need a second-trimester survey to provide a more reliable assessment of fetal anatomy.

The type and order of testing depend on patient preference, which is often influenced by insurance coverage. As an example, for patients who elect genetic screening rather than testing, many will have an ultrasound at 10 to 13 weeks to confirm gestational age and fetal heart activity, determine the number of fetuses, assess for aneuploidy markers such as enlarged nuchal translucency, and evaluate early fetal anatomy, acknowledging that early fetal anatomy is best evaluated at the latter part of this interval (12 to 13 weeks). Blood for cell-free DNA screening is often drawn at this visit; however, patients with enlarged nuchal translucency or multiple soft markers may opt for diagnostic testing instead of screening based on the sonographic findings. If the ultrasound is normal, the patient returns at 18 to 20 weeks for a detailed anatomy scan. For patients who opt for diagnostic testing rather than screening, chorionic villus sampling (CVS) can be performed at the 10 to 13 weeks ultrasound examination. For the rare patient who prefers an amniocentesis to CVS, we suggest an ultrasound at 10 to 13 weeks to assess for indications for earlier genetic testing (eg, enlarged nuchal translucency) and if none are found, the patient is reassured that waiting until 15 to 16 weeks for the amniocentesis is reasonable. (See "Prenatal genetic evaluation of the fetus with anomalies or soft markers", section on 'Approach to the evaluation of the fetus with "soft markers" and no structural anomalies'.)

Carrier screening — In the United States, genetic carrier screening for cystic fibrosis and spinal muscular atrophy is offered routinely and, at a minimum, red blood cell indices are routinely used to screen for carriers of hemoglobinopathies [40]; however, we prefer the addition of high performance liquid chromatography or capillary electrophoresis, as shown in the algorithm (algorithm 1). (See "Hemoglobinopathy: Screening and counseling in the reproductive setting and fetal diagnosis".)

For other heritable disorders, clinicians may choose to take an ethnic-specific or panethnic approach. Alternatively, clinicians may offer all patients an expanded carrier screening panel. (See "Preconception and prenatal panethnic expanded carrier screening".)

If the patient is found to be a carrier for a specific condition, their reproductive partner should be offered screening to determine the risk of an affected child. Referral to a genetic counselor is useful to discuss the specific disorder, residual risk, options for prenatal diagnosis, and the patient's reproductive options. One study found that the most common missed indications for genetics referral were personal or family history of congenital anomalies, intellectual disability, autism, and positive genetic carrier screening test [41]. (See "Genetic counseling: Family history interpretation and risk assessment".)

Information on specific disorders is available separately, including but not limited to:

- Cystic fibrosis. (See "Cystic fibrosis: Carrier screening".)
- Spinal muscular atrophy. (See "Spinal muscular atrophy", section on 'Genetics'.)
- Hemoglobinopathy (eg, alpha or beta thalassemia; hemoglobin S, C, D, or E) – (See "Hemoglobinopathy: Screening and counseling in the reproductive setting and fetal diagnosis".)
- Fragile X syndrome. (See "Fragile X syndrome: Prenatal screening and diagnosis", section on 'Screening'.)
- Disorders such as Tay-Sachs disease, Canavan disease, cystic fibrosis, familial dysautonomia, mucolipidosis IV, Niemann Pick disease type A, Fanconi anemia group C, Bloom syndrome, Gaucher disease, familial hyperinsulinism, glycogen storage disease type I, Joubert syndrome, maple syrup urine disease, and Usher syndrome are more common in people of Ashkenazi Jewish ancestry.

  Tay-Sachs disease is also more common among people of Pennsylvania Dutch, Southern Louisiana Cajun, and Eastern Quebec French Canadian ancestry. (See "Preconception and prenatal carrier screening for genetic disorders more common in people of Ashkenazi Jewish descent and others with a family history of these disorders".)
- Skeletal dysplasia. (See "Approach to prenatal diagnosis of the lethal (life-limiting) skeletal dysplasias" and "Skeletal dysplasias: Specific disorders".)

Genome-wide fetal screening — The clinical utility of expanding cell-free DNA testing of maternal blood to include panels of microdeletions and microduplications, rare autosomal

trisomies, and monogenic disorders has not been established. Professional societies, such as the American College of Medical Genetics and Genomics, European and American Societies for Human Genetics, Society for Maternal-Fetal Medicine (SMFM), and International Society for Prenatal Diagnosis, recommend against offering expanded cell-free DNA testing as part of routine prenatal genetic screening, while endorsing its use for screening for trisomies 21, 18, and 13 and sex chromosome aneuploidy [42-44]. Patients who desire to maximize information about the genetic status of their fetus should undergo diagnostic testing of amniocytes or chorionic villi by microarray. The potential for detecting a microdeletion/microduplication by microarray is 30- to 50-fold greater than that by cell-free DNA screening of maternal blood [45].

The recommendation against expanded cell-free DNA screening was made because it is not possible to provide reliable estimates of no call rates, detection rates, false-positive rates, or positive predictive values, given the small numbers of cases detected, variable penetrance, uncertainty in the underlying prevalence, difficulty in follow-up, and lack of clinical validation based on real samples. Expanded noninvasive genetic screening using cell-free DNA is discussed in detail separately. (See "Cell-free DNA screening for fetal conditions other than the common aneuploidies".)

Issues related to consanguinity — Consanguinity, which is defined as the reproductive union of second cousins or closer relatives, is common in several ethnic/religious groups and increases the fetal risk for recessive disorders due to runs of homozygosity, including inborn errors of metabolism, common variable immune deficiency, some types of deafness, and congenital abnormalities with a complex etiology [46,47]. It is most common in North Africa and parts of sub-Saharan Africa, the Middle East, and west, central, and south Asia (eg, Pakistan, India), but consanguineous couples can be found anywhere because of local customs and immigration; thus, it is prudent to assess the possibility of consanguinity in all pregnant couples [48].

Consanguineous couples should be offered genetic counseling to discuss the increased risk of recessive conditions in their offspring, as well as increased risks for stillbirth or perinatal mortality. First cousins share approximately one-eighth of their variants. For a variant with a frequency of 1 in 100, the chance that unrelated partners will both be carriers of the pathogenic variant is 1/100 X 1/100 = 1/10,000, whereas the chance that two first cousins will both be carriers is 1/100 X 1/8 = 1/800 [49]. The prevalence of congenital disorders in the offspring of first cousins has been estimated to be 1.7 to 2.8 percent higher than the background population risk, mostly attributable to autosomal recessive diseases [50].

Laboratory tests

Confirmation of pregnancy — In the absence of diagnostic physical findings of pregnancy (ie, an ultrasound image of the gestational sac/embryo/fetus or auscultation of fetal heart activity by a hand-held Doppler device), suspected pregnancy should be confirmed by detection of the beta-subunit of human chorionic gonadotropin (hCG) in blood or urine. (See "Clinical manifestations and diagnosis of early pregnancy", section on 'Diagnosis'.)

Standard panel — A standard panel of laboratory tests is obtained on every pregnant patient at the first prenatal visit, augmented by additional tests in those at risk for specific conditions (see 'Selective screening' below). Repetition of tests performed preconceptionally is unnecessary.

We perform the following assessments, which are generally consistent with recommendations from ACOG [51]. The rationale for each test and implications of findings are also addressed.

ABO and RhD type and antibody screen — RhD-negative pregnant people without alloantibodies should receive prophylactic anti(D)-immune globulin at 28 weeks of gestation (or at 28 and 34 weeks in some countries) and when clinically indicated to prevent alloimmunization. (See "RhD alloimmunization: Prevention in pregnant and postpartum patients", section on 'Guidelines for prevention of anti-D alloimmunization (United States)'.)

RhD-positive or -negative pregnant people who have a positive antibody screen may be at risk for hemolytic disease of the fetus and newborn. Evaluation and management of these pregnancies are reviewed separately. (See "RhD alloimmunization in pregnancy: Overview" and "RhD alloimmunization in pregnancy: Management" and "Management of non-RhD red blood cell alloantibodies during pregnancy".)

Hematocrit or hemoglobin, mean corpuscular volume, ferritin — Anemia is generally defined by a hemoglobin level <11 g/dL (hematocrit <33 percent) in the first and third trimester and <10.5 g/dL (approximate hematocrit <32 percent) in the second trimester [52]. It is commonly related to iron deficiency. Increasingly, pregnant patients are screened for iron deficiency with a ferritin level, even when not anemic. This is based on the concern that limiting testing to those with anemia or a low mean corpuscular volume (MCV) has the potential to miss a substantial number of iron-deficient patients and deprive them of a straightforward therapy (oral or intravenous iron replacement) that is potentially beneficial to both the mother and the child and is not harmful. (See "Anemia in pregnancy".)

An MCV <80 fL in the absence of iron deficiency suggests thalassemia; further testing with hemoglobin electrophoresis is indicated. (See "Hemoglobinopathy: Screening and counseling in the reproductive setting and fetal diagnosis".)

Documentation of rubella immunity — Presumptive evidence of immunity against rubella requires at least one of the following [53]:

- Written documentation of vaccination with one dose of live rubella virus-containing vaccine administered on or after the first birthday
- Laboratory evidence of immunity (rubella IgG by enzyme immunoassay [EIA], which can reliably detect rubella IgG concentrations >10 international units/mL, the cutoff for defining rubella immunity used in the United States [54])
- Laboratory confirmation of rubella disease

If presumptive evidence of immunity is not available, then the patient should be counseled to avoid exposure to individuals with rubella and receive postpartum immunization. The rubella vaccine is a live vaccine and thus contraindicated during pregnancy. (See "Immunizations during pregnancy", section on 'Measles, mumps, rubella'.)

Documentation of varicella immunity — Immunity to varicella is based on a health care provider's diagnosis of varicella or verification of history of varicella disease, documented vaccination, or laboratory evidence of immunity (note: post-vaccination serology is not recommended for any recipients of varicella vaccine, including health care personnel. Commercially available antibody assays are not sufficiently sensitive to reliably detect vaccine-induced antibody, which may result in false-negative results and unnecessary revaccination).

Pregnant people who do not have evidence of immunity to varicella should be counseled to avoid exposure to individuals with varicella, may be candidates for passive immunization during pregnancy if exposed to varicella, and are candidates for varicella vaccination postpartum [55]. The varicella vaccine is a live vaccine and thus contraindicated during pregnancy. (See "Immunizations during pregnancy", section on 'Varicella'.)

Urine protein — Screening for proteinuria, such as with a dipstick, is useful as a baseline for comparison with testing performed later in pregnancy. (See "Proteinuria in pregnancy: Diagnosis, differential diagnosis, and management of nephrotic syndrome" and "Preeclampsia: Clinical features and diagnosis".)

Urine culture — Routine urine culture in early pregnancy is recommended because untreated asymptomatic bacteriuria places the patient at high risk of developing pyelonephritis and at modestly increased risk for preterm birth; rapid tests for bacteriuria do not have adequate sensitivity and specificity. (See "Urinary tract infections and asymptomatic bacteriuria in pregnancy", section on 'Diagnosis'.)

Treatment of a positive culture is per standard guidelines; however, some clinicians treat group B streptococcal (GBS) bacteriuria at colony counts $<10^5$ CFU/mL. Presence of GBS bacteriuria at any colony count is an indication for intrapartum GBS prophylaxis to prevent early-onset neonatal infection. (See "Urinary tract infections and asymptomatic bacteriuria in pregnancy", section on 'Management' and "Group B streptococcal infection in pregnant individuals", section on 'Asymptomatic bacteriuria'.)

Up to 30 percent of pregnant patients fail to clear asymptomatic bacteriuria following a short course of therapy [56]. Thus, a repeat culture is generally recommended as a test of cure, which can be performed a week after completion of therapy for asymptomatic bacteriuria [57]. However, there are insufficient data informing the utility of repeat testing following an initial episode of asymptomatic bacteriuria, and it is not known whether retreatment of recurrent or persistent bacteriuria improves outcomes. Management, including further testing and use of suppressive or prophylactic antibiotics for persistent or recurrent asymptomatic bacteriuria, is reviewed separately. (See "Urinary tract infections and asymptomatic bacteriuria in pregnancy".)

Cervical cancer screening — The frequency of cervical cancer screening is not affected by the pregnant state, but management of an abnormal test result is different for pregnant patients. (See "Screening for cervical cancer in resource-rich settings" and "Cervical intraepithelial neoplasia: Management", section on 'Pregnant patients' and "Cervical cancer in pregnancy".)

HIV — Medical organizations generally support universal HIV testing of pregnant patients early in each pregnancy using an "opt-out" approach [58-64].

Advantages of universal testing include:

- Appropriate medical management can be initiated.
- Patients can be counseled about prevention of transmission to or identification of infected partners.
- Perinatal transmission can be substantially reduced with appropriate intervention (eg, antiretroviral therapy antepartum and intrapartum, cesarean birth and avoidance of breastfeeding in those without viral suppression, newborn antiretroviral prophylaxis). (See "Prenatal evaluation of women with HIV in resource-rich settings" and "Antiretroviral selection and management in pregnant individuals with HIV in resource-rich settings" and "Intrapartum and postpartum management of pregnant women with HIV and infant prophylaxis in resource-rich settings" and "Prevention of vertical HIV transmission in resource-limited settings".)

- An informed decision can be made about continuing the pregnancy.

An opt-out approach can achieve high rates of testing (95 to 100 percent in some studies), whereas an opt-in policy has had testing rates of only 50 to 60 percent due to patient refusal or clinician failure to offer the test [65,66].

Local regulations may require patient notification as well as a signed consent form indicating permission for HIV testing. The medical record should document the patient's decision to accept or decline testing. Reasons for refusal should be explored and testing offered again at another time.

Testing should be repeated in pregnant people with a sexually transmitted infection, signs and symptoms of acute HIV infection, or with ongoing exposure to HIV.

Partner testing provides an opportunity for initiating treatment in those who test positive and initiating preexposure prophylaxis for the uninfected partner when the partners are serodifferent [64].

Risk factors for acquiring HIV and serologic testing are discussed in detail separately. (See "Screening for sexually transmitted infections".)

Syphilis — Serologic testing to diagnose syphilis should be performed and can be done with a either a nontreponemal or treponemal test, depending on the preference of the laboratory performing the test (algorithm 2). Confirmatory testing is necessary due to the potential for false-positive results with these tests. The diagnostic approach is the same as in nonpregnant individuals. The cost and morbidity associated with testing for syphilis are low and the benefits of detecting and treating the disease during pregnancy are high for both mother and child. (See "Syphilis in pregnancy".)

Hepatitis B — All pregnant patients are screened for hepatitis in each pregnancy, regardless of previous vaccination status, because prevaccination screening to exclude acute or chronic hepatitis B virus (HBV) infection is not commonly performed. The initial screen (called the triple panel) consists of hepatitis B surface antigen (HBsAg), hepatitis B surface antibody (anti-HBs), and total hepatitis B core antibody (anti-HBc). If a previous triple panel was negative and the patient has had no HBV exposures since the triple panel was performed, then subsequent screening can be limited to HBsAg testing. However, patients who are at high risk for HBV infection (eg, injection drug user, sexual partner or household contact with chronic HBV) should be tested for anti-HBs and anti-HBc as well. Patients who are susceptible to infection should be offered immunization. (See "Immunizations during pregnancy", section on 'Hepatitis B'.)

Pregnant people who carry HBsAg can transmit HBV to the fetus, typically during birth. Passive and active immunization of the newborn within 12 hours of birth can reduce the risk of HBV transmission by >95 percent. Management of screen-positive pregnant patients is shown in the algorithm (algorithm 3) and discussed in detail separately. (See "Epidemiology, transmission, and prevention of hepatitis B virus infection", section on 'Mother-to-child transmission' and "Hepatitis B and pregnancy".)

Hepatitis C — Hepatitis C virus (HCV) screening is recommended for all pregnant individuals at the first prenatal visit of each pregnancy. The rationale is that HCV infection is increasing in females of childbearing age, risk-based screening is not consistently performed, risk-based screening alone fails to detect a sizable minority of infected individuals, and documentation of infection may affect pregnancy management (eg, avoid chorionic villus sampling and use of an internal fetal heart rate monitoring electrode) [67-71]. In addition, knowledge of HCV status during pregnancy facilitates appropriate postpartum maternal treatment and informs infant follow-up.

Initial screening or diagnostic testing for chronic HCV typically begins with an antibody test by immunoassay. (See "Screening and diagnosis of chronic hepatitis C virus infection", section on 'Standard approach'.)

- If the antibody test is nonreactive, then chronic HCV infection is unlikely and testing can stop. (See "Screening and diagnosis of chronic hepatitis C virus infection", section on 'Nonreactive anti-HCV antibody'.)
- Reactive HCV antibody tests should be followed with an HCV RNA test. The absence of detectable HCV RNA using a sensitive assay essentially confirms the absence of chronic HCV infection. False-negative tests for RNA are unusual. A reactive antibody test in this setting is generally a false positive or reflective of past, cleared infection. (See "Screening and diagnosis of chronic hepatitis C virus infection", section on 'Reactive antibody and negative RNA test'.)
- A positive HCV RNA result is evidence of HCV infection. (See "Screening and diagnosis of chronic hepatitis C virus infection", section on 'Reactive antibody and positive RNA test'.)

In 2020, the CDC revised their previous risk-factor-based guidance and recommended universal HCV screening during each pregnancy, except in settings where the prevalence of HCV infection is <0.1 percent [72]. In the absence of available data for HCV prevalence, they advised health care providers to initiate universal HCV screening until they establish that the prevalence of HCV RNA positivity in their population is <0.1 percent. The same year, the USPSTF recommended one-time HCV screening for asymptomatic adults aged 18 to 79 years (including pregnant

persons) without known liver disease [73]. In 2021, ACOG and the SMFM updated their hepatitis C screening guidance to recommend HCV screening for all pregnant individuals at the first prenatal visit of each pregnancy [74]. The goal is to connect pregnant patients who screen positive for HCV with appropriate care so (1) they can begin direct-acting antiviral treatment postpartum and after completion of breastfeeding and (2) the pediatrician responsible for the care of their newborn is informed about their hepatitis C carrier status.

If universal screening is not performed, risk-based screening is indicated. Several organizations have provided guidelines that describe criteria for considering an individual high risk, regardless of pregnancy status. Despite having reviewed similar data, the various guidelines are not concordant. In a study that offered screening for HCV antibody to all pregnant people presenting for prenatal care before 23 weeks of gestation, over 106,000 patients were screened, and HCV antibody seroprevalence was 2.4 cases per 1000 pregnant people (95% CI 2.1-2.7) [75]. Factors associated with HCV antibody positivity included injection drug use (adjusted odds ratio [aOR] 22.9, 95% CI 8.2-64.0), blood transfusion (aOR 3.7, 95% CI 1.3-10.4), a partner with HCV (aOR 6.3, 95% CI 1.8-22.6), more than three lifetime sexual partners (aOR 5.3, 95% CI 1.4-19.8), and smoking (aOR 2.4, 95% CI 1.2-4.6). A composite of any of these risk factors had 91 percent sensitivity for detecting HCV antibody. These findings suggest that traditional historic risk factors for HCV screening should be expanded to include more than three lifetime sexual partners and possibly smoking. (See "Epidemiology and transmission of hepatitis C virus infection" and "Screening and diagnosis of chronic hepatitis C virus infection" and "Vertical transmission of hepatitis C virus".)

Chlamydia — Chlamydia prevalence is highly related to age and sexual behavior. The Centers for Disease Control and Prevention (CDC) and United States Preventive Services Task Force (USPSTF) recommend screening all pregnant people <25 years of age and those ≥25 years of age with risk factors for sexually transmitted infection (table 11) [63,76].

Nucleic acid amplification tests (NAATs) have high sensitivity and excellent specificity for detection of *Chlamydia trachomatis*, and are superior to culture. During prenatal care, the preferred approach is to test a specimen obtained from a swab of the endocervix or vagina, although urine testing appears to be as sensitive [63,77-81]. Some NAATs have been cleared by the US Food and Drug Administration (FDA) for use on liquid-based cytology specimens.

Patients with positive test results should be treated. In pregnancy, they then undergo a test-of-cure three to four weeks after treatment and are retested three to four months later [63]. (See "Clinical manifestations and diagnosis of *Chlamydia trachomatis* infections", section on 'Nucleic acid amplification testing (test of choice)'.)

Selective screening

Thyroid function — Both hyper- and hypothyroidism during pregnancy can have adverse effects on the mother and child. (See "Hyperthyroidism during pregnancy: Clinical manifestations, diagnosis, and causes", section on 'Pregnancy complications' and "Hypothyroidism during pregnancy: Clinical manifestations, diagnosis, and treatment", section on 'Pregnancy complications'.)

Pregnant people with signs or symptoms of thyroid disease should undergo measurement of thyroid-stimulating hormone (TSH) level. The TSH should be interpreted using population- and trimester-specific TSH reference ranges for pregnant people, when available. If the TSH is abnormal, free or total T4 should be measured.

- The diagnosis of overt hyperthyroidism during pregnancy is based primarily upon a suppressed (<0.1 milli-units/L) or undetectable (<0.01 milli-units/L) serum TSH value and a free T4 and/or free T3 (or total T4 and/or total T3) measurement that exceeds the normal range for pregnancy. (See "Hyperthyroidism during pregnancy: Clinical manifestations, diagnosis, and causes", section on 'Diagnosis'.)

- The diagnosis of overt primary hypothyroidism during pregnancy is based upon a TSH above the population- and trimester-specific upper limit of normal, or above 4 milli-units/L when local reference ranges are not available, in conjunction with a decreased free T4 concentration (below assay normal using reference range for pregnant women). (See "Hypothyroidism during pregnancy: Clinical manifestations, diagnosis, and treatment", section on 'Diagnosis'.)

- The diagnosis of subclinical hypothyroidism during pregnancy is based upon an elevated trimester-specific serum TSH concentration and a normal free T4 concentration.

  Screening for asymptomatic hypothyroidism is controversial. Professional societies (eg, ACOG [82], the Endocrine Society [83], the American Thyroid Association [84]) recommend targeted rather than universal screening in pregnancy, which is our approach. However, a targeted approach will miss as many as one-third of pregnant patients with subclinical hypothyroidism [85-88]. For this reason and concern that not treating these patients may be associated with adverse pregnancy outcomes, some experts have advocated universal screening for thyroid dysfunction in pregnancy or in patients planning to become pregnant [89]. Criteria for selecting candidates for targeted TSH screening (eg, personal or family history of thyroid disease, type 1 diabetes mellitus, or clinical suspicion of thyroid disease), diagnostic evaluation (free T4, TPO antibodies) of patients with an elevated trimester-specific serum TSH concentration, and decision-making regarding treatment of

these patients are reviewed separately. (See "Hypothyroidism during pregnancy: Clinical manifestations, diagnosis, and treatment", section on 'Screening' and "Hypothyroidism during pregnancy: Clinical manifestations, diagnosis, and treatment", section on 'Effect of thyroid hormone replacement' and "Hypothyroidism during pregnancy: Clinical manifestations, diagnosis, and treatment", section on 'Indications for treatment'.)

Type 2 diabetes — Both the American Diabetes Association (ADA) and ACOG suggest early pregnancy testing for undiagnosed type 2 diabetes in patients with risk factors [90,91]. By contrast, a USPSTF guideline concluded available evidence was insufficient to assess the balance of benefits and harms of screening asymptomatic pregnant people for glucose intolerance before 24 weeks of gestation [92,93].

The ADA defines patients at increased risk of undiagnosed type 2 diabetes based on BMI ≥25 kg/m^2 (≥23 kg/m^2 in Asian Americans) **plus** one or more of the following [91]:

- Gestational diabetes mellitus in a previous pregnancy
- A1C ≥5.7 percent (39 mmol/mol), impaired glucose tolerance, or impaired fasting glucose on previous testing
- First-degree relative with diabetes
- High-risk race/ethnicity (eg, African American, Latin American, Native American, Asian American, Pacific Islander)
- History of cardiovascular disease
- Hypertension (≥140/90 mmHg) or on therapy for hypertension
- HDL cholesterol level <35 mg/dL (0.90 mmol/L) and/or a triglyceride level >250 mg/dL (2.82 mmol/L)
- Polycystic ovary syndrome
- Physical inactivity
- Other clinical condition associated with insulin resistance (eg, severe obesity, acanthosis nigricans)

For patients at increased risk of diabetes, a diagnosis of overt diabetes can be made at the initial prenatal visit if:

- Fasting plasma glucose ≥126 mg/dL (7.0 mmol/L) **or**

- A1C ≥6.5 percent (48 mmol/mol) using a standardized assay **or**
- Random plasma glucose ≥200 mg/dL (11.1 mmol/L) and classic symptoms of hyperglycemia

(See "Gestational diabetes mellitus: Screening, diagnosis, and prevention", section on 'Screening for overt diabetes in early pregnancy'.)

Infection — Symptomatic patients should be tested for the suspected infection. The following discussion applies to selection of asymptomatic patients for screening.

Hepatitis A — In the United States, hepatitis A vaccination during pregnancy is recommended for patients at high risk for infection [94] (see "Hepatitis A virus infection in adults: Epidemiology, clinical manifestations, and diagnosis", section on 'Epidemiology'), such as those with:

- Planned international travel
- Use of illicit drugs (injection or noninjection)
- Occupational risk for infection (eg, daycare center, residential institution, military personnel)
- Close contact with an international adoptee or persons experiencing homelessness
- Concern for a severe outcome from hepatitis A virus (HAV) infection (eg, personal history of chronic liver disease or HIV)

Prevaccination serology to determine preexisting immunity to HAV is generally not warranted but is reasonable for individuals with a high likelihood of prior HAV exposure. This is discussed in detail elsewhere. (See "Hepatitis A virus infection: Treatment and prevention", section on 'Role of prevaccine serology'.)

Measles — In areas of ongoing measles outbreaks with sustained transmission in close-knit communities, serologic testing for measles immunoglobulin G (IgG) in pregnant patients without documented immunity to measles is reasonable [95]. Any of the standard serologic assays for measles-specific IgG may be used for laboratory documentation. (See "Measles: Clinical manifestations, diagnosis, treatment, and prevention", section on 'Pregnant women' and "Measles: Clinical manifestations, diagnosis, treatment, and prevention", section on 'Diagnosis'.)

For patients not at high risk of measles exposure, evidence of immunity includes documentation of age-appropriate completion of the measles-mumps-rubella (MMR) vaccination (at least one dose of live measles-containing vaccine), laboratory evidence of immunity, or laboratory

confirmation of measles [96,97]. For patients at high risk of measles exposure (eg, health care workers, students at post-high school institutions, international travelers), evidence of immunity is similar except at least two doses of a live measles-containing vaccine are required [96]. However, if laboratory evidence of immunity is available, this is sufficient documentation of immunity, regardless of the number of doses of vaccine previously administered.

Pregnant people without documented evidence of immunity should be immunized postpartum, as MMR is a live vaccine. (See "Measles, mumps, and rubella immunization in adults".)

Gonorrhea — All pregnant people aged <25 years and those aged ≥25 years at increased risk for gonorrhea should be screened for *Neisseria gonorrhoeae* at the first prenatal visit [51,63]. Risk factors for sexually transmitted infection are listed in the table (table 11). Clinicians should consult local public health authorities for information on groups that are more vulnerable to gonorrhea acquisition based on local disease prevalence [63].

NAAT is the preferred test for the microbiologic diagnosis of *N. gonorrhoeae* because of its superior accuracy; a swab is used to collect a vaginal or endocervical specimen for testing. (See "Clinical manifestations and diagnosis of *Neisseria gonorrhoeae* infection in adults and adolescents".)

Pregnant patients who test positive are treated immediately and retested in three months. (See "Treatment of uncomplicated gonorrhea (*Neisseria gonorrhoeae* infection) in adults and adolescents".)

Tuberculosis — Asymptomatic patients are screened for latent tuberculosis infection (LTBI) during pregnancy when one of the following significant risk factors for progression to active disease, which would justify prompt treatment for LTBI, is present [98]:

- Suspicion for recent TB infection based on epidemiologic exposure
- Significant immunocompromise, such as HIV infection or profound immunosuppressive therapy

Tools for diagnosis of latent TB include tuberculin skin tests (TSTs) and interferon-gamma release assays (IGRAs). An IGRA is preferred for patients with history of Bacillus Calmette-Guerin vaccination and for individuals from groups that historically have poor rates of return for skin test reading. The procedure for and interpretation of these tests and management of patients with positive test results are described separately. (See "Tuberculosis infection (latent tuberculosis) in adults: Approach to diagnosis (screening)" and "Tuberculosis disease (active tuberculosis) in pregnancy".)

Toxoplasmosis — Whether all pregnant people should undergo serological screening for toxoplasmosis is controversial. It is a routine practice is some areas with a high prevalence of infection, but this is uncommon. Maternal acquisition of toxoplasmosis is via environmental exposure (eg, ingestion of unwashed fruit or vegetables contaminated with oocytes in soil or water) and ingestion of undercooked or cured meat from infected animals. (See "Toxoplasmosis and pregnancy".)

Bacterial vaginosis — ACOG, USPSTF, CDC, and Society of Obstetricians and Gynaecologists of Canada among others suggest **not** routinely screening and treating all pregnant individuals with asymptomatic bacterial vaginosis to prevent preterm birth and its consequences [99-103]. Whether patients with a history of prior preterm birth should be screened for bacterial vaginosis and treated (if positive) is controversial as a reduction in recurrent preterm birth is unproven. (See "Spontaneous preterm birth: Overview of interventions for risk reduction", section on 'Routinely screening for cervicovaginal and sexually transmitted infections'.)

Trichomonas vaginalis — Although screening for *Trichomonas vaginalis* is not recommended as a routine component of prenatal care for asymptomatic HIV-negative individuals, those with HIV infection and those aged ≤35 years residing in a correctional facility should be screened for trichomonas at the first prenatal visit and treated if infected [63]. Trichomoniasis in individuals with HIV is associated with an increased risk of vertical and horizontal transmission of HIV. Testing should be repeated three months after treatment. (See "Trichomoniasis: Clinical manifestations and diagnosis".)

Herpes simplex virus — For pregnant people with no history of a previous herpes simplex virus (HSV) infection, serologic screening has been proposed to accurately identify two groups of individuals:

- Those who are truly HSV negative, so they can take precautions to avoid acquiring the infection
- Those who are HSV positive, so they can be offered suppressive antiviral therapy, carefully examined for lesions at the onset of labor, and offered cesarean birth, if indicated (eg, lesions are present)

Although accurate type-specific serologic tests are available to identify these individuals [104-106] and guide counseling, expert panels have recommended against universal serologic screening [63,106-108]. Available evidence indicates that screening for HSV would not meet usual criteria for an effective preventive strategy [109-111], as has been demonstrated in other

infections, such as HIV and HBV [112-114]. (See "Genital herpes simplex virus infection and pregnancy", section on 'Screening pregnant women with no HSV history'.)

Cytomegalovirus — ACOG [115] and SMFM [116] recommend against routine serological screening for cytomegalovirus (CMV). Proponents of universal screening argue that knowledge of negative serology and provision of CMV counseling increase some patients' motivation to practice good hygiene and thus decrease the risk of seroconversion during pregnancy. There is also emerging evidence of possible fetal benefit from maternal pharmacotherapy. (See "Cytomegalovirus infection in pregnancy", section on 'Role of maternal screening'.)

Testing pregnant people for CMV is indicated:

- As part of the diagnostic evaluation of mononucleosis-like illnesses (see "Infectious mononucleosis", section on 'Clinical manifestations')
- If a fetal anomaly suggestive of congenital CMV infection is detected on prenatal ultrasound examination (see "Cytomegalovirus infection in pregnancy", section on 'Fetal issues')
- If the patient requests the test

Zika — In areas with no mosquito-borne Zika virus transmission, health care providers should ask all pregnant patients about possible exposure:

- Residence in or travel to an area where mosquito-borne transmission of Zika virus infection has been reported, or
- Unprotected sexual contact with a person who meets these criteria

Pregnant patients should be tested within 12 weeks of possible exposure, regardless of symptoms. Issues related to diagnostic evaluation of pregnant patients with Zika virus exposure are reviewed in detail separately. (See "Zika virus infection: Evaluation and management of pregnant patients".)

COVID-19 — SARS-CoV-2 viral testing is not routinely performed in asymptomatic patients in the community based on pregnant status alone. Indications for testing are reviewed separately. (See "COVID-19: Epidemiology, virology, and prevention", section on 'Testing and masking precautions'.)

Routine performance upon admission to labor and delivery depends on symptoms, the prevalence of COVID-19 in the community, and the patient's vaccination status. (See "COVID-19: Intrapartum and postpartum issues", section on 'Approach to infection control'.)

Chagas disease — Screening for Chagas disease is recommended for females of reproductive age who were born in or lived in a region of Mexico, South or Central America with endemic Chagas disease (table 12) [117]. Infected individuals are often unaware of their infection and the potential seriousness of the condition (eg, maternal cardiovascular/gastrointestinal complications, transmission to the fetus, hydrops fetalis). Ideally, screening is performed before pregnancy because antitrypanosomal drugs prevent congenital infection and are contraindicated during pregnancy. If prepregnancy screening was not performed, testing in pregnancy is still useful because early diagnosis and treatment of infected infants improves the prognosis of congenital Chagas disease and maternal treatment can be initiated postpartum, if appropriate. (See "Chronic Chagas cardiomyopathy: Clinical manifestations and diagnosis" and "Chagas disease: Epidemiology, screening, and prevention", section on 'Vertical transmission' and "Chagas disease: Acute and congenital Trypanosoma cruzi infection" and "Chagas disease: Chronic Trypanosoma cruzi infection".)

Lead level — Selective screening is indicated if the clinician has reason to suspect that the patient has any of the characteristics in the table (table 13), which increase the likelihood of lead exposure and increased blood lead levels [118,119].

If the blood lead level is <5 mcg/dL, no follow-up testing is needed. Otherwise, follow-up testing depends on the initial level (table 14) [118]. At birth, the pediatric provider should be informed of the mother's blood lead level (see "Childhood lead poisoning: Exposure and prevention", section on 'Prenatal exposure'). The management of elevated blood lead levels in pregnancy is discussed separately. (See "Occupational and environmental risks to reproduction in females: Specific exposures and impact", section on 'Lead' and "Lead exposure, toxicity, and poisoning in adults".)

Slight elevations of blood lead levels in pregnant people are of concern because of the potential for adverse effects on the mother and fetus (spontaneous abortion, gestational hypertension, LBW, impaired neurodevelopment). Major organizations in the United States recommend against universal lead level screening in pregnancy because the prevalence of blood lead levels over 5 mcg/dL in this setting is less than 1 percent [118,119]. The USPSTF concluded that evidence is insufficient to assess the balance of benefits and harms of screening for elevated blood lead levels in asymptomatic pregnant persons [120].

REFERRALS

Referrals in the following areas should be considered, depending on individual patient needs and the expertise and resources of the obstetric provider's practice.

- **Maternal-Fetal Medicine**, for high-risk pregnancies (eg, those with significant medical, surgical, or pregnancy conditions). For patients with chronic medical disorders, additional referral to a specialist in medicine or surgery may be indicated. (See 'Care provider' above.)

- **Registered dietician**, for nutritional and other dietary guidance (eg, issues regarding medically indicated or self-imposed diets, gestational weight gain) (See "Nutrition in pregnancy: Assessment and counseling".)

- **Social Services/case management**, to help with social, economic, or lifestyle issues. These include but are not limited to providing mental health assessment, counseling/support, crisis intervention, and referral; assistance accessing community services (eg, housing, transportation, utilities, childcare and parenting, food [eg, Women, Infants, & Children (WIC) Nutrition Program], health insurance [eg, Medicaid], education, treatment of substance use disorders, safety from interpersonal violence); assistance understanding insurance benefits and local maternity-related regulations (eg, Family Medical Leave Act, Occupational Safety and Health Administration protections); and assistance finding benefits that the patient may be eligible to receive.

- **Genetics counselor**, for patients at increased risk of a fetal disorder/abnormality because of a potential heritable disorder, exposure to a potential teratogen, or prior stillbirth. (See "Genetic counseling: Family history interpretation and risk assessment".)

- **Dental services**, for patients who have not attended to their oral health. (See "Oral and systemic health" and "Spontaneous preterm birth: Overview of risk factors and prognosis", section on 'Infection'.)

HEALTH EDUCATION AND HEALTH PROMOTION

Health education and promotion, including clinical practice issues, diet/nutrition/supplements, health-promoting behaviors, gestational weight gain, immunization, common patient concerns (eg, sexual activity, travel, employment, exercise, pets), management of common pregnancy-related discomforts, and medication use, are reviewed in detail separately. (See "Prenatal care: Patient education, health promotion, and safety of commonly used drugs".)

Information on preparation for childbirth is also provided separately. (See "Preparation for childbirth" and "Breastfeeding: Parental education and support".)

SPECIAL POPULATIONS

- **Adolescents** — (See "Pregnancy in adolescents".)
- **Advanced maternal age** — (See "Effects of advanced maternal age on pregnancy" and "Management of pregnancy in patients of advanced age".)
- **Incarcerated pregnant people** — (See "Prenatal care: Incarcerated females".)
- **Patients with disabilities** — The American College of Obstetricians and Gynecologists (ACOG) provides resources for obstetricians serving pregnant patients with disabilities [121]. General issues regarding care of adults with disabilities are discussed separately. (See "Primary care of the adult with intellectual and developmental disabilities" and "Disability assessment and determination in the United States".)
- **Grand multiparity** — (See "Grand multiparity".)
- **Patients with obesity** — (See "Obesity in pregnancy: Complications and maternal management".)
- **Patients with acute or chronic medical or psychiatric disorders** — Refer to pregnancy section of individual topic reviews on the specific disorder.
- **Patients with substance use disorders** — (See "Substance use during pregnancy: Overview of selected drugs" and "Opioid use disorder: Overview of treatment during pregnancy" and "Alcohol intake and pregnancy".)
- **Multiple gestation** — (See "Twin pregnancy: Overview" and "Twin pregnancy: Routine prenatal care" and "Triplet pregnancy".)

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: General prenatal care".)

INFORMATION FOR PATIENTS

UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more

sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Basics topics (see "Patient education: Prenatal care (The Basics)" and "Patient education: Activity during pregnancy (The Basics)")
- Beyond the Basics topics (see "Patient education: Avoiding infections in pregnancy (Beyond the Basics)" and "Patient education: Should I have a screening test for Down syndrome during pregnancy? (Beyond the Basics)" and "Patient education: Group B streptococcus and pregnancy (Beyond the Basics)")

SUMMARY AND RECOMMENDATIONS

- **Effectiveness** – Prenatal care confers some health benefits, although how it does so and the types and magnitude of these benefits appear to be complex and multifactorial. It has many components, and the effectiveness of many of these components or packages of components generally has not been evaluated in randomized trials. (See 'Effectiveness' above.)
- **Goals** – The major goal of prenatal care is to help ensure the birth of a healthy newborn while minimizing maternal risk. This requires identification of individuals at increased risk of medical or obstetric complications; anticipation of problems, with intervention (if possible) to prevent or minimize morbidity; and health promotion, education, support, and shared decision-making. (See 'Goals' above.)

  This is achieved, in part, by taking a comprehensive medical, obstetric, psychosocial, and family history; establishing an accurate estimated date of delivery; and appropriate laboratory testing. Forms can be helpful for this purpose. (See 'Components of the initial prenatal visit' above.)
- **Timing** – Prenatal care should be initiated in the first trimester, ideally by 10 weeks of gestation. (See 'Timing' above.)
- **Care provider(s)** – Prenatal care is generally provided to individual patients by midwives, obstetrician-gynecologists, or family medicine clinicians. Group prenatal care is an

appealing alternative for some patients. Referral to a maternal-fetal medicine (MFM) specialist is appropriate for patients with chronic health conditions, patients who have experienced pregnancy complications in the past, and patients who develop complications during their current pregnancy. (See 'Care provider' above.)

- **Use of ultrasound** – Routine early (before 20 weeks of gestation) ultrasound examination provides better estimation of gestational age than menstrual dates (calculator 1 and calculator 2), resulting in reduced frequency of labor induction for postterm pregnancy and use of tocolysis for suspected preterm labor. Early ultrasound examination can lead to earlier detection of clinically unsuspected fetal malformations and multiple pregnancy. (See 'Calculating the estimated date of delivery' above and 'Ultrasound examination' above.)

  In patients with risk factors for ectopic pregnancy (table 2), early identification of the location of the pregnancy is important. (See "Ectopic pregnancy: Epidemiology, risk factors, and anatomic sites", section on 'Risk factors' and "Ectopic pregnancy: Clinical manifestations and diagnosis", section on 'Diagnostic evaluation'.)

- **History and physical examination** – A thorough history and physical examination includes the past obstetric history (table 1); medication review (table 3); and screening for substance use (table 4), depression and anxiety (table 5 and figure 1A-B), and abuse or assault (table 9). Calculating body mass index (calculator 3) facilitates counseling about the appropriate amount of weight gain over the course of pregnancy (table 10). (See 'History' above and 'Physical examination' above.)

- **Standard laboratory panel** – The following tests are performed on all pregnant people at the initial prenatal visit (see 'Laboratory tests' above):

  - RhD type and red blood cell antibody screen.
  - Hematocrit/hemoglobin and mean corpuscular volume (MCV).
  - Documentation of immunity to rubella and varicella.
  - Qualitative assessment of urine protein.
  - Assessment for asymptomatic bacteriuria. We suggest urine culture.
  - Cervical cancer screening according to standard guidelines.
  - Testing for syphilis (algorithm 2), hepatitis B antigen (algorithm 3), hepatitis C antibody, and chlamydia.
  - Opt-out approach to HIV testing.

- **Laboratory screening**

- **Aneuploidy screening** – All pregnant people are offered aneuploidy screening or a diagnostic invasive procedure (genetic studies on samples obtained by chorionic villus biopsy or amniocentesis) before 20 weeks of gestation, regardless of maternal age.

  Screening tests fall into two categories: (1) Assessment of maternal serum levels of specific biochemical markers associated with trisomy 21 (Down syndrome), with or without assessment of specific ultrasound markers and (2) Assessment of cell-free DNA in the maternal circulation. Either approach is acceptable as long as the patient receives appropriate pretest genetic counseling to make an informed choice and is aware that costs may differ substantially. (See 'Aneuploidy screening and diagnosis' above.)

- **Carrier screening**

  - **Ethnic versus panethnic** – An ethnic-specific or panethnic approach may be taken for carrier screening; however, an ethnic-based approach is not considered reliable in some countries because of the increasingly diverse ethnic distribution of the population.

  - **Cystic fibrosis and spinal muscular atrophy** – All patients are offered genetic carrier screening for cystic fibrosis and spinal muscular atrophy, either alone or as part of an expanded carrier screening panel. (See 'Carrier screening' above.)

  - **Hemoglobinopathy** – Red cell indices are used to screen for carriers of hemoglobinopathies; an MCV less than 80 femtoliters (fL) in the absence of iron deficiency denotes patients at increased risk for alpha or beta thalassemia. However, a complete blood count (CBC) and MCV may not detect carriers of hemoglobin S, C, or E; thus, maternal hemoglobin analysis by either high-performance liquid chromatography (HPLC) or isoelectric focusing (IEF) is recommended to identify these abnormal hemoglobins.

- **Thyroid disease and diabetes** – Patients at increased risk of thyroid disorders (hypo- or hyperthyroidism) or type 2 diabetes mellitus are screened for these disorders. (See 'Thyroid function' above and 'Type 2 diabetes' above.)

- **Infection** – Patients at increased risk of specific infectious diseases are screened for these disorders. Risk factors for a sexually transmitted infection are listed in the table (table 11). (See 'Infection' above.)

- **Lead** – Lead level screening is indicated in patients at risk for lead exposure (table 13). If the blood lead level is <5 mcg/dL, no follow-up testing is needed.

Otherwise, follow-up testing depends on the initial level (table 14). (See 'Lead level' above.)

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Topic 446 Version 220.0

GRAPHICS

Components of the past obstetrical history

A. Types and numbers of pregnancies

Pregnancies	Full term deliveries	Preterm deliveries	Multiple gestations	Miscarriages	

B. Delivery outcomes

Delivery m/d/y	Gestational age at delivery	Birth weight	Sex	Spontaneous labor or induction	Length of labor	Type of delivery	ce in

m/d/y: month/day/year

Graphic 119098 Version 1.0

Risk factors for ectopic pregnancy compared with pregnant controls

Degree of risk	Risk factors	Odds ratio
High	Previous ectopic pregnancy	2.7 to 8.3
	Previous tubal surgery	2.1 to 21
	Tubal pathology	3.5 to 25
	Sterilization	5.2 to 19
	IUD	
	▪ Past use	1.7
	▪ Current use	4.2 to 16.4
	▪ Levonorgestrel IUD	4.9*
	In vitro fertilization in current pregnancy	4 to 9.3
Moderate	Current use of estrogen/progestin oral contraceptives	1.7 to 4.5
	Previous sexually transmitted infections (gonorrhea, chlamydia)	2.8 to 3.7
	Previous pelvic inflammatory disease	2.5 to 3.4
	In utero DES exposure	3.7
	Smoking	
	▪ Past smoker	1.5 to 2.5
	▪ Current smoker	1.7 to 3.9
	Previous pelvic/abdominal surgery	4
	Previous spontaneous abortion	3
Low	Previous medically induced abortion	2.8
	Infertility	2.1 to 2.7
	Age ≥40 years	2.9
	Vaginal douching	1.1 to 3.1
	Age at first intercourse <18 years	1.6

	Previous appendectomy	1.6

IUD: intrauterine device; DES: diethylstilbestrol.

* Rates of ectopic pregnancy may be higher among those using the 13.5 mg compared with the 52 mg levonorgestrel IUD. This is discussed in related UpToDate content.

Data from:

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Graphic 82282 Version 10.0

Selected agents with potential adverse fetal effects

Reproductive toxin	Alleged fetal effects	Timing of exposure
Drugs		
Androgens	Masculinization of the developing female fetus can occur from androgens and high doses of some male-derived progestins.	First trimester for labial fusion; second and third trimesters for clitoral hypertrophy
Angiotensin-converting enzyme inhibitors and angiotensin receptor blockers	Fetal hypotension resulting in fetal kidney hypoperfusion and anuria, oligohydramnios, pulmonary hypoplasia, cranial bone hypoplasia, fetal growth restriction and demise. Neonatal oliguria, anuria, hypotension, and renal tubular dysgenesis.	Second and third trimesters
Antiseizure medications		
▪ Carbamazepine	Increases the risk of facial dysmorphology, neural tube defects, cardiovascular defects, and urinary tract defects.	First trimester
▪ Phenytoin	Increases the risk of fetal hydantoin syndrome, consisting of facial dysmorphology, cleft palate, ventricular septal defect, and growth and intellectual disability.	18 to 60 days postconception (organogenesis)
▪ Trimethadione and paramethadione	Increases the risk of characteristic facial dysmorphology, intellectual disability, V-shaped eyebrows, low-set ears with anteriorly folded helix, high-arched palate, irregular teeth, CNS anomalies, and severe developmental delay.	First trimester
▪ Valproic acid	Increases the risk of spina bifida, facial dysmorphology, autism, atrial septal defect, cleft palate, hypospadias, polydactyly, craniosynostosis, and limb abnormalities.	18 to 60 days postconception (organogenesis)
Antidepressants	Publications have implicated some of the SSRIs administered in the last trimester with postnatal neurobehavioral effects that are transient and whose long-term effects have not been determined. First trimester exposures to some SSRIs have been reported to increase the risk of some congenital malformations, predominantly congenital heart disease. The results have not been consistent, but warnings have been issued.	First and third trimesters

	However, other developmental toxicities have been associated with SSRIs including spontaneous abortions, low birth weight, prematurity, neonatal serotonin syndrome, neonatal behavioral syndrome (withdrawal), and persistent pulmonary hypertension of the newborn.	
Antituberculous therapy	Isoniazid does not appear to cause congenital anomalies; paraaminosalicylic acid may cause an increased risk of ear and limb defects and hypospadias.	First trimester and possibly second trimester
Cyclophosphamide and other chemotherapeutic agents and immunosuppressive agents (eg, cyclosporine, leflunomide)	Many chemotherapeutic agents used to treat cancer have a theoretical risk for producing malformations in the fetus when administered to pregnant women, especially because most of these drugs are teratogenic in animals, but the clinical data are not consistent. Many of these drugs have not been shown to be teratogenic, but the numbers of cases in the studies are small. Caution is the byword. Cyclophosphamide causes congenital defects when used during organogenesis, and fetal bone marrow suppression may occur when exposure occurs later in pregnancy.	First trimester for malformations; second and third trimesters possibly associated with fetal growth restriction and pancytopenia
Diethylstilbestrol	Administration during pregnancy produces genital abnormalities, adenosis, and clear cell adenocarcinoma of vagina in adolescents. The last has a risk of 1:1000 to 1:10,000, but the other effects, such as adenosis, can be quite high.	First and second trimesters
Dolutegravir	Preliminary results from an observational study suggest that serious cases of neural tube congenital anomalies involving the brain, spine, and spinal cord may occur in babies of women with HIV treated with this drug.[1]	Fetuses with exposure at the time of conception or early in the first trimester appear to be at higher risk for these defects
Ethanol	Fetal alcohol syndrome consists of microcephaly, intellectual disability, growth restriction, typical facial dysmorphogenesis, abnormal ears, small palpebral fissures.	First trimester for fetal alcohol syndrome or fetal alcohol-related congenital anomalies; second and third trimesters for fetal alcohol neurodevelopmental disorders

Glucocorticoids	High exposures administered systemically have a low risk for cleft palate in some studies, but the epidemiologic studies are not consistent.	First trimester
Insulin shock therapy	Microcephaly and intellectual disability.	First trimester
Lithium therapy	Chronic usage for the treatment of bipolar disorder has an increased risk for Ebstein anomaly and other malformations, but the risk seems to be very low.	First trimester
Macrolides (eg, azithromycin, clarithromycin, erythromycin)	Increased incidence in congenital malformations, in particular cardiovascular effects. Increased incidence in genital malformations.	First trimester for congenital malformations; first, second, and third trimesters for genital malformations
Minoxidil	Promotion of hair growth in the fetus and hirsutism in newborns.	First trimester
Methimazole	Aplasia cutis has been reported to be increased in mothers administered this drug during pregnancy.* Other anomalies have been reported and include tracheoesophageal fistulas, patent vitellointestinal duct, choanal atresia, omphalocele, and omphalomesenteric duct anomaly.	First trimester; especially weeks 6 to 10
Methotrexate	Pregnancy loss, growth restriction, microcephaly, meningomyelocele, intellectual disability, decreased ossification of the calvarium, hypoplastic supraorbital ridges, small low-set ears, micrognathia, and limb defects.	18 to 60 days postconception (organogenesis)
Methylene blue intra-amniotic instillation	Fetal intestinal atresia, hemolytic anemia, and jaundice in the neonatal period. This procedure is no longer used to identify one twin.	18 to 60 days postconception (organogenesis)
Misoprostol	A low incidence of vascular disruptive phenomenon, such as limb-reduction defects and Mobius syndrome, has been reported in pregnancies in which this drug was used to induce an abortion.	First and second trimesters
Mycophenolate mofetil	First trimester exposure associated with miscarriage, abnormalities of the brain, ears, eyes, distal limbs, heart, esophagus, kidney, and cleft lip/palate.	First trimester

Penicillamine (D-penicillamine)	This drug results in the physical effects referred to as "lathyrism," the results of poisoning by the seeds of the genus *Lathyrus*. It causes collagen disruption, cutis laxa, and hyperflexibility of joints. The condition seems to be reversible, and the risk is low.	Timing associated with the occurrence of these anomalies is not clear
Progestin therapy	Very high doses of androgen hormone-derived progestins can produce masculinization. Many drugs with progestational activity do not have masculinizing potential. None of these drugs have the potential for producing nongenital malformations.	Third trimester
Propylthiouracil	This drug and other antithyroid medications administered during pregnancy can result in an infant born with a goiter.	Throughout gestation
Retinoids	Systemic retinoic acid, isotretinoin, and etretinate can cause increased risk of CNS, cardioaortic, ear, and clefting defects such as microtia, anotia, thymic aplasia, other branchial arch and aortic arch abnormalities, and certain congenital heart malformations.	First trimester
Retinoids, topical	Topical administration is very unlikely to have teratogenic potential because teratogenic serum levels cannot be attained by topical exposure to retinoids.	
Streptomycin	Streptomycin and a group of ototoxic drugs can affect the eighth nerve and interfere with hearing; it is a relatively low-risk phenomenon. Children are less sensitive than adults to the ototoxic effects of these drugs. However, deafness in newborns can occur.	Throughout gestation
Sulfa drugs and vitamin K	These drugs can produce hemolysis in some subpopulations of fetuses. Sulfa drugs can cross the placenta and bind proteins displacing bilirubin and trigger kernicterus at low bilirubin levels.	Second and third trimesters
Tetracycline	This drug produces bone and teeth staining; it does not increase the risk of any other malformations.	Second and third trimesters
Thalidomide	Multiple defects in the following systems: limbs, other skeleton, craniofacial, major organs (lungs, cardiovascular, gastrointestinal, and genitourinary), and inguinal hernia.	22 to 36 days postconception

Trimethoprim	Has been linked to an increased incidence of neural tube defects. The risk is not high, but it is biologically plausible because of the drug's effect on lowering folic acid levels, which has resulted in neurologic symptoms in adults taking this drug. It is also associated with cardiovascular defects and possibly oral clefts.	First trimester
Vitamin A	Although still controversial, the malformations reported with the retinoids have been reported with very high doses of vitamin A (retinol). Doses to produce congenital anomalies would have to be in excess of 25,000 to 50,000 units/day. Other gravida exposed to high doses of vitamin have had normal pregnancies.	Possibly during the first trimester
Warfarin and warfarin derivatives	Early exposure during pregnancy can result in nasal hypoplasia, stippling of secondary epiphysis, intrauterine growth restriction. CNS malformations can occur in late pregnancy exposure because of bleeding.	First trimester
Radiation		
Ionizing radiation	Radiation exposure above a threshold of 20 rad (0.2 Gy) can increase the risk for some fetal effects such as microcephaly or growth retardation, but the threshold for intellectual disability is higher.	First trimester
Radioactive isotopes	Tissue- and organ-specific damage depends on the radioisotope element and distribution (ie, high doses of Iodine-131 administered to a pregnant woman can cause fetal thyroid hypoplasia after the eighth week of development).	After eighth week
Chemicals		
Carbon monoxide	CNS damage has been reported with very high exposures (carbon monoxide poisoning), but the risk seems to be low.*	
Lead	Very high exposures can cause pregnancy loss; intrauterine teratogenesis is not established at very low exposures below 20 microgram/percent in the serum of pregnant mothers.	Potential risk throughout pregnancy
Gasoline	Facial dysmorphology, intellectual disability, embryopathy from exposure due to gasoline addiction.	Throughout the pregnancy

Methyl mercury	Minamata disease consists of cerebral palsy, microcephaly, intellectual disability, blindness, and cerebellum hypoplasia. Other epidemics have occurred from adulteration of wheat with mercury-containing chemicals that are used to prevent grain spoilage. Present environmental levels of mercury are unlikely to represent a teratogenic risk, but reducing or limiting the consumption of carnivorous fish has been suggested to avoid exceeding the maximum permissible exposure recommended by the Environmental Protection Agency, an exposure level far below the level at which the toxic effects of mercury are seen.	Throughout the pregnancy
Polychlorinated biphenyls	Poisoning has occurred from adulteration of food products ("Cola-colored babies," CNS effects, pigmentation of gums, nails, teeth, and groin; hypoplastic deformed nails; intrauterine growth retardation; abnormal skull calcification). The threshold exposure has not been determined, but it is unlikely to be teratogenic at the present environmental exposures.	Throughout the pregnancy
Toluene	Facial dysmorphology, intellectual disability, embryopathy from exposure due to toluene addiction.	
Embryonic and fetal infections		
Cytomegalovirus infection	Retinopathy, CNS calcification, microcephaly, intellectual disability. Occurs in 30 to 50% of primary infections.	First 6 months of pregnancy
Rubella	Deafness, congenital heart disease, microcephaly, cataracts, intellectual disability. Occurs in up to 80% of fetuses with a primary infections.	Up to 16 weeks although more significant in the first 2 months of pregnancy
Herpes simplex	Fetal infection, liver disease, death.	Throughout the pregnancy
HIV	Perinatal HIV infection.	Throughout the pregnancy
Parvovirus infection, B19	Stillbirth, hydrops.	Up to 20 weeks gestation
Syphilis	Maculopapular rash, hepatosplenomegaly, deformed nails, osteochondritis at joints of extremities, congenital neurosyphilis, abnormal epiphyses, chorioretinitis.	Throughout the pregnancy

Toxoplasmosis	Hydrocephaly, microphthalmia, chorioretinitis, intellectual disability.	Throughout the pregnancy
Varicella zoster	Skin and muscle defects; intrauterine growth retardation; limb reduction defects, CNS damage (very low increased risk).	First trimester
Venezuelan equine encephalitis	Hydranencephaly; microphthalmia; destructive CNS lesions; luxation of hip.	First trimester
Zika virus	Microcephaly, intracranial calcifications, intellectual disability.	Up to 20 weeks gestation
Maternal disease states		
Corticosteroid-secreting endocrinopathy	Mothers who have Cushing's disease can have infants with hyperadrenocorticism, but anatomic malformations do not seem to be increased.	
Iodine deficiency	Can result in embryonic goiter and intellectual disability.	
Intrauterine problems of constraint and vascular disruption	These defects are more common in multiple-birth pregnancies, pregnancies with anatomic defects of the uterus, placental emboli, or amniotic bands. Possible congenital anomalies include club feet, limb-reduction defects, aplasia cutis, cranial asymmetry, external ear malformations, midline closure defects, cleft palate and muscle aplasia, cleft lip, omphalocele, and encephalocele.	
Maternal androgen endocrinopathy (adrenal tumors)	Masculinization of female fetuses.	
Maternal diabetes with poor glycemic control	Increases the risk of a wide variety of congenital anomalies; cardiac abnormalities are most common.	
Maternal folic acid in reduced amounts	An increased incidence of neural tube defects.	
Maternal phenylketonuria	Abortion, microcephaly, and intellectual disability; very high risk in untreated patients.	
Maternal starvation	Intrauterine growth restriction, abortion, neural tube defects (Dutch famine experience).	
Tobacco smoking	Fetal growth restriction and stillbirth. Although the risk of defects is small (approximately twofold), they can involve the heart and great vessels, limbs, skull, genitourinary system, feet, abdominal wall, small bowel, and muscles.	

Zinc deficiency*	Neural tube defects.*	

CNS: central nervous system; SSRI: selective serotonin reuptake inhibitor; HIV: human immunodeficiency virus.

* Controversial.

Reference:

1. *FDA drug safety communication: FDA to evaluate potential risk of neural tube congenital anomalies with HIV medicine dolutegravir (Juluca, Tivicay, Triumeq), May 18, 2018. https://www.fda.gov/Drugs/DrugSafety/ucm608112.htm (Accessed on May 30, 2018).*

Graphic 73369 Version 18.0

Clinical screening tools for substance use disorders during pregnancy

4 Ps[1]
Parents: Did any of your parents have a problem with alcohol or other drug use?
Partner: Does your partner have a problem with alcohol or drug use?
Past: In the past, have you had difficulties in your life because of alcohol or other drugs, including prescription medications?
Present: In the past month, have you drunk any alcohol or used other drugs?
Scoring: Any "yes" should trigger further questions.
NIDA Quick Screen[2]
Screen your patients
Step 1. Use the **NIDA Quick Screen** to ask the patient about past-year drug use
Step 2. Ask the patient about lifetime drug use
Step 3. Determine risk level
Step 4. Depending on risk level: **A**dvise, **A**ssess, **A**ssist, and **A**rrange
CRAFFT – Substance Abuse Screen for Adolescents and Young Adults[3]
C Have you ever ridden in a **CAR** driven by someone (including yourself) who was high or had been using alcohol or drugs?
R Do you ever use alcohol or drugs to **RELAX**, feel better about yourself, or fit in?
A Do you ever use alcohol or drugs while you are by yourself or **ALONE**?
F Do you ever **FORGET** things you did while using alcohol or drugs?
F Do your **FAMILY** or friends ever tell you that you should cut down on your drinking or drug use?
T Have you ever gotten in **TROUBLE** while you were using alcohol or drugs?
Scoring: Two or more positive items indicate the need for further assessment.

Confidentiality statement: NOTICE TO CLINIC STAFF AND MEDICAL RECORDS: The information on this page is protected by special federal confidentiality rules (42 CFR Part 2), which prohibit disclosure of this information unless authorized by specific written consent. A general authorization for release of medical information is NOT sufficient.[3]

Reproduced from:

1. *Ewing H. A practical guide to intervention in health and social services with pregnant and postpartum addicts and alcoholics: theoretical framework, brief screening tool, key interview questions, and strategies for referral to recovery resources. Martinez (CA): The Born Free Project, Contra Costa County Department of Health Services; 1990.*
2. *Screening for Drug Use in General Medical Settings: Quick Reference Guide, Version 2. National Institute on Drug Abuse. https://nida.nih.gov/sites/default/files/pdf/screening_qr.pdf (Accessed on October 31, 2023).*

3. *Center for Adolescent Behavioral Health Research, Children's Hospital Boston. The CRAFFT screening interview. Boston (MA): CABHRe; 2009. © John R. Knight, MD, Boston Children's Hospital, 2018. All rights reserved. Reproduced with permission. For more information, contact crafft@childrens.harvard.edu.*

Graphic 128222 Version 3.0

PHQ-9 depression questionnaire

Name:	**Date:**			
Over the last 2 weeks, how often have you been bothered by any of the following problems?	**Not at all**	**Several days**	**More than half the days**	**Nearly every day**
Little interest or pleasure in doing things	0	1	2	3
Feeling down, depressed, or hopeless	0	1	2	3
Trouble falling or staying asleep, or sleeping too much	0	1	2	3
Feeling tired or having little energy	0	1	2	3
Poor appetite or overeating	0	1	2	3
Feeling bad about yourself, or that you are a failure, or that you have let yourself or your family down	0	1	2	3
Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
Moving or speaking so slowly that other people could have noticed? Or the opposite, being so fidgety or restless that you have been moving around a lot more than usual.	0	1	2	3
Thoughts that you would be better off dead, or of hurting yourself in some way	0	1	2	3
Total ___ =	___	**+** ___	**+** ___	**+** ___
PHQ-9 score ≥10: Likely major depression				
Depression score ranges:				
5 to 9: mild				
10 to 14: moderate				
15 to 19: moderately severe				
≥20: severe				
If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?	Not difficult at all ___	Somewhat difficult ___	Very difficult ___	Extremel difficult ___

PHQ: Patient Health Questionnaire.

Graphic 59307 Version 12.0

Appendix A: Edinburgh Postnatal Depression Scale

Name _____

Date: _____

Number of Months Postpartum: _____

As you have recently had a baby, we would like to know how you are feeling. Please mark the answer which comes closest to how you have felt in the past **7 days**, not just how you feel today.

Here is an example, already completed:

I have felt happy:
__ Yes, all the time
X Yes, most of the time
__ No, not very often
__ No, not at all

This would mean "I have felt happy most of the time during the past week". Please complete the following questions in the same way.

In the past 7 days:

1. I have been able to laugh and see the funny side of things
   - __ As much as I always could 0
   - __ Not quite so much now 1
   - __ Definitely not so much now 2
   - __ Not at all 3

2. I have looked forward with enjoyment to things
   - __ As much as I ever did 0
   - __ Rather less than I used to 1
   - __ Definitely less than I used to 2
   - __ Hardly at all 3

3. I have blamed myself unnecessarily when things went wrong
   - __ Yes, most of the time 3
   - __ Yes, some of the time 2
   - __ Not very often 1
   - __ No, never 0

Reproduced from: Cox JL, Holden JM, Sagovsky R. Detection of Postnatal Depression: Development of the 10-item Edinburgh Postnatal Depression Scale. Br J Psychiatry 1987; 150:782. Copyright © 1987 British Journal of Psychiatry.

Graphic 67741 Version 3.0

Appendix A: Edinburgh Postnatal Depression Scale (EPDS) (continued)

In the past 7 days:

4. I have been anxious or worried for no good reason
   - __ No, not at all 0
   - __ Hardly ever 1
   - __ Yes, sometimes 2
   - __ Yes, very often 3

5. I have felt scared or panicky for no very good reason
   - __ Yes, quite a lot 3
   - __ Yes, sometimes 2
   - __ No, not much 1
   - __ No, not at all 0

6. Things have been getting on top of me
   - __ Yes, most of the time I haven't been able to cope 3
   - __ Yes, sometimes I haven't been coping as well as usual 2
   - __ No, most of the time I have coped quite well 1
   - __ No, I have been coping as well as ever 0

7. I have been so unhappy that I have had difficulty sleeping
   - __ Yes, most of the time 3
   - __ Yes, sometimes 2
   - __ Not very often 1
   - __ No, not at all 0

8. I have felt sad or miserable
   - __ Yes, most of the time 3
   - __ Yes, quite often 2
   - __ Not very often 1
   - __ No, not at all 0

9. I have been so unhappy that I have been crying
   - __ Yes, most of the time 3
   - __ Yes, quite often 2
   - __ Only occasionally 1
   - __ No, never 0

10. The thought of harming myself has occurred to me
    - __ Yes, quite often 3
    - __ Sometimes 2
    - __ Hardly ever 1
    - __ Never 0

We suggest a cutoff score of 11, which appears to maximize sensitivity plus specificity in screening for postpartum depression. Women who report depressive symptoms without suicidal ideation or major functional impairment (or score between 5 and 9 on the EPDS) should be re-evaluated within one month.

Graphic 81407 Version 6.0

4-item Patient Health Questionnaire (PHQ-4) for anxiety and depression

Over the *last 2 weeks*, how often have you been bothered by the following problems?	Not at all	Several days	More than half the days	Nearly every day
Feeling nervous, anxious or on edge	0	1	2	3
Not being able to stop or control worrying	0	1	2	3
Feeling down, depressed or hopeless	0	1	2	3
Little interest or pleasure in doing things	0	1	2	3

Total score ≥ 3 for first 2 questions suggests anxiety.

Total score ≥ 3 for last 2 questions suggests depression.

Graphic 100637 Version 3.0

GAD-7 anxiety scale

	Not at all	Several days	More than half the days	Nearly every day
Over the last 2 weeks, how often have you been bothered by the following problems?				
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid as if something awful might happen	0	1	2	3
Total score*¶ _____ =	Add Columns	_____ +	_____ +	_____
If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?				
Circle one	Not difficult at all	Somewhat difficult	Very difficult	Extremely difficult

* Score: 5 to 9 = mild anxiety; 10 to 14 = moderate anxiety; 15 to 21 = severe anxiety.

¶ This is a form that can be printed out and filled out by hand rather than a calculator that can be filled in online.

Developed by Drs. Robert L Spitzer, Janet BW Williams, Kurt Kroenke, and colleagues, with an educational grant from Pfizer, Inc. No permission required to reproduce, translate, display or distribute. Published in: Spitzer RL, Kroenke K, Williams JB, Lowe B. A brief measure for assessing generalized anxiety disorder: the GAD-7. Arch Intern Med 2006; 166:1092.

Graphic 77755 Version 23.0

Mood disorder questionnaire

1. Has there ever been a period of time when you were not your usual self and...	**Yes**	**No**
...you felt so good or so hyper that other people thought you were not your normal self or you were so hyper that you got into trouble?		
...you were so irritable that you shouted at people or started fights or arguments?		
...you felt much more self-confident than usual?		
...you got much less sleep than usual and found you didn't really miss it?		
...you were much more talkative or spoke faster than usual?		
...thoughts raced through your head or you couldn't slow your mind down?		
...you were so easily distracted by things around you that you had trouble concentrating or staying on track?		
...you had much more energy than usual?		
...you were much more active or did many more things than usual?		
...you were much more social or outgoing than usual, for example, you telephoned friends in the middle of the night?		
...you were much more interested in sex than usual?		
...you did things that were unusual for you or that other people might have thought were excessive, foolish, or risky?		
...spending money got you or your family into trouble?		
2. If you checked YES to more than one of the above, have several of these ever happened during the same period of time? *Please circle one response only.*	**Yes**	**No**

3. How much of a problem did any of these cause you - like being unable to work; having family, money, or legal troubles; getting into arguments or fights? *Please circle one response only.*	**No problem**	**Minor problem**	**Moderate problem**	**Serious problem**

Patients screen positively for bipolar disorder if they answer "yes" to seven or more items in section 1, "yes" in section 2, and "moderate problem" or "serious problem" in section 3.

The mood disorder questionnaire should not be used to diagnose bipolar disorder. Patients who screen positive should be interviewed to establish the diagnosis; including family members is often helpful.

Hirschfeld RM, Williams JB, Spitzer RL, et al. Development and validation of a screening instrument for bipolar spectrum disorder: the Mood Disorder Questionnaire. Am J Psychiatry 2000; 157:1873. Reprinted with permission from the American Journal of

Psychiatry (Copyright 2000). American Psychiatric Association.

Graphic 53409 Version 4.0

Strategies for responding to disclosure of abuse or assault in pregnant women

Obstetrically focused response to disclosure of past sexual abuse or assault

1. Offer mental health referral.
2. Create obstetric care plan (trigger avoidance and preparation for unavoidable stressors at delivery).

Preparation for delivery stressors

Generate plan to address intrapartum triggers

- Involve multidisciplinary team for birth planning and counseling early in pregnancy (including but not limited to trauma-trained nurse educators, certified nurse midwives, psychologists, social workers, and clergy when appropriate).
- If team not available, consider nurse educator trained in trauma-informed birth planning to assist the woman in identifying triggers and generating a feasible birth plan.
- Final coordination and collaboration between the obstetrician, the woman, and the trauma-trained multidisciplinary team or educator in preparation for delivery.

A few common triggers and possible modifications

Triggers identified antepartum	Intrapartum modifications	Postpartum modifications
▪ Undressing, genital exposure.	▪ Drape adequately during examinations and at delivery. ▪ Limit spectator cheering/sensitive photos at delivery. ▪ Avoid shining bright light directly at perineum.	▪ Cover breasts adequately when examining or assisting with breast feeding.
▪ Feeling of fluid escaping from vagina, loss of bowel/bladder control.	▪ Attend to keeping perineum clean during labor and at delivery.	▪ Encourage staff to warn a woman before touching her and explain why they are doing so. ▪ Pay close attention to perinea care.
▪ Intrusive touch.	▪ Always ask before touching. ▪ Limit vaginal examinations and caregivers performing internal examination when possible. ▪ Avoid rushing. ▪ Encourage woman to bring calming music and/or support	▪ Avoid pressure to breastfeed triggers unwanted memories.

	persons.	
▪ Feeling powerless, limited mobility.	▪ Avoid overpowering words/behaviors (eg, command to relax). ▪ Avoid leaning over patient for vaginal examinations. ▪ Consider intermittent monitoring to allow greater mobility. ▪ Discuss epidural timing with emphasis on the loss of mobility and improved pain control.	▪ Encourage postpartum social work or multidisciplinary team involvement. ▪ Consider home visitation program. ▪ Ask about stressors at postpartum visit.

Special issues to consider

Timing of abuse disclosure

- Disclosure of past abuse may occur at any time, often later in pregnancy when trust is established. Allow the woman to control the timing of her own disclosure.
- Consider repeating abuse inquiry later in pregnancy if anxiety behaviors or comments lead you to suspect an abuse history, but respect her boundaries if she denies such a history.

Patient privacy, perception of safety, and control

- Seek permission before sharing the woman's past abuse history with the obstetrical care team, othe providers, and especially family members who may be unaware of this history.
- Avoid unrealistic promises (eg, "Don't worry, you'll be fine"), which can undermine trust.
- Emphasize realistic goals (eg, "We'll try to follow the delivery plan as much as possible, and if we have to change the plan because of concerns for you or the baby, we will discuss it with you").

Suspected ongoing abuse

- Goal of safety planning takes precedence.
- Offer crisis hotline number, safety card, or educational material (National Domestic Violence Hotline 1-800-799-SAFE).
- Offer community resources (shelters, law enforcement contacts, mental health services, referral to social worker or multidisciplinary team if available to assist with safety planning).

Special safety issues when screening adolescents

- Disclosure of childhood abuse for adolescent patients may suggest ongoing abuse. If ongoing abuse is suspected, state-specific mandatory reporting requirements apply.
- An immediate and coordinated response (including law enforcement involvement) is needed to assist the young woman in securing a safe environment.

Reimbursement and office time concerns

▪ Consider using CPT codes for extended counseling. ▪ Involve nurse educator or experienced certified nurse midwives if appropriately trained to address trauma-related issues. This may alleviate office time concerns for birth planning and counseling.
Coordinating care with labor and delivery staff and postpartum staff
▪ Obtain the patient's permission first before discussing her unique birth plan with labor and delivery staff and explain the reasons for sharing the plan. ▪ The delivery team will need to be aware of specific triggers and planned modifications upfront. ▪ Postpartum nurses will also need to be aware of specific triggers and planned modifications.
Obstetrical emergencies
▪ Discuss the possibility of obstetrical emergencies during birth planning. ▪ Encourage the presence of support persons during labor, especially a trained labor coach or doula t facilitate adaptive stress coping. ▪ When unplanned obstetrical interventions are necessary to expedite delivery, discuss the labor course with the woman after delivery and encourage her to describe her feelings about the birth experience. ▪ Consider referral for postpartum birth counseling for abuse survivors who describe an unsettling birth experience or desire such counseling.

While the strategies presented in the table are for pregnant women with a history of prior sexual abuse, the information regarding disclosure, privacy, and safety can be applied to any adult patient.

CPT: current procedural terminology.

Graphic 111021 Version 6.0

Recommendations for total and rate of weight gain for singleton pregnancies by prepregnancy BMI

	Total weight gain		Rates of weight gain* second and third trimester	
Prepregnancy BMI	**Range in kg**	**Range in lb**	**Mean (range) in kg/week**	**Mean (range) in lb/week**
Underweight (<18.5 kg/m^2)	12.5 to 18	28 to 40	0.51 (0.44 to 0.58)	1 (1 to 1.3)
Normal weight (18.5 to 24.9 kg/m^2)	11.5 to 16	25 to 35	0.42 (0.35 to 0.50)	1 (0.8 to 1)
Overweight (25.0 to 29.9 kg/m^2)	7 to 11.5	15 to 25	0.28 (0.23 to 0.33)	0.6 (0.5 to 0.7)
Obese (≥30.0 kg/m^2)	5 to 9	11 to 20	0.22 (0.17 to 0.27)	0.5 (0.4 to 0.6)

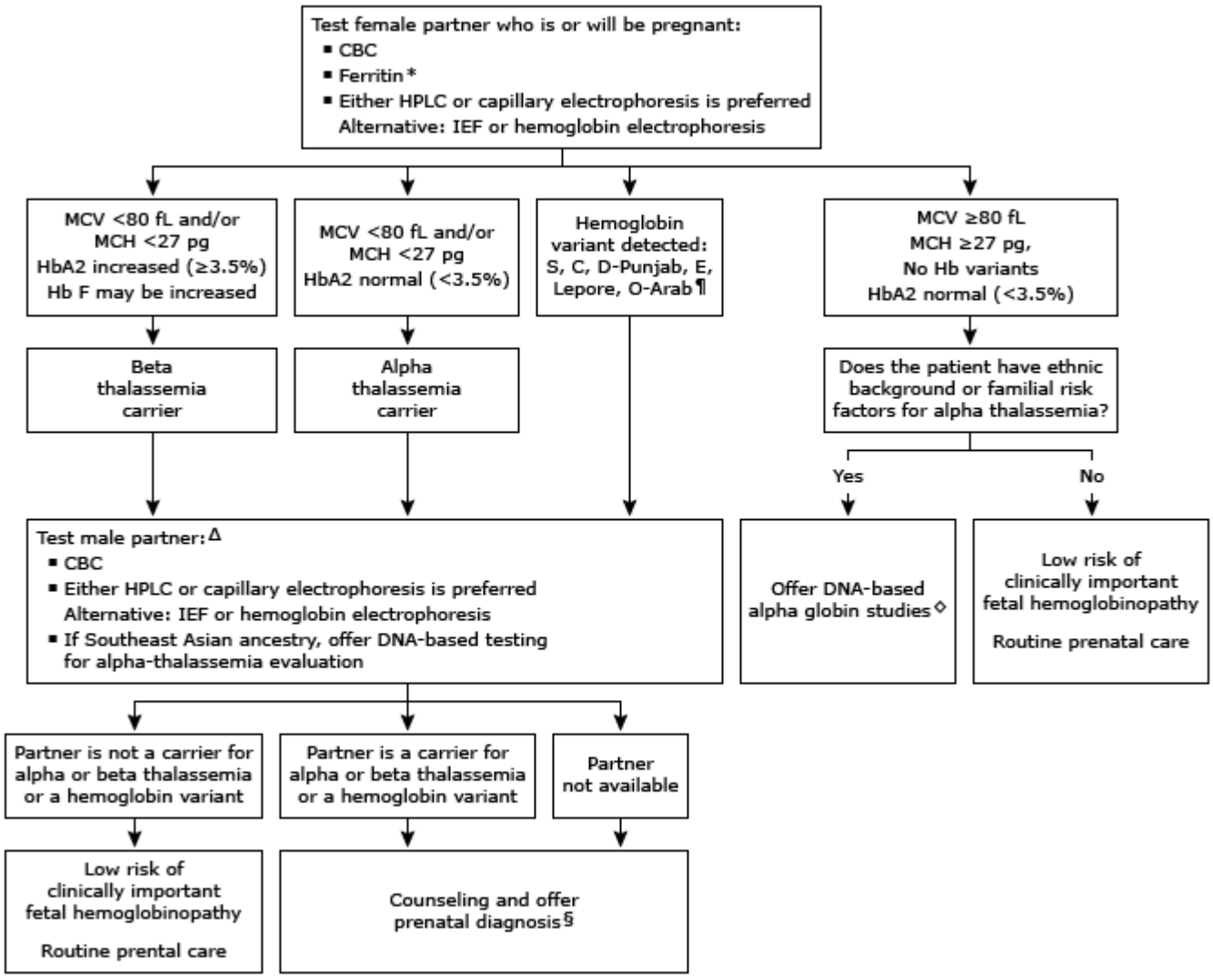
Recommended weight gain is higher for people with multiple gestations.

BMI: body mass index.

* Calculations assume a 0.5 to 2 kg (1.1 to 4.4 lb) weight gain in the first trimester.

Graphic 75820 Version 19.0

Our approach to prenatal/preconception screening for hemoglobinopathies



Whether screening for hemoglobinopathy should be performed universally or targeted to populations at increased risk is controversial. Given the increasingly diverse ethnic and geographic distribution of hemoglobinopathy genotypes in the United States and elsewhere, risk assessment based on race and ethnic origin alone may not be reliable.

HPLC: high performance liquid chromatography; CBC: complete blood count; Hb: hemoglobin; MCV: mean corpuscular volume; MCH: mean corpuscular hemoglobin; IEF: isoelectric focusing.

* A ferritin level is obtained because iron deficiency can mask beta-thalassemia trait. The diagnosis heterozygous beta-thalassemia is based on an increased HbA2 level, but individuals with beta-thalassemia and concomitant iron deficiency can have a normal rather than increased HbA2 level. Therefore, in individuals with microcytosis and normal HbA2, testing must be repeated after iron repletion or DNA-based testing can be performed.

¶ These are the most common variants. If another hemoglobin variant is detected, consult a hematologist.

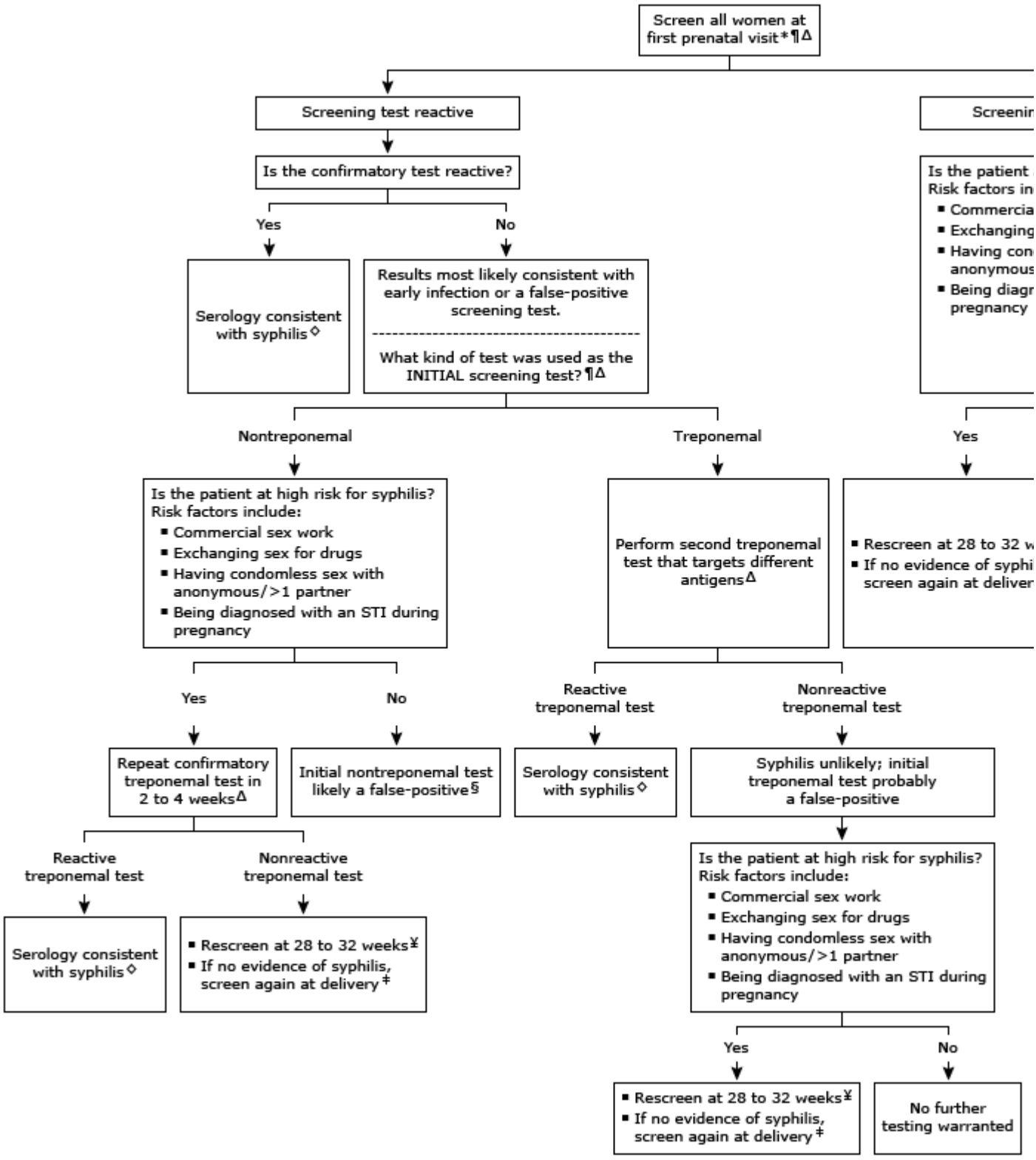
Δ The criteria for diagnosis of a hemoglobinopathy in the male partner are the same as the criteria for diagnosis in the female partner. Refer to UpToDate content for descriptions of counseling and fetal diagnosis.

◇ CBC and hemoglobin analysis will not identify alpha thalassemia silent carrier (loss of one of the four alpha globin genes), which can only be identified by DNA-based analysis. Therefore, DNA-based analysis should be considered in any patient with ethnic or familial risk factors for alpha thalassemia. Cost and the potential consequences of a missed diagnosis of HbH disease in offspring are factors in decision-making. If DNA-based testing shows the mother is not a carrier, no further testing is required. If DNA-based testing shows that the mother is a silent carrier, then paternal DNA-based testing should be performed. If the father has cis alpha thalassemia trait (loss of two alpha globin genes on the same chromosome), their child has a one in four chance of HbH disease (ie, loss of three of the four alpha globin genes). Newborns with HbH disease may have mild hemolytic anemia, often presenting with neonatal jaundice and mild anemia. Most do not require chronic transfusion but occasional transfusions may be needed. Iron overload due to increased iron absorption is also a significant issue.

§ Refer to UpToDate content for information on counseling and fetal diagnosis.

Graphic 100633 Version 5.0

Screening and diagnosis of syphilis in pregnant women without prior syphilis



STI: sexually transmitted infection.

* The initial type of screening test (treponemal versus nontreponemal) is typically dictated by the clinical laboratory.

¶ Nontreponemal tests include the rapid plasma reagin (RPR), the Venereal Disease Research Laboratory (VDRL), and the toluidine red unheated serum test (TRUST).

Δ Treponemal tests include the fluorescent treponemal antibody absorption (FTA-ABS), the *Treponema pallidum* particle agglutination (TPPA), the *T. pallidum* enzyme immunoassay (TP-EIA), or chemiluminescence immunoassay (CIA). These different treponemal tests target different antigens.

◇ Refer to the topic that discusses syphilis and pregnancy for treatment regimens.

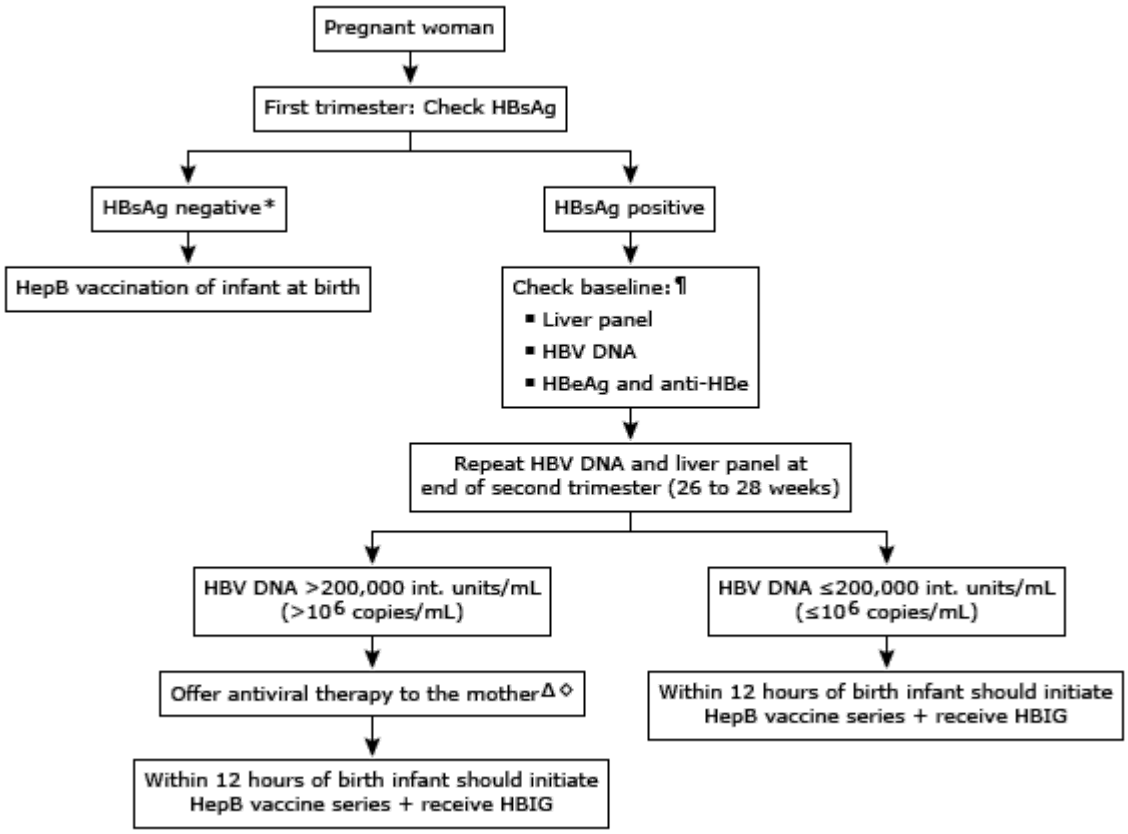
§ A reactive low titer nontreponemal screening test can be considered a transient biologic false-positive result due to pregnancy if the confirmatory treponemal test is negative and the patient is asymptomatic and at low risk of acute syphilis. False-positive nontreponemal test results can also be related to an acute event, such as an acute febrile illness or recent immunization. Test abnormalities attributed to these conditions are usually transitory and typically last for 6 months or less.

¥ If at 28 to 32 weeks gestation a screening nontreponemal test (eg, RPR) is reactive and the confirmatory treponemal test (eg, FTA-ABS) is nonreactive, treatment is usually the best option rather than repeating a confirmatory treponemal test in 2 to 4 weeks. If at 28 to 32 weeks a screening treponemal test is reactive and the confirmatory nontreponemal test is nonreactive, a second treponemal test that targets different antigens should be performed; if positive, serology is consistent with syphilis, and, if negative, syphilis is unlikely. However, if there is diagnostic uncertainty (eg, a second treponemal test cannot be performed) in the setting of pregnancy, we prefer to treat.

‡ Testing performed at delivery is used to help inform the pediatrician regarding screening/treatment of the newborn. Treatment of the mother at delivery does not prevent transmission.

Graphic 116084 Version 4.0

Algorithm for hepatitis B virus during pregnancy



Anti-HBc: hepatitis B core antibody; anti-HBe: hepatitis B e antibody; anti-HBs: hepatitis B surface antibody; HBeAg: hepatitis B e antigen; HBIG: hepatitis B immune globulin; HBsAg: hepatitis B surface antigen; HBV: hepatitis B virus.

* Check anti-HBs and anti-HBc if mother is at high risk for HBV infection (eg, injection drug user, sexual partner or household contact has chronic HBV). Mothers with no evidence of prior HBV infection (ie, negative for HBsAg, anti-HBs, and anti-HBc) should be vaccinated. In addition, such women should have HBsAg repeated late in pregnancy (approximately 28 weeks).

¶ Women who have a high HBV DNA (>200,000 int. units/mL), elevated aminotransferase levels, and/or a positive HBeAg should be referred to a hepatologist to see if early initiation of antiviral medications is needed.

Δ Start at 28 to 30 weeks gestation. We prefer tenofovir disoproxil fumarate rather than other antiviral agents. Refer to the topic on Hepatitis B and pregnancy for a more detailed discussion of treatment.

◇ For those who continue antiviral therapy after delivery, the pros and cons of breastfeeding must be discussed with the mother. Refer to the topic on Hepatitis B and pregnancy for more detailed discussions of breastfeeding.

Graphic 87231 Version 9.0

Individuals at increased risk of acquiring a sexually transmitted infection

- Personal history of a prior sexually transmitted infection
- Age <25 years
- New sex partner in past 60 days
- More than one sex partner in the past 6 months or sex partner with multiple concurrent sex partners
- Sex partner diagnosed with a sexually transmitted infection
- No or inconsistent condom use outside a mutually monogamous sexual partnership
- Trading sex for money or drugs
- Sexual contact with sex workers
- Meeting anonymous partners on the internet
- Admission to correctional facility or juvenile detention center
- Use of illicit drugs
- Living in a community with a high prevalence of sexually transmitted infections

Graphic 112388 Version 4.0

Public health and clinical screening for Chagas disease in the United States

Target population	Screening methods	Primary goal	Secondary goal	Intervention details and effectiveness	Published estimates o Chagas disease prevalence
Blood donors	Serology	Prevent transmission	Refer infected persons for management	Discard screen-positive donations; highly effective	Approximately 1/15,000 first-ti donors, up to 1/2700 in high-r areas[1]
Organ donors	Risk-based*, serology	Prevent transmission		Heart from infected donor not used; use of other organs with appropriate monitoring; highly effective	0.9% in combine risk-based and serologic donor screening[2]
Pregnant females from Latin America; infants born to infected mothers	Maternal serology, serial testing of infants¶; serology in siblings	Detect and treat infected infants early in life	Refer infected mothers and their other children for treatment	Early treatment of infants; treatment of mothers after lactation ends; treat infected siblings; highly effective in infants and children, moderate in young mothers	Approximately 1 mothers and <1 infected child pe 4000 high-risk females (majori born in Latin America)[3]
Immigrants from Latin America[Δ] and individuals with other risk factors*	Risk-based*, serology	Detect asymptomatic infected individuals	Refer family members at risk[◇]	Treatment of infected individuals; effectiveness high in children, uncertain in adults	0.5 to 4% in high risk populations many of those detected were > in whom treatment not generally recommended[
Patients from Latin America with	Serology; molecular	Detect infected		Treatment of *Trypanosoma*	No systematic data on

immunosuppressive conditions (HIV, transplant candidates, transplant recipients)	testing if high index of suspicion	individuals before reactivation occurs		*cruzi* reactivation can be life-saving; prospective monitoring for reactivation improves prognosis	prevalence of *T. cruzi* in these populations in t United States

* Risk factors include being born or having lived ≥6 months in an endemic country of Latin America, persons born to a mother with confirmed *T. cruzi* infection, or persons with evidence of a bite or other exposure to a triatomine bug in Latin America or regions of United States with known enzootic cycles.

¶ Polymerase chain reaction (plus microscopy if available) twice in the first 3 months of life, followed by immunoglobulin G serology at 9 months or later.

Δ Highest priority for children, young adults, and females of childbearing age due to considerations of antitrypanosomal treatment effectiveness[7].

◇ Family members of infected individuals should also be tested if they share the same risk factors, such as residence in an endemic country[8].

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Graphic 138385 Version 1.0

Risk factors for lead exposure in pregnancy and during lactation

Recent emigration from or residency in areas where ambient lead contamination is high
Women from countries where leaded gasoline is still being used (or was recently phased out) or where industrial emissions are not well controlled
Living near a point source of lead
Examples include lead mines, smelters, or battery recycling plants (even if the establishment is closed)
Working with lead or living with someone who does
Women who work in or who have family members who work in an industry that uses lead (eg, lead production, battery manufacturing, paint manufacturing, ship building, ammunition production, or plastic manufacturing)
Using lead-glazed ceramic pottery
Women who cook, store, or serve food in lead-glazed ceramic pottery made in a traditional process and usually imported by individuals outside the normal commercial channels
Eating nonfood substances (pica)
Women who eat or mouth nonfood items that may be contaminated with lead, such as soil or lead-glazed ceramic pottery
Using alternative or complementary substances, herbs, or therapies
Women who use imported home remedies or certain therapeutic herbs traditionally used by East Indian, Indian, Middle Eastern, West Asian, and Hispanic cultures that may be contaminated with lead
Using imported cosmetics or certain food products
Women who use imported cosmetics, such as kohl or surma, or certain imported foods or spices that may be contaminated with lead
Engaging in certain high-risk hobbies or recreational activities
Women who engage in high-risk activities (eg, stained glass production or pottery making with certain leaded glazes and paints) or have family members who do
Renovating or remodeling older homes without lead hazard controls in place
Women who have been disturbing lead paint, creating lead dust, or both or have been spending time ir such a home environment
Consumption of lead-contaminated drinking water
Women whose homes have leaded pipes or source lines with lead
Having a history of previous lead exposure or evidence of elevated body burden of lead

Women who may have high body burdens of lead from past exposure, particularly those who have deficiencies in certain key nutrients (calcium or iron)
Living with someone identified with an elevated lead level
Women who may have exposure in common with a child, close friend, or other relative living in the same environment

Reproduced from: Centers for Disease Control and Prevention. Guidelines for the identification and management of lead exposure in pregnant and lactating women. Atlanta 2010. Available at: http://www.cdc.gov/nceh/lead/publications/leadandpregnancy2010.pdf.

Graphic 86038 Version 4.0

Frequency of maternal blood lead follow-up testing during pregnancy

Venous blood lead level (BLL; mcg/dL)	Perform follow-up test(s)
<5	None (no follow-up testing is indicated).
5 to 14	Within one month. Obtain a maternal BLL* or cord BLL at delivery.
15 to 24	Within one month and then every two to three months. Obtain a maternal BLL* or cord BLL at delivery. More frequent testing may be indicated based on risk factor history.
25 to 44	Within one to four weeks and then every month. Obtain a maternal BLL* or cord BLL at delivery.
≥45	Within 24 hours and then at frequent intervals depending on clinical interventions and trend in BLLs. Consultation with a clinician experienced in the management of pregnant women with BLLs in this range is strongly advised. Obtain a maternal BLL* or cord BLL at delivery.

BLL: blood lead level.

* If possible, obtain a maternal BLL prior to delivery since BLLs tend to rise over the course of pregnancy.

Reproduced from: Ettinger AS, Wengrovitz AG. Guidelines for the Identification and Management of Lead Exposure in Pregnant and Lactating Women. Centers for Disease Control and Prevention. November 2010.

Graphic 81402 Version 5.0

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