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Prenatal care

AU: 1

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KEY POINTS

- *Prenatal care is of benefit to pregnant women, especially those with modifiable risk factors.*
- *Most women can be offered midwife-led models of care,* and women should be encouraged to ask for this option. Continuity of care by midwives has been associated with improved patient satisfaction. Caution should be exercised in applying this advice to women with substantial medical or obstetric complications.
- *Group prenatal care should be promoted* as it has been associated reduction in preterm birth (PTB), greater satisfaction with care, and higher breastfeeding initiation. In the developing world, participatory intervention with women's groups is associated with decreased maternal and neonatal mortality.
- *Women should be allowed to carry their record.*
- Prenatal care usually consists of 7–12 visits per pregnancy, with a first prenatal visit soon after the pregnancy test is positive, and in time to establish location and number of embryo(s), usually at around 6–8 weeks, then at 11–14 weeks for aneuploidy screening, followed by visits about every 4 weeks approximately at 16, 20, 24, and 28 weeks; about every 2 weeks from 34 to 36 weeks, then weekly until delivery. *In settings with limited resources* where the number of visits is already low, *reduced visits programs of antenatal care (<5) are associated with an increase in perinatal mortality* compared with standard care.
- See Table 2.1 for screening and interventions at different times in pregnancy.
- *Early ultrasonography* should be used to determine the estimated date of confinement (EDC) if there is any uncertainty regarding last menstrual period (LMP).
- Content issues that should be included in prenatal care are lifestyle, nutrition, supplements, vaccinations, drugs, environment, prenatal education, and others.
- *Regular exercise is beneficial to overall maternal fitness and sense of well-being,* as well as associated with prevention of excessive weight gain.
- Most studies report that *sexual activity* is associated with *better pregnancy* outcomes, probably because women who are sexually active are healthier to begin with compared with women with less sexual activity.
- *Balanced nutrition and protein supplementation* is associated with modest increases in maternal weight gain and in mean birth weight, and *reduction in risk of small-for-gestational-age (SGA), stillbirth, and neonatal death*. High-protein and isocaloric protein supplementation should be avoided as they are associated with increased risk of SGA.
- *Suggested weight gain* in pregnancy is shown in Table 2.4. *Women who are underweight are at increased risk for low birth weight (LBW) and PTB and have better outcomes with a higher total weight gain. Excessive weight gain in women with normal body mass index (BMI) can be prevented with dietary and lifestyle counseling.*
- *Folic acid supplementation is recommended for neural tube defect (NTD) prevention,* with 400 µg/day for all women, and 4 mg/day for women with prior children with NTD. All reproductive-age women should be on folic acid (FA) supplementation.
- Immunity to *rubella, varicella, hepatitis B, influenza, tetanus, and pertussis should be assessed at the first prenatal visit*. Ideally *needed vaccinations should be provided preconception. Influenza vaccine* is recommended for pregnant women during flu season. *Tetanus, diphtheria, and acellular pertussis vaccine, also known as TDAP vaccine,* is recommended for all pregnant women after 28 weeks. Partners and family members should be encouraged to be vaccinated as well.
- *Prenatal education* directed at specific objectives has been demonstrated to be effective.
- *Implementation of community-based interventional care packages* is associated with a trend for *reduction in maternal mortality,* and with *significant reductions in maternal morbidity, neonatal mortality, stillbirths, and perinatal mortality.*
- *Perineal massage* with sweet almond oil for 5–10 minutes daily from 34 weeks until delivery is associated with a significantly higher chance of intact perineum in nulliparous women.
- *Antenatal classes with training to prepare for labor and delivery* are associated with *arriving to labor and delivery (L & D) ward more often in active labor,* and *less use of epidural analgesia.*
- *Identifying mothers at risk for postpartum depression assists in prevention compared with intervening on the general population.*
- *Breastfeeding is the best feeding method for most infants* and should be *strongly encouraged. Continued counseling and education* facilitate breastfeeding success.
- *Unsensitized RhD-negative women should be offered anti-D immunoglobulin prophylaxis.*
- *Sweeping or "stripping" of membranes* during cervical exam at ≥38 weeks *reduces the rate of postterm delivery.*
- *Magnesium lactate or citrate chewable tablets* 5 mmol in the morning and 10 mmol in the evening for 3 weeks for women with leg cramps are associated with *significant improvement in persistent leg cramps.*
- *Water gymnastics* for 1 hour weekly starting at <19 weeks *reduces back pain* in pregnancy and allows more women to continue to work, with no adverse effects. *Both physiotherapy and acupuncture* starting <32 weeks for 10 sessions *might reduce back and pelvic pain.*
- *Exercise, increase in water intake, dietary counseling, and certain foods (e.g., prunes)* have shown relief in constipation. If these self-help measures are inadequate, the pregnant woman should then try *daily bran or wheat fiber supplements. Docusate sodium* is an effective *stimulant laxative.*

Table 2.1 Suggested Prenatal Care Counseling, Screening, and Intervention

Initial visit ≤14 weeks	Visits at: 14–24 weeks	24–28 weeks	28–34 weeks	34–41 weeks
		Assessments/procedures		
• Complete history and risk identification • Assessment of EDB by LMP and sizing; ultrasound if indicated • Baseline BP screening • Weight and BMI • Screening for domestic abuse • Vaccines according to risk status and season • Referral for specialist care according to history • Offer 11–13 6/7 weeks aneuploidy screening ultrasound	• Fetal heart tones • Fundal height • Fetal movement • BP • Weight • Screening ultrasound for anatomy	• Fetal heart tones • Fundal height • Fetal movement • BP • Weight • Rh immunoglobulin if indicated • Screening for domestic abuses	• Fetal heart tones • Fundal height • Fetal movement • BP • Weight	• Fetal heart tones • Fundal height/ EFW • Fetal movement • Fetal presentation • BP • Weight • Sweeping of membranes starting at ≥38 weeks
		Laboratory tests		
• Multiple-marker aneuploidy screen • CBC; Blood type, Rh, antibody screen; Rubella IgG; RPR; HBsAg; HIV • Urine dipstick for protein and glucose • Urinalysis and urine culture • Gonorrhea/Chlamydia[a] • Pap[a] • Additional testing as directed by history and PE[a]	• Multiple-marker aneuploidy screen • Urine dipstick for protein if indicated	• Gestational diabetes screen; repeat CBC and antibody screen • Antibody screen if indicated • Urine dipstick for protein	• Urine dipstick for protein	• Group B Strep • Urine dipstick for protein • HIV
		Education/counseling		

• Cessation of harmful substances
• Exercise/Activity
  • Nutrition
  • Nutrition
  • Weight gain
  • Supplements
  • Food safety
• Breastfeeding
	• Review and discuss results of testing	• Preterm labor s/sx	• Preterm labor s/sx
			• Preeclampsia s/sx
				Labor symptoms/ when to call
				Preeclampsia s/sx
				Post-dates management
				Breastfeeding

		Education/counseling not limited to specific weeks gestation		
• Danger signs • Dental care • Family planning • Labor preparation, options, s/sx to report • Travel • TOLAC				
		Assessments/procedures		
• Complete history and risk identification • Assessment of EDB by LMP and sizing; ultrasound if indicated • Baseline BP screening • Weight and BMI • Screening for domestic abuse • Vaccines according to risk status and season • Referral for specialist care according to history • Offer 11–13 6/7 weeks aneuploidy screening ultrasound	• Fetal heart tones • Fundal height • Fetal movement • BP • Weight • Screening ultrasound for anatomy	• Fetal heart tones • Fundal height • Fetal movement • BP • Weight • Rh immunoglobulin if indicated • Screening for domestic abuses	• Fetal heart tones • Fundal height • Fetal movement • BP • Weight	• Fetal heart tones • Fundal height/ EFW • Fetal movement • Fetal presentation • BP • Weight • Sweeping of membranes starting at 38 weeks

Table 2.1 Suggested Prenatal Care Counseling, Screening, and Intervention (*Continued*)

Initial visit ≤14 weeks	Visits at: 14–24 weeks	24–28 weeks	28–34 weeks	34–41 weeks
Laboratory tests				
• Multiple-marker aneuploidy screen • CBC; blood type, Rh, antibody screen; Rubella IgG; RPR; HBsAg; HIV • Urine dipstick for protein and glucose • Urinalysis and urine culture • Gonorrhea/Chlamydia[a] • Pap[a] • Additional testing as directed by history and PE[a]	• Multiple-marker aneuploidy screen • Urine dipstick for protein if indicated	• Gestational diabetes screen; repeat CBC and antibody screen • Antibody screen if indicated • Urine dipstick for protein	• Urine dipstick for protein	• Group B Strep • Urine dipstick for protein • HIV
Education/counseling				
• Cessation of harmful substances • Exercise/Activity • Nutrition • Nutrition • Weight gain • Supplements • Food safety • Breastfeeding	• Review and discuss results of testing	• Preterm labor s/sx	• Preterm labor s/sx • Preeclampsia s/sx	• Labor symptoms/ when to call • Preeclampsia s/sx • Postdates management • Breastfeeding
Education/counseling not limited to specific weeks gestation				
• Danger signs • Dental care • Family planning		• Labor preparation, options, s/sx to report • Travel • TOLAC		

Source: Adapted from a review of current prenatal care guidelines from four major groups: U.S. Veterans Health Administration, Department of Veteran Affairs, and Health Affairs, Department of Defense; Institute for Clinical Systems Improvement; the American Academy of Pediatrics and the American College of Obstetricians and Gynecologists; and the American Academy of Family Physicians; Hanson L et al., *J. Midwifery Women's Health*, 54(6), 458–468, 2009.

[a]*See text, only in certain circumstances.*

Abbreviations: EDB, expected date of birth; LMP, last menstrual period; BP, blood pressure; BMI, body mass index; EFW, estimation of fetal weight; RPR, rapid plasma regain; HIV, human immunodeficiency virus; CBC, complete blood count; PE, physical exam; TOLAC, trial of labor after cesarean; s/sx, signs and symptoms.

DEFINITION

Prenatal care is the care provided to pregnant women with the aim to prevent complications and decrease the incidence of perinatal and maternal morbidity and mortality [1]. This care consists of health promotion, risk assessment, and intervention linked to the risks and conditions uncovered. These activities require the cooperative and coordinated efforts of the woman, her family, her prenatal care providers, and other specialized providers. Prenatal care begins when conception is first considered and continues until labor begins. The objectives of prenatal care for the mother, infant, and family relate to outcomes through the first year following birth [1].

PURPOSE

Prenatal care developed, historically, to reduce the incidence of LBW and preterm infants [2]. It has evolved to encompass a broader purpose; to identify pregnancies with maternal or fetal conditions associated with morbidity/mortality, to provide interventions to prevent or treat such complications, and to provide education support and health promotion that can have lasting effects on the health of an entire family [3]. Care should be systematic, evidence based, and should result in informed shared decision making between the patient and the provider.

EFFECTIVENESS

Prenatal care is of benefit to pregnant women. Nonetheless, the value of prenatal care is controversial, as there is no definite evidence that prenatal care improves birth outcomes. *There are no randomized control trials (RCTs) of prenatal care versus no prenatal care.* Most studies are observational. Selection bias (women who self-select to prenatal care usually are more inclined to have better outcomes) leads to confounding bias (e.g., risk factors associated with LBW and neonatal death are also risk factors for inadequate prenatal care).

There are several RCTs on the number of prenatal care visits, which indirectly demonstrate the beneficial effects of prenatal care. There is a higher incidence of perinatal mortality [relative risk (RR) 1.14, 95% confidence interval (CI) 1.00–1.31)] *in programs with significantly less (<5) numbers of prenatal visits, compared with the usual 8–12.* This is particularly significant for low- and middle-income countries [4]. Also, studies demonstrate *a reduction in poor outcomes in high-risk pregnancies with enhanced prenatal care* at no added cost [4] (see Section "Number

and Timing of Visits"). In addition, *women are dissatisfied with a reduced schedule of prenatal visits* indicating a perceived benefit by women [4]. Specific interventions for specific risks may reduce morbidity and mortality. Prenatal care is probably of most benefit to medically high-risk women [2].

ORGANIZATIONAL ISSUES

Health-Care Provider

There is no evidence that physicians need to be involved in the prenatal care of every woman experiencing an uncomplicated pregnancy. The effect of midwife-led care compared with physician-led care or to other provider-led care has been evaluated mostly for the whole pregnancy, including together both antepartum care and care during labor and delivery (see also Chapter 7). Therefore it is difficult to assess the effect of midwife-led care just on antepartum care. From the evidence from both antepartum and L and D care, *most women can be offered midwife-led models of care and women should be encouraged to ask for this option. Caution should be exercised in applying this advice to women with substantial medical or obstetric complications.* In a meta-analysis, women, the vast majority low risk, who had midwife-led models of care, were *less likely to experience antenatal hospitalization, and less likely to experience fetal loss before 24 weeks' gestation* (RR 0.79, 95% CI 0.65–0.97), although there were no statistically significant differences in fetal loss/neonatal death of at least 24 weeks (RR 1.01, 95% CI 0.67–1.53) or in fetal/neonatal death overall (RR 0.83, 95% CI 0.70–1.00) [5] (see also Chapter 7). It is not clear whether these associations are due to *greater continuity of care or to midwifery care* [5].

Group Prenatal Care

In a meta-analysis, educational interventions were the focus of group prenatal care, and no consistent results were found. Sample sizes were very small to moderate. No data were reported concerning anxiety, breastfeeding success, or general social support. Knowledge acquisition, sense of control, factors related to infant-care competencies, and some labor and birth outcomes were measured. The largest of the included studies (n = 1275) examined an educational and social support intervention to increase vaginal birth after cesarean delivery. This high-quality study showed similar rates of vaginal birth after cesarean delivery in "verbal" and "document" groups (RR 1.08, 95% CI 0.97–1.21) [6]. One large RCT demonstrated significant *reduction in PTB, greater satisfaction with care, and higher breastfeeding initiation* at no added cost for group prenatal care over standard care in a group of medically low-risk (but socially at-risk) women in an urban clinic [7]. In this study, group care included, among other interventions, continuity of care from a single provider, patient keeping copies of their records, no waiting time at visits, about 20 hours of provider/patient time, with 8–10 women in each group session. *In the developing world, participatory intervention with women's groups* is associated with *decreased maternal and neonatal mortality* in several large cluster-randomized trials [8–10]. In one of these studies, participatory care involved a female facilitator convening nine women's group meetings every month. The facilitator supported groups through an action–learning cycle in which they identified local perinatal problems and formulated strategies to address them [8]. This strategy holds great promise in decreasing maternal and perinatal deaths among the most vulnerable in our world.

Group prenatal care may even be utilized in a higher risk population. In a non-RCT study, group prenatal care for women with gestational diabetes (GDM) is associated with decreased progression to A2 gestational diabetes and improved postpartum follow-up for appropriate diabetes screening without significantly affecting obstetrical or neonatal outcomes [11].

Group prenatal care should be promoted and further studied among more diverse populations.

Prenatal Record

A formal, structured record should be used for documenting care during the pregnancy. Structured records with reminder aids help ensure that providers incorporate evidence-based guidelines into clinical practice. There is no trial comparing different records. *Women should be allowed to carry their record.* A meta-analysis of three trials showed that carrying the record is *associated with increased maternal control and satisfaction during pregnancy, increased availability of antenatal records during hospital attendance, but also with more operative deliveries.* Importantly, all of the three trials included in the meta-analysis report that more women in the case notes group would prefer to hold their antenatal records in another pregnancy [12].

Number and Timing of Visits

There is insufficient evidence to recommend an ideal schedule of prenatal visits for all pregnant women. The most important visit to optimize pregnancy outcomes is the *preconception visit* (see Chapter 1). A visit early, soon after the pregnancy test is positive, and in time to establish location and number of embryo(s), usually around 6–8 weeks, is also desirable. At this early visit, each woman should be assessed for risk factors (see Tables 1.3 and 1.4 in Chapter 1). The frequency of subsequent visits can be determined based on risk factors.

In developed countries, *prenatal care usually consists of 7–12 visits per pregnancy, with a prenatal visit ideally at 10–14 weeks for aneuploidy screening* (see Chapters 5 and 6), *followed by visits about every 4 weeks approximately at 16, 20, 24, and 28 weeks; about every 2 weeks from 32 to 36 weeks, then weekly until delivery* (Table 2.1) [13]. Uncomplicated multiparous women may need fewer visits than uncomplicated nulliparous ones. Individual patient needs and risk factors should be assessed at the first prenatal visit and reassessed at each appointment thereafter. AU: 2

A small reduction in the traditional number of prenatal visits in both developed and developing countries has *not* been associated with adverse biological maternal or perinatal outcomes, but *women may feel less satisfied with fewer visits* [4]. *But, in settings with limited resources where the number of visits is already low, reduced antenatal visits (<5) are associated with an increase in perinatal mortality compared with standard care, although admission to neonatal intensive care may be reduced* [4]. *Women prefer the standard visits schedule. Where the standard number of visits is low, visits should not be reduced without close monitoring of fetal and neonatal outcome* [4]. *In addition, women in high-resource settings were more often dissatisfied with a reduced schedule of visits (defined as eight). The schedule of visits should be determined by the purpose of the appointment. A minimum of four prenatal care visits is recommended even for low-risk women* [4].

STRUCTURE

Initial Visit

Ideally, this visit should occur prior to 12 weeks of gestation. Women should receive *written* information regarding their pregnancy care services, the proposed schedule of visits, screening tests that will be offered, and lifestyle issues, such as nutrition and exercise. Major parts of the visit include history, risk identification, physical examination, laboratory

testing, education for health promotion, and a detailed plan of care for any risks identified (see Table 2.1) (see also Chapter 1, Tables 1.2–1.5).

History

A comprehensive history should be performed, preferably using standardized record forms (e.g., www.acog.org). Risk assessment should be performed with detailed review of systems. In particular, the woman who may require additional care or referral should be identified. *Early ultrasonography should be used to determine the EDC if there is any uncertainty regarding LMP* [14]. Accuracy of EDC is critical for timing of screening tests and appropriate interventions, managing complications, and consideration of delivery timing. It also provides early identification and chorionicity of multiple pregnancies (see Section "Ultrasonography" and Chapter 4). Content issues such as lifestyle, nutrition, supplements, drugs, environment, vaccinations, prenatal education, and others should be discussed (see Section "Content of Prenatal Care"). Prenatal diagnosis and screening for aneuploidy (Chapter 5) and genetic screening (Chapter 6) should be reviewed.

Physical Exam

The physical exam should be both general (Table 2.1) and directed by any risks identified in the history (see Chapter 1).

Weight and height should be determined at the initial prenatal visit in order to determine BMI [*BMI* = weight (kg)/height squared (m^2)]. BMI should be based on weight at time of conception or the earliest known weight in pregnancy. Categories of BMI are in Table 2.2. Women with *obesity* are at increased risk for diabetes, shoulder dystocia, cesarean section, and other complications, and have better outcomes with a lower (or no) total weight gain. Women who are underweight (<50 kg or <120 lb.) also are at increased risk for LBW and PTB, and have better outcomes with a higher total weight gain (see Section "Nutrition").

Blood pressure is recommended at each prenatal visit. Initial blood pressure evaluation may help to identify women with chronic hypertension, while subsequent blood pressure readings aid in preeclampsia screening. A diastolic blood pressure of >80 at booking is associated with later risks of preeclampsia [15]. There are significant risks associated with both hypertension and preeclampsia in pregnancy. This simple, inexpensive, and widely accepted screening tool may help to identify abnormal trends in blood pressure over time. Blood pressure should be taken in the sitting position using an appropriately sized cuff and correct technique (see Chapter 1 in *Maternal–Fetal Evidence Based Guidelines).*

Pelvic Examination

Routine pelvic examination early in pregnancy is not as accurate for assessment of gestational age compared with ultrasound (see Chapter 4) and not a reliable predictive test of PTB or cephalopelvic disproportion later in pregnancy (see also Chapters 7 and 17), and so it is not recommended for these assessments. Abdominal and pelvic examination to detect gynecologic pathology can be included in the initial examination, with no level 1 evidence for effectiveness of this screening test.

Table 2.2 Body Mass Index (BMI) Categories

Weight category	BMI
Underweight	<18.5
Normal weight	18.5–24.9
Overweight	25–29.9
Obesity (class I)	30–34.9
Obesity (class II)	35–39.9
Extreme obesity (class III)	>40

Laboratory Screening

Recommended initial universal laboratory screening is listed in Table 2.1. Other lab testing may be ordered if other risks/conditions are present.

ABO/Rh (D) type and antibody screen. Testing for blood group, Rh status, and atypical red cell antibodies at the initial visit is recommended. Unsensitized RhD-negative women should be offered anti-D immunoglobulin at 28 weeks (see Chapter 53 in *Maternal–Fetal Evidence Based Guidelines).* Anti-D immunoglobulin should also be offered for any invasive procedure [e.g., amniocentesis, chorionic villus sampling (CVS), percutaneous umbilical blood sampling (PUBS)], second- or third-trimester bleeding, partial molar pregnancies, spontaneous abortion, elective termination, and any condition that might be associated with fetal–maternal hemorrhage, such as abdominal trauma, external cephalic version, or placental abruption. It may also be offered for any first-trimester threatened abortion and ectopic pregnancy, although the evidence is not as strong, and it is probably not cost-effective or necessary unless the bleeding is significant. For the RhD-negative woman with a known RhD-negative father of the pregnancy, anti-D immunoglobulin can be deferred. Du-positive women do not need anti-D immunoglobulin (see Chapter 53 in *Maternal–Fetal Evidence Based Guidelines*).

Complete blood count. Recommended at the first prenatal visit to identify anemia (hemoglobin and hematocrit) and to screen for thalassemia [mean corpuscular volume (MCV)]. Pregnant women identified with anemia (Hgb < 11.0 g/dL in first trimester) should be treated as per Chapter 14 in *Maternal–Fetal Evidence Based Guidelines.* Initial determination of platelet count (optimally also before pregnancy) may help identify chronic thrombocytopenias and aid in diagnosis of gestational thrombocytopenia or HEELP (hemolysis, elevated liver enzyme levels, and a low platelet count) syndrome later in pregnancy.

Rubella antibody. Screen all women at first encounter. Nonimmune pregnant women should be counseled to avoid exposure and seek immunization postpartum (see Chapter 38 in *Maternal–Fetal Evidence Based Guidelines*).

Syphilis screening. All pregnant women should be screened with a serologic test for syphilis at the first prenatal visit. Women who are at high risk, live in areas of high syphilis morbidity, or are previously untested should be screened at 28 weeks and again at delivery (see Chapter 35 in *Maternal–Fetal Evidence Based Guidelines*).

HBsAg. Screen at initial encounter, and rescreen high-risk populations in third trimester. Postnatal intervention is recommended in all HBsAg-positive women to reduce the risk of viral transmission to the neonate. Pregnancy and breastfeeding are not contraindications to immunization in women who are at risk for acquisition of the hepatitis B virus (see Chapter 30 in *Maternal–Fetal Evidence Based Guidelines*).

HIV serology. Screening is recommended for all pregnant women. The "opt-out" approach is recommended. It should be emphasized that testing not only provides the opportunity to maintain maternal health, but interventions can be offered to dramatically reduce the risk of viral transmission to the fetus (see Chapter 32 in *Maternal–Fetal Evidence Based Guidelines*).

Urine dipstick for protein. Screening for proteinuria should occur at the initial visit and routinely after 20 weeks in women at risk for preeclampsia. Urine dipsticks for protein do not reliably detect the variable elevations in albumin that may occur in preeclampsia and may not be indicated at each visit in low-risk women [16]. In women at high risk for preeclampsia, the 24-hour collection is a reasonable screen for proteinuria as a baseline at the first prenatal visit, and when other signs/symptoms of preeclampsia are present. The proteinuria/creatinine (P/C) ratio may be used as a screening test as a good predictor for remarkable proteinuria since it seems to be highly predictive for diagnosis to detect proteinuria over one gram but inadequate in detecting lower levels [17] (see Chapter 1 in *Maternal–Fetal Evidence Based Guidelines*).

Urine dipstick for glucose. Glycosuria ≥250 mg/dL (equivalent to 1+) on urine dipstick in the first or second trimester is associated with abnormal GDM screening later in pregnancy. Presence of significant glycosuria before 24–28 weeks is an indicator for earlier gestational glucose screening (see Chapters 4 and 5 in *Maternal–Fetal Evidence Based Guidelines*).

Urine culture for asymptomatic bacteriuria. Screening for bacteriuria is recommended at the first prenatal visit for all women. Pregnant women with asymptomatic bacteriuria are at increased risk for symptomatic infection and pyelonephritis. There is also as a positive relationship between untreated bacteriuria and LBW/PTB. Treatment of asymptomatic bacteriuria prevents these complications (see Chapter 17 in *Maternal–Fetal Evidence Based Guidelines*).

Cervical cancer screening. Cervical cancer screening should be obtained if not current according to guidelines. Pap smear screening should be initiated at age 21, regardless of onset of sexual activity. Routine screening intervals have also been extended to every 3 years for women in their 20s without human papillomavirus (HPV) co-testing and every 5 years in women over 30 with the addition of HPV co-testing. Colposcopy can be performed during pregnancy and a plan can be made for treatment postpartum (see Chapter 31).

Selective (Only Women with Risk Factors) Laboratory Screening

Hepatitis C serology. A test for hepatitis C antibodies should be performed in pregnant women at increased risk for exposure, such as those with a history of IV drug abuse, exposure to blood products or transfusion, organ transplants, kidney dialysis, etc. (see Chapter 31 in *Maternal–Fetal Evidence Based Guidelines*).

Chlamydia screening. All women of age <25 years (strongest risk factor), multiple sex partners, new partner within past 3 months, single marital status, inconsistent use of barrier contraception, previous or concurrent sexually transmitted infection (STI), vaginal discharge, mucopurulent cervicitis, friable cervix, or signs of cervicitis on physical examination should be screened. Some agencies advocate universal chlamydia screening. Rescreen in the third trimester if at increased risk for infection. Screening using polymerase chain reaction (PCR) technology is most accurate (see Chapter 34 in *Maternal–Fetal Evidence-Based Guidelines*).

Gonorrhea screening. All women of age <25 years, prior STI, multiple sexual partners, having a partner with a past history of any sexually transmitted disease (STD), sex work, drug use, and inconsistent condom use should be screened for gonorrhea. Some agencies advocate universal gonorrhea screening. Rescreen in the third trimester if at increased risk for infection. Screening using PCR technology is most accurate (see Chapter 33 in *Maternal–Fetal Evidence Based Guidelines).*

Bacterial vaginosis. There is *no benefit* to routine screening and treatment for asymptomatic bacterial vaginosis. Consideration can be given to screening and treating women with a prior PTB, but given the inconclusive evidence we do not recommended it as routine. However, those women who are symptomatic should be screened (see Chapter17 in *Maternal–Fetal Evidence Based Guidelines).*

Genital herpes. Routine serologic or other screening for herpes simplex virus (HSV) in asymptomatic pregnant women is not recommended. In the absence of lesions during the third trimester, routine serial cultures are not indicated for women with a history of recurrent genital herpes (see Chapter 50 in *Maternal–Fetal Evidence Based Guidelines).*

Varicella. Screening is indicated if a woman has had neither past infection nor vaccination. Varicella vaccine (live attenuated) is not recommended during pregnancy, but seronegative women should be advised to take appropriate precautions (see Chapters 38 and 51 in *Maternal–Fetal Evidence Based Guidelines).*

Tuberculosis. Quantiferon gold or purified protein derivative (PPD) can be offered to high-risk women at any gestational age in pregnancy to screen for tuberculosis, and follow-up chest x-ray is recommended for recent converters. High-risk factors include human immunodeficiency virus (HIV) disease, homeless or impoverished women, prisoners, recent immigrants from areas where tuberculosis is prevalent, and others (see Chapter 24 in *Maternal–Fetal Evidence Based Guidelines).*

Cytomegalovirus (CMV). Routine testing is not recommended. Good hand washing and practicing universal precautions are recommended to prevent transmission [18] (see Chapter 47 in *Maternal–Fetal Evidence Based Guidelines).* AU: 3

Parvovirus. Routine screening is not recommended, but can be considered for high-risk groups (see Chapter 48 in *Maternal–Fetal Evidence Based Guidelines).*

Toxoplasmosis. Universal screening is not recommended. Education regarding prevention of disease should be addressed (Table 2.3) (see Chapter 48 in *Maternal–Fetal Evidence Based Guidelines).*

Follow-up Visits

Follow-up visits should provide for the following:

- Follow-up physical exam, laboratory screening, and testing as indicated
- Ongoing assessment of risk factors and plan for intervention as indicated

Table 2.3 Prevention of Food-Borne Illnesses

Food-borne illness to avoid	Preventive strategy
Listeriosis	Cook meat thoroughly including luncheon meats; avoid raw or smoked meats or fish, pates, unpasteurized cheese, and raw milk.
Toxoplasmosis	Cook meat and wash fruits and vegetables thoroughly; avoid cat litter; wear gloves when gardening outdoors.
Escherichia coli and *Salmonella*	Follow food-handling guidelines above.
Methylmercury	Avoid consumption of large, mercury-containing fish.

- Education and health promotion directed to individual plan of care
- Opportunity for discussion and questions

Follow-up Physical Exam

- **Weight:** Usually done at each visit, as optimal weight gain (Table 2.4) is associated with better outcomes. Excessive fast weight gain can be a sign of preeclampsia.
- **Blood pressure:** Should be performed and recorded at each visit.
- **Fetal heart tones:** Should be performed and recorded at each visit after the first trimester.
- **Symphyseal-fundal height measurement:** Can be performed at each visit from the 24th through 41st weeks. Fundal height measurement may help to detect fetal growth restriction (FGR) and macrosomia, but there is poor intra- and interuser reliability. There is probably some value in evaluating trends and although it will not impact on the underlying condition, it may affect decision making on fetal surveillance. *There is insufficient evidence to show whether this measurement has any impact, beneficial or not, on pregnancy outcomes, with no effect in the only one trial* [19] (see also Chapter 45 in *Maternal–Fetal Evidence Based Guidelines).*
- **Cervical examination:** *Routine digital examination of the cervix is not recommended as a screening measure for prevention of PTB* (see Chapter 17 in *Maternal–Fetal Evidence Based Guidelines*).
  - *Sweeping or "stripping" of membranes during cervical exam at ≥ 38 weeks reduces the rate of late-term delivery* (see Chapter 21). Cervical examination may assist in the identification of abnormal presentation, and therefore the opportunity to offer appropriate intervention (i.e., version).
- **Fetal movement:** There is no evidence that formalized kick counts reduce the incidence of fetal death in the healthy singleton [20] (see Chapter 56 in *Maternal–Fetal Evidence Based Guidelines).* Nonetheless, women may be instructed to be aware of daily fetal movements from at or around 28 weeks.
- **Leopold's maneuvers:** Perform at each visit from 34 weeks to estimate fetal weight and determine presentation. Ultrasound can be used to confirm findings, and interventions may be offered [21,22].
- **Clinical pelvimetry:** Measurement of the bony birth canal is of limited, unproven value in predicting dystocia during delivery (see Chapters 7 and 8).
- **Routine evaluation for edema:** Edema has traditionally been a part of the evaluation for preeclampsia, but by itself, it is neither specific nor sensitive.

Table 2.4 Institute of Medicine Recommended Total Weight Gain in Pregnancy by Prepregnancy BMI [kg (lb.)]

BMI	Singleton	Twin
<18.5	12.5–18 (27–40)	Insufficient information
18.5–24.9	11.5–16 (25–35)	17–25 (37–55)
25.0–29.9	7–11.5 (15–25)	14–23 (31–51)
≥30[a]	5–9 (11–20)	11–19 (24–41)

Source: Modified from Rasmussen KM and Yaktine AL, eds., *JAMA*, 302, 241–242, 2009.

[a]See Table 2.6 for our recommendations.

Follow-up Laboratory Screening

- **10 6/7–13 6/7 weeks:** Serum aneuploidy screening, with nuchal translucency screening by ultrasound (see below), should be offered to every pregnant woman. Consider cell-free DNA aneuploidy testing (also called noninvasive prenatal testing, NIPT) in high-risk women (see Chapter 5) (Table 2.1).
- **14–21 weeks:** The second part of serum aneuploidy screening (best at 16–18 weeks) should be offered to all pregnant women interested in prenatal diagnosis of aneuploidy (see Chapter 5). Counseling regarding the variety of screening options and the limitations of testing should be made available to all pregnant women.
- **24–28 weeks:** Women with risk factors for GDM should be screened with either one-step or two-step tests, since intervention (diet, exercise, glucose monitoring, and, as necessary, medical therapy) prevents maternal and perinatal morbidities (see Chapter 5 in *Maternal–Fetal Evidence Based Guidelines). Universal glucose challenge screening for GDM* is the most sensitive approach, but the following women are at low risk and less likely to benefit from testing (must meet all of the following criteria): age <25 years; ethnic origin of low-risk (not Hispanic, African, Native American, South or East Asian, or Pacific Islander); BMI <25; no previous personal or family history of impaired glucose tolerance; and no previous history of adverse obstetric outcomes associated with GDM. Antibody screening and hemoglobin and hematocrit are also repeated. Repeat screening of rapid plasma reagin (RPR) [or venereal disease research laboratory (VDRL)] and HIV in the early third trimester and at delivery can be considered for high-risk populations (see Chapters 32 and 35 in *Maternal–Fetal Evidence Based Guidelines).*
- **35–37 weeks:** *Group B Streptococcus (GBS*) is a significant cause of morbidity and mortality in neonates. Approximately 10%–30% of pregnant women are asymptomatically colonized with GBS in the vagina or rectum. Vertical transmission of this organism from mother to fetus occurs most commonly after onset of labor or rupture of membranes. All women should be screened for GBS colonization by rectovaginal culture at 35–37 weeks of gestation. Colonized women should be treated with IV antibiotics (penicillin is first choice if not allergic) in labor or with rupture of membranes (see Chapter 37 in *Maternal–Fetal Evidence Based Guidelines).*

Ultrasonography

Ultrasound has not been proven harmful to mother or fetus (see Chapter 4).

- **First-trimester "fetal dating" ultrasonography (before 14 weeks):** First-trimester ultrasound is more accurate than LMP to determine gestational age. First-trimester ultrasound also allows earlier detection of multiple pregnancies, aneuploidy screening with nuchal translucency, and diagnosis of nonviable pregnancies.
- **Second-trimester "fetal anatomy" ultrasound:** Generally, women are offered an ultrasound at 18–22 weeks to screen for structural anomalies. Routine use of ultrasound reduces the incidence of postterm pregnancies and rates of induction of labor for postterm pregnancy, increases early detection of multiple pregnancies, increases earlier detection of major fetal anomalies when termination of pregnancy is possible, increases detection rates of fetal malformations,

and decreases admission to special care nursery [23,24]. Given the benefits mentioned, all pregnant women should be offered a second-trimester ultrasound. No significant differences are detected for substantive clinical outcomes such as perinatal mortality, possibly because of insufficient data. Transvaginal ultrasound (TVU) cervical length (CL) screening of all singletons gestations, even those without a prior spontaneous PTB, can be offered (ACOG 2012, SMFM 2012), and is recommended by experts [25].

- **Third-trimester "fetal growth" ultrasound:** In low-risk or unselected populations, routine third-trimester ultrasound has not been associated with improvements in perinatal mortality [26]. Selective ultrasound in later pregnancy is of benefit in specific situations, such as calculation of interval growth for suspected FGR, assessment of amniotic fluid index for suspect oligohydramnios or hydramnios, and assessment of malpresentation (see Chapter 4). A large prospective cohort study showed that screening of nulliparous women with universal third-trimester fetal biometry roughly tripled the detection of SGA infants and that the combined analysis of fetal biometry and fetal growth velocity identified a subset of SGA fetuses that were at increased risk of neonatal morbidity [27].
- Routine umbilical artery or other Doppler ultrasound in low-risk or unselected patients has not been shown to be of benefit.

CONTENT OF PRENATAL CARE

The content of prenatal care is extensive and reviewed in detail not only in this chapter but also in most other chapters in this book, as well as its companion, *Maternal–Fetal Evidence Based Guidelines.* In Chapter 1, see Table 1.2 for topics to be reviewed, Table 1.3 for screening, Table 1.4 for laboratory tests, Table 1.5 for vaccinations, Table 1.6 for interventions for all women, and Table 1.7 for interventions for women with risk factors. Prenatal care usually incorporates, among other things, the following:

- *Prenatal education and reassurance* (regarding drugs, environment, lifestyle, nutrition, supplements, vaccinations, preventive measures, preparation for labor and delivery, depression, breastfeeding, etc.)
- Provision of evidence-based screening tests at appropriate intervals (Table 2.1)
- Risk assessment
- Problem-oriented visits as needed
- Condition-specific care for high-risk patients

Content issues that should be included in prenatal care such as drugs and environment, lifestyle, nutrition, supplements, vaccinations, prenatal education, and others are described below.

Drugs and Environment

Substance Abuse

Screening for use and counseling for cessation of tobacco, alcohol, and recreational or illicit drug use is recommended (see Chapters 22 and 23 in *Maternal–Fetal Evidence Based Guidelines*). Maternal smoking as well as exposure to secondhand smoke is dangerous to both the woman and her fetus. Provider support and educational material tailored to pregnancy are shown to increase smoking cessation by 70% and reduce LBW and PTB [28–30] as well as the number of women who continue to smoke in late pregnancy [30].

Alcohol use at any level in pregnancy cannot be supported although deleterious effects at low-moderate levels are difficult to quantify [31]. The evidence from the limited number of studies suggests that *psychological and educational interventions may result in increased abstinence from alcohol, and a reduction in alcohol consumption among pregnant women.* However, results were not consistent, and the paucity of studies, the number of total participants, the high risk of bias of some of the studies, and the complexity of interventions limit our ability to determine the type of intervention that would be most effective in increasing abstinence from, or reducing the consumption of, alcohol among pregnant women [32]. Counseling may be effective in reducing substance abuse in pregnancy, although women with *addictions will need specialized interventions. Screening and brief intervention (SBI)* for unhealthy alcohol use has demonstrated efficacy in some trials. There is some evidence regarding the acceptability and efficacy of computer-delivered SBI plus tailored mailings in women who screened positive for alcohol risk [33]. There is insufficient evidence to recommend the routine use of home visits for women with a drug or alcohol problem [34]. However, a cluster randomized controlled trial among urban South African mothers showed that a home-visiting intervention improved the emotional health of low-income mothers and that relative to standard care, intervention mothers were significantly less likely to report depressive symptoms and alcohol abuse [35].

Over-the-Counter, Alternative/Complementary, and Prescription Medications

Because of the possibility of adverse fetal effects, medication use, including alternative remedies, should be limited to circumstances where benefit outweighs risk. Beneficial medications should be continued in pregnancy when safe for both mother and fetus (see specific disease guidelines in *Maternal–Fetal Evidence Based Guidelines*).

Environmental/Occupational Risks and Exposures

In general, working is not associated with poor pregnancy outcome. Some workplace exposures, such as toxic chemicals, radiation (>5 rad), heavy repeated lifting, prolonged (>8 hours) standing, excessive (>80/week) work hours, and high fatigue score may be associated with pregnancy complications, but there is insufficient evidence on the effect of avoidance of these risks (see also Chapter 17). There is insufficient safety data for paint, solvents, hair dyes, fumes, anesthetic drugs, etc., with no absolute evidence of harm. Hot tubs, saunas should avoid temperatures >102°F to avoid risk of dehydration, especially in the first trimester.

Domestic Violence

Domestic violence against pregnant women is associated with an increased risk of PTB, LBW, second-and third-trimester bleeding, and fetal injury. Domestic violence may escalate during pregnancy. As such, providers need to be alert to signs and symptoms of abuse and provide opportunities for private disclosure. However, so far, there is insufficient evidence to assess the effectiveness of interventions for domestic violence on pregnancy outcome [36].

Lifestyle

Work

There is insufficient evidence to recommend exact work hours and when to take off from work before delivery (if at all). Work accommodations are often necessary and helpful to allow a

pregnant woman to continue working and earning an income. Pregnant women should not be discriminated on by their employers just because they are pregnant. The website www.pregnantatwork.org provides online tools that health-care professionals can use to prepare notes drafted using language that increases the likelihood that a patient will receive the accommodations she needs to continue doing her job safely. Occupational lifting guidelines have been published [37].

Exercise

Regular exercise during low-risk pregnancies is beneficial as it increases overall maternal fitness and sense of well-being. Aerobic training is an effective tool in maternal weight gain control in pregnancy [38] and *decreases the risk of gestational diabetes mellitus* [39]. Moreover, regular exercise during pregnancy appears to modestly increase the chance *for vaginal delivery* among healthy pregnant women [40]. Structured physical exercise programs appear also to be safe for the neonate [41] and *reduce the risk of having a large newborn without a change in the risk of having a small newborn* [42]. Furthermore, there is some evidence that exercise may be *effective in treating depression* during pregnancy [43]. Diet or exercise, or both, during pregnancy can *reduce the risks of: excessive gestational weight gain (GWG), cesarean section, maternal hypertension, macrosomia, and neonatal respiratory morbidity,* particularly for high-risk women receiving combined diet and exercise interventions [39]. However, most of the studies included in the meta-analysis were carried out in developed countries and therefore it is not clear if these findings are widely applicable [44]. In another meta-analysis, exercise was associated with a lower (by 600 g) GWG [45]. Possible *maternal* benefits include *improved cardiovascular function, limited pregnancy weight gain, decreased musculoskeletal discomfort, reduced incidence of muscle cramps and lower limb edema, mood stability, and attenuation of GDM and gestational hypertension. Fetal benefits include decreased fat mass, improved stress tolerance, and advanced neurobehavioral maturation [46]. For most pregnant women, at least 30 minutes of moderate exercise is recommended on most days all of the week. There is no target heart rate that is right for every pregnancy woman. Walking, swimming, and other sports with low chance of loss of balance are recommended* (Table 2.5) [47]. Avoid contact sports and sports with high chance of loss of balance. Special considerations may be made for professional athletes at the patient and provider's discretion. Avoid hypoglycemia and dehydration. It is important to advise women to be careful while stretching, as the hormone relaxin can leave joints vulnerable to overstretching and injury [47]. It is important for clinicians to keep emphasizing that *exercise is medicine* [48].

Yoga

Yoga in pregnancy is associated with lower pain and discomfort, as well as lower perceived stress and improved quality of life in physical domains in the three RCTs evaluating its effects [49].

Travel

Counseling should include the proper use of passenger restraint systems in automobiles with the lap belt below the abdomen, reduction of risk of venous thromboembolism during long-distance air travel by walking and exercise, and provision of care and prevention of illness during travel abroad.

Sex and Sexuality

Intercourse has not been associated with adverse outcomes in pregnancy. Some women have a progressive decrease in sexual desire during the pregnancy, most markedly in the third trimester. Couples are often concerned that intercourse may harm the pregnancy. This is associated with progressively decreasing frequency of sexual intercourse in pregnancy [50]. Most women desire more communication regarding sex in pregnancy by their care providers. Health-care provider counseling should be reassuring, in the absence of pregnancy complications. Semen is a source of prostaglandin, pyospermia is associated with preterm premature rupture of membranes (PPROM), and orgasms and nipple stimulation do increase contractions [51]. Therefore, sexual intercourse may be detrimental in women with cervical dilatation and/or shortening but this is not well studied. PTB and other complications of pregnancy do not seem increased in most studies of sex in pregnancy. *Most studies report that sexual activity is associated with better pregnancy outcomes,* probably because women who are sexually active are healthier to begin with compared with women with less sexual activity [52].

Table 2.5 Examples of Safe and Unsafe Physical Activities During Pregnancy

The following activities are safe to initiate or continue[a]:

- Walking
- Swimming
- Stationary cycling
- Low-impact aerobics
- Yoga, modified[b]
- Pilates, modified
- Running or jogging[c]
- Racquet sports[c,d]
- Strength training[c]

The following activities should be avoided:

- Contact sports (e.g., ice hockey, boxing, soccer, and basketball)
- Activities with a high risk of falling (e.g., downhill snow skiing, water skiing, surfing, off-road cycling, gymnastics, and horseback riding)
- Scuba diving
- Sky diving
- "Hot yoga" or "hot pilates"

Source: Adapted from Committee Opinion No. 650, *Obstet. Gynecol.,* 126, 135–142, 2015. [Guideline]

[a]In women with uncomplicated pregnancies in consultation with an obstetric care provider.

[b]Yoga positions that result in decreased venous return and hypotension should be avoided as much as possible.

[c]In consultation with an obstetric care provider, running or jogging, racquet sports, and strength training may be safe for pregnant women who participated in these activities regularly before pregnancy.

[d]Racquet sports wherein a pregnant woman's changing balance may affect rapid movements and increase the risk of falling should be avoided as much as possible.

Nutrition

Energy (Calorie)/Protein Supplementation

A meta-analysis of 17 RCTs provided evidence that *antenatal nutritional education* with the goal of increasing energy and protein intake in pregnant women appears to be effective in *reducing the risk of PTB and of LBW* and effective in increasing the head circumference at birth and the birth weight *among undernourished women [53]. Balanced energy and protein supplementation seems to improve fetal growth, and may reduce the risk of stillbirth and infants born SGA. However, high-protein supplementation does*

not seem to be beneficial and may be harmful to the fetus increasing the risk of SGA. Balanced-protein supplementation alone has no significant effects on perinatal outcomes [53].

Cholesterol-Lowering Diet
A cholesterol-lowering diet with omega-3 fatty acids and dietary counseling does not affect cord or neonatal lipids but is associated with a 90% reduction in PTB <37 weeks in one trial [54] (see also Chapter 17). More evidence is needed for a recommendation.

Low-Glycemic Index Diet
A low-glycemic index diet appears to be beneficial to both mother and child in reducing the incidence of abnormal glucose tolerance tests, large-for-gestational-age (LGA) infants, and ponderal indices. The numbers of studies and subjects are small, however, and therefore considered inconclusive [55]. Studies evaluating the effects of different types of dietary advice for women with gestational diabetes mellitus did not find any significant benefits for the diets investigated [56].

Antigen Avoidance Diet
Prescription of an antigen avoidance diet (e.g., avoiding chocolate or nuts) to a pregnant woman is unlikely to reduce her child's risk of atopic disease and such a diet may adversely affect maternal or fetal nutrition [57].

Probiotics
A probiotic capsule intervention among women with abnormal glucose tolerance had no impact on glycemic control [58].

Food Safety
Food safety and prevention of food-borne illness and infection are suggested in Tables 2.3 and 2.6.

BMI and Weight Gain
BMI is utilized in counseling a woman on optimal weight gain in pregnancy (Table 2.2) [59–71].

Suggested weight gain in pregnancy is shown in Table 2.4 [59]. *Women who are underweight are at increased risk for LBW and PTB and have better outcomes with a higher total weight gain* [67]. *Excessive weight gain in women with normal BMI can be prevented with dietary and lifestyle counseling* [62–69]. For example, a program of education on recommended GWG, application of personalized weight graph, formalized prescription of exercise, and regular monitoring of GWG at every antenatal visit is associated with a significant reduction in GWG [70]. Obesity is associated with cardiovascular disease, diabetes, hypertension, stroke, osteoarthritis, gallstones, endometrial, breast, and colon cancers, cardiomyopathy, fatty liver, obstructive sleep apnea, urinary tract infections, other complications, and most importantly, mortality. Prepregnancy obesity and excessive gestational weight gain are associated with increased risk of childhood obesity for the fetus. *Obese pregnant* women are specifically at increased risk for miscarriage, congenital malformations, GDM, hypertension, preeclampsia, stillbirth, cesarean birth, labor abnormalities, macrosomia, anesthesia complications, wound infection, and thromboembolism. These women *have better maternal outcomes with lower (or no) total weight gain* [60,61,67,68,71] (Table 2.7) (see also Chapter 3 in *Maternal–Fetal Evidence Based Guidelines*). Even if some studies have reported some small increased risk of SGA with weight loss in obese women, this is really NOT an increase. What happens is that obese women who gain weight have larger babies (incidence of SGA <5%), while those who lose weight have a normal incidence of SGA (i.e., ≤10%) [72]. Moreover, all other neonatal outcomes are the same or better with no weight gain or some moderate weight loss in obese pregnant women (Table 2.7) [61,72].

Caffeine
Moderate caffeine consumption (<200 mg/ day) does not appear to be a major contributing factor in miscarriage or PTB.

Reducing the caffeine intake of regular coffee drinkers (3+ cups/day) during the second and third trimester by an average of 182 mg/day did not affect birth weight or length of gestation in one RCT [73]. A meta-analysis from two RCTs concluded that there is insufficient evidence to confirm or refute the effectiveness of caffeine avoidance on birth weight or other pregnancy outcomes; moreover, they found that reducing the caffeine intake of regular coffee drinkers (3+ cups/day) during the second and third trimester did not affect PTB or SGA rate [74].

Supplements
Multivitamin
There is *insufficient evidence* to suggest replacement of iron and folate supplementation with a multiple-micronutrient supplement. A reduction in the number of LBW and SGA babies and maternal anemia has been found with a multiple-micronutrient supplement compared with supplementation with two or less micronutrients or none or a placebo, but analyses revealed no added benefit of multiple-micronutrient supplements compared with iron and FA supplementation [75,76]. These results are limited by the small number of studies available. There is also insufficient evidence to identify which micronutrients are more effective, to assess adverse effects, and to say that excess multiple-micronutrient supplementation during pregnancy is harmful to the mother or the fetus [75,76]. Therefore, there is *insufficient evidence* to recommend routine multivitamin supplementation for all women, or even only for women who are underweight, have poor diets, smokers, substance abusers, vegetarians, multiple gestations, or others. *Excess (>1) prenatal vitamin intake per day should be avoided. No prenatal multivitamin supplement has been shown to be superior to another.* Use of multivitamin supplement not specific for pregnancy should be

Table 2.6 Food Safety in Pregnancy

Clean: Wash hands thoroughly with soap and water, before and after handling food, using the bathroom, changing diapers, or handling pets. Wash cutting boards, dishes, utensils, and countertops with soap and water. Rinse raw fruits and vegetables well, under running water.
Separate: Separate raw meats and seafood from fresh or prepared foods. Use a separate cutting board for raw meats and seafood. Place prepared food on a clean plate.
Cook: Cook foods thoroughly. Avoid allowing foods to sit at temperatures between 40°F and 140°F (4°C and 60°C). Discard foods left out at room temperature for more than 2 hours. Avoid foods made with raw eggs.
Chill: Maintain refrigerator temperature at 40°F (4°C) or below and the freezer at 0°F (–18°C).

Table 2.7 Weight Gain Suggestions for Overweight and Obese Women

Prepregnancy Weight category	Our Suggested Total weight gain range (lb.)	IOM Recommendations (lb.)
Overweight (BMI 25–29.9 kg/m^2)	6–20 (2.7–9.0 kg)	15–25 (6.8–11.4 kg)
Class I obesity (BMI 30–34.9 kg/m^2)	5–15 (2.3–6.8 kg)	11–20 (5–9.1 kg)
Class II obesity (BMI 35–39.9 kg/m^2)	–9–9 (–4.0–4.0 kg)	11–20 (5–9.1 kg)
Class III obesity (BMI >40 kg/m^2)	–15–0 (–6.8–0 kg)	11–20 (5–9.1 kg)

Source: Rasmussen KM and Yaktine AL, eds., *JAMA*, 302, 241–242, 2009.
Abbreviation: IOM, Institute of Medicine.

discouraged, as often excess doses can pose risks to the pregnancy. Each supplement, including each vitamin supplement, should be studied for safety and efficacy individually.

Folic Acid

Folic acid supplementation is recommended, with *minimum 400 µg/day for all women* (93% decrease in NTDs), and *5 mg/day for women with prior children with NTD* (69% decrease in NTD) [77,78]. Supplementation should *start at least 1 month before conception and continue until at least 28 days after conception* (time of neural tube closure). Given the unpredictability of conception and that 50% of pregnancies are unplanned, all reproductive-age women should be on FA supplementation. Because in several countries the baseline serum folate level is only 5 ng/mL, and increases in this level are directly proportional with a decrease in the incidence of NTD, some experts have advocated 5 mg of FA per day as optimal supplementation [79]. No increase in ectopic pregnancy, miscarriage, or stillbirth has been associated with folate supplementation, but it might increase (nonsignificant trend) the incidence of multiple gestations by 40% [77–82]. However, a multicenter prospective cohort study showed that children whose mothers used FA supplement dosages higher than 5 mg/mL had a lower mean psychomotor scale score than children whose mothers used a recommended FA supplements dosages (i.e., 400 µg/day) [82]. Folic acid supplementation has been associated (one non-RCT study) with decrease in severe language delay at 3 years of age [81]. *Fortifying basic foods such as grains* with added folate is associated with an increase in supplementation of only 140–200 µg/day, and with only a 20%–50% decrease in incidence of NTD, with the potential for large-scale prevention [80]. Women taking antiseizure medications, other drugs that might interfere with FA metabolism, those with homozygous methylenetetrahydrofolate reductase (MTHFR) enzyme mutations, or those who are obese may need higher doses of folate supplementation. Women with first-trimester diabetes mellitus or exposure to valproic acid or high temperatures might not experience the decrease in NTD risk with folate supplementation due to these risks (see also Chapter 1).

Vitamin A

In pregnancy, some extra vitamin A is required for growth and tissue maintenance in the fetus, for providing fetal reserves, and for maternal metabolism. However, vitamin A in its synthetic form as well as in large doses as retinol (preformed vitamin A found in cod liver oil and chicken or beef liver) is teratogenic. It is recommended that pregnant women ingest vitamin A as carotene and limit the ingestion of retinol during pregnancy. In vitamin A-deficient populations (where night blindness is present), and in HIV-positive women, vitamin A supplementation reduces maternal night blindness and anemia**.** *Excess vitamin A intake can cause birth defects and miscarriages at doses >25,000 IU/day. Vitamin A supplements should be avoided, with maximum daily intake prior to and during pregnancy probably 5000 IU and certainly ≤10,000 IU, respectively. Vitamin A supplementation may be beneficial in women with vitamin A deficiency, especially in prevention of night blindness, in developing countries*. Optimal duration of supplement use cannot be evaluated. One large population-based trial in Nepal shows a possible beneficial effect on maternal mortality after weekly vitamin A supplements. Night blindness, associated with vitamin A deficiency, was assessed in a nested case–control study within this trial and found to be reduced but not eliminated. There is insufficient evidence to support vitamin A supplementation as an intervention for anemia [81,84].

Vitamin B6 (Pyridoxine)

There is *insufficient evidence* to evaluate pyridoxine supplementation during pregnancy [85]. There are few trials, reporting few clinical outcomes and mostly with unclear trial methodology and inadequate follow-up. There is not enough evidence to detect clinical benefits of vitamin B6 supplementation in pregnancy and/or labor other than one trial suggesting protection against dental decay [86]. For the aim of decreasing dental decay or missing/filled teeth, pyridoxine supplementation 20 mg/day (lozenges or capsules) is associated with decreased incidence of these outcomes in pregnant women [86]. Pyridoxine has been used in the management of *nausea and vomiting* in pregnancy. It is now considered Category A in combination with doxylamine as "Diclegis" which is the only U.S. Food and Drug Administration (FDA) approved treatment for nausea and vomiting of pregnancy. Studies done for FDA approval of the drug showed no adverse outcomes and demonstrated safety and good tolerance by women when used in the recommended dose of up to 4 pills (10 mg/10 mg) per day (see Chapter 9 in *Maternal–Fetal Evidence Based Guidelines*).

Vitamin C

The *data are insufficient* to assess if vitamin C supplementation either alone or in combination with other supplements is beneficial during pregnancy for either low-or high-risk women. There may be an associated increased risk of PTB with vitamin C supplementation (RR 1.38, 95% CI 1.04–1.82, 3 trials, 583 women) [87]. No other difference in outcome is noted between vitamin C supplementation and no treatment or placebo. There are very limited trials available to assess whether vitamin C supplementation may be useful for all pregnant women. Usually the women involved in the trials were either at high risk of preeclampsia or PTB or the women had established severe early-onset preeclampsia (see also Chapter 1 in *Maternal–Fetal Evidence Based Guidelines*). No difference is seen between women supplemented with vitamin C alone and those supplemented with vitamin C in combination with other supplements compared with placebo for the risk of stillbirth, neonatal death, LBW, or intrauterine growth restriction (IUGR) [87].

Vitamin D

There is *insufficient evidence* to evaluate the effects of vitamin D supplementation during pregnancy [88–92]. Vitamin D 1000 IU/ day in the third trimester is associated with no consistent effect on incidence of LBW [88]. *Neonatal hypocalcemia is less common* with vitamin D supplementation compared with placebo [88]. Vitamin D supplementation during pregnancy is associated with increase circulating 25(OH)D levels, birth weight and birth length but with no effects on maternal–fetal outcomes [89]. There are limited data to assess any benefit of vitamin D supplements for complete vegetarians and women with extremely limited exposure to sunlight. Vitamin D supplementation of vitamin D deficient pregnant women prevents neonatal vitamin D deficiency [90]. Vitamin D plus calcium have no effect on duration of pregnancy, type of delivery, and infant anthropometric indicators [91]. However, low maternal vitamin D levels in pregnancy ≤50 nmol/L may be associated with an increased risk of preeclampsia, gestational diabetes, PTB, and SGA [92].

Vitamin E

There is *insufficient evidence* to assess if vitamin E supplementation either alone or in combination with other supplements is beneficial during pregnancy [93]. All evidence tested women at high risk of preeclampsia or with established preeclampsia and assessed vitamin E in combination with other supplements (usually vitamin C) (see Chapter 1 in *Maternal–Fetal Evidence Based Guidelines).* There is no convincing evidence that vitamin E supplementation alone or in combination with other supplements results in other important benefits or harms [93].

Magnesium

Numerous studies demonstrate an association between magnesium supplementation and decreased incidences of LBW, SGA, antenatal hospitalization, and antenatal hemorrhage. The majority of RCTs are of poor quality, except one judged to be of high quality which did not support these associations. There is *insufficient high-quality evidence* to show that dietary magnesium supplementation during pregnancy is beneficial [94]. Including high- and low-quality trials, oral magnesium treatment from before the 25th week of gestation is associated with a lower frequency of PTB, a lower frequency of LBW, and fewer SGA infants compared with placebo [87]. In addition, magnesium-treated women have less hospitalization during pregnancy and fewer cases of antepartum hemorrhage than placebo-treated women. Incidences of preeclampsia and all other outcomes are similar. In the analysis of one high-quality trial, no differences between magnesium and placebo groups are seen. Poor-quality trials are likely to have resulted in a bias favoring magnesium supplementation.

Calcium

Calcium supplementation is associated with a *reduction of the incidence of preeclampsia in pregnancy in all women, particularly for women at high risk of hypertension and in women with low dietary calcium intake* (e.g., <600 mg/day) [95]. The minimum dose in the Cochrane review was 1 g/day. Further research is needed to determine whether dietary sources of calcium confer the same benefit and at what amount. There is insufficient evidence to determine optimum dosage and the effect on other important maternal and fetal outcomes. There is no overall reduction in PTB, although there is *reduction in PTB among women at high risk of developing hypertension*. Benefits are considered to outweigh an anomalous increase in the risk of HELLP syndrome, which was small in absolute numbers. There is no evidence of any effect of calcium supplementation on stillbirth or death before discharge from hospital. In women at high risk of hypertension, calcium supplementation is associated with fewer babies with birth weight <2500 g. In one study, childhood systolic blood pressure >95th percentile was reduced [95] (see also Chapter 1 in *Maternal–Fetal Evidence Based Guidelines).*

Iron

There is no evidence to advice against a policy of routine iron and folate supplementation in pregnancy. Iron supplementation is associated with *prevention of low hemoglobin at birth or at 6 weeks postpartum* [96]. Iron supplementation, however, has no detectable effect on any substantive measures of either maternal or fetal outcome. One trial, with the largest number of participants of selective versus routine supplementation, shows an increased likelihood of cesarean section and postpartum blood transfusion, but a lower perinatal mortality rate (up to 7 days after birth). There are few data derived from communities where iron deficiency is common and anemia is a serious health problem. There is limited evidence for daily versus intermittent supplementation. High-dose supplementation (80 mg daily) has no clinical advantage over low-dose supplementation (20 mg daily) and is associated with more gastrointestinal (GI) side effects. One RCT suggests adverse effects of hemoconcentration from iron supplementation in nonanemic women. For iron supplementation for women with anemia, see chapter 14 in *Maternal–Fetal Evidence Based Guidelines.*

Zinc

There is insufficient evidence to evaluate fully the effect of zinc supplementation during pregnancy [97]. Zinc supplementation is associated with *significant reduction in PTB* (RR 0.86, 95% CI 0.76–0.98; 13 RCTs; 6854 women). These studies were primarily from a low social-economic population and *may reflect overall poor nutrition.* Reductions in induction of labor and cesarean delivery are from small studies, with no other differences detected between groups of women who had zinc supplementation and those who had either placebo or no zinc during pregnancy. There is insufficient evidence to assess the best dose, gestational age and duration, and population for zinc supplementation in pregnancy [97].

Iodine

Iodine is essential for normal fetal thyroid and brain development. Iodine supplementation *in populations with low iodine intake and high levels of endemic cretinism* results in an important reduction in the incidence of the condition with no apparent adverse effects. Iodine supplementation is associated with *a reduction in deaths during infancy and early childhood, with decreased endemic cretinism at the age of 4 years and better psychomotor development scores between 4 and 25 months of age* [98]. There is little data, however, on the safety of routine iodine supplementation in populations with normal or low normal iodine levels. Some data suggest an increased risk of fetal and maternal hypothyroidism from iodine supplementation. The upper levels of safety have not been established [98,99].

Omega-3

Pregnancy is a time of increased risk for omega-3 deficiency as omega-3 is used for the developing fetus. Thirty-four RCTs have been performed to assess whether omega-3

supplementation during pregnancy affects maternal–fetal outcomes. Pooled results from the 34 studies [100] show lack of evidence to support the routine use of omega-3 supplementation during pregnancy, as omega-3 supplementation did not affect PTB, preeclampsia, IUGR, gestational diabetes, SGA, post-partum depression, children development or other maternal or fetal outcomes. Meta-analyses also found that omega-3 supplementation during pregnancy did not prevent PTB in low-risk women [101], or in women with prior PTB [102], and did not prevent recurrent IUGR [103].

Oral Health Care

Oral health care is an important component of general health and therefore should be maintained during pregnancy and through a woman's lifespan. However, although some studies have shown a possible association between periodontal infection and pregnancy outcome such as PTB and preeclampsia, the evidence shows *no improvement in obstetric or perinatal outcomes after dental treatment* during pregnancy. A meta-analysis from 13 RCTs showed that providing periodontal treatment to pregnant women was not associated with reduction in PTB, or perinatal mortality, except for a significant reduction in PTB and LBW in populations with high occurrence (>20%) of PTB and LBW [104].

Vaccinations

Immunity to *rubella, varicella, hepatitis B, influenza, tetanus, and pertussis should be assessed at the first prenatal visit. Ideally, needed vaccinations would be provided preconception.* There is no vaccine that is more dangerous to a pregnant woman or her fetus than the disease it is designed to prevent. Recombinant, inactivated, and subunit vaccines, as well as toxoids, and immunoglobulins pose no threat to a developing fetus. Inactivated influenza vaccine should be given (by injection, as killed virus) to all pregnant women during the influenza season. The live attenuated form of the vaccine (intranasal spray) should not be given during pregnancy. Hepatitis B vaccine can be safely given in pregnancy. TDAP or "whooping cough" vaccine is recommended for all pregnant women after 28 weeks (see Table 1.5 in Chapter 1, and Chapter 38 in *Maternal–Fetal Evidence Based Guidelines*).

Abdominal Decompression

Abdominal decompression consists of a rigid dome placed about the abdomen and covered with an airtight suit, with the space around the abdomen decompressed to –50 to –100 mmHg for 15–30 seconds out of each minute for 30 minutes once to thrice daily, or with uterine contractions during labor. This is thought to "pump" blood through the intervillous space. There is no evidence to support the use of abdominal decompression in normal pregnancies. There is no difference between the abdominal decompression groups and the control groups for LBW, admission for preeclampsia, low Apgar score, perinatal mortality, and childhood development [105].

Prevention of Complications

Please see specific diseases in each chapter of this book, and its companion, *Maternal–Fetal Evidence Based Guidelines.* Here are reported only some general, nonspecific interventions.

Antibiotic prophylaxis of pregnant women with no specific risk factor or infection is associated with similar incidence of PPROM, PTB, and postpartum endometritis [106,107] (see also Chapter 17).

Programs offering *additional social support* (caring family members, friends, and health professionals) for at-risk (e.g., for PTB and LBW) pregnant women are not associated with improvements in any perinatal outcomes, but there is a *reduction in the likelihood of antenatal hospital admission* (RR 0.79, 95% CI 0.68–0.92) and *cesarean birth* (RR 0.87, 95% CI 0.78–0.97) [108].

For issues such as mild hypertension or preeclampsia, small studies suggest that there are no major differences in clinical outcomes for mothers or babies between antenatal day units and hospital admission, but women may prefer day care [109] (see also Chapter 1 in *Maternal–Fetal Evidence Based Guidelines*).

Prenatal Education

There is insufficient evidence to assess the effectiveness of formal prenatal education programs. *Prenatal education directed at specific objectives (e.g., promoting breastfeeding and avoiding planned induction of labor) has been demonstrated to be effective* [110–113]. Individualized prenatal education directed toward avoidance of a cesarean delivery does not increase the rate of vaginal birth after cesarean section. As a part of prenatal care, women should be provided with information and instruction regarding their health, including risk avoidance, breastfeeding, what to expect during labor and birth (see Section "Preparation for Labor and Delivery"), how to obtain care when labor begins, and the value of a support person during the labor process (see Chapters 7 and 8).

Community Interventions

There is encouraging evidence of the value of integrating maternal and newborn care in community settings through a range of interventions that can be packaged effectively for delivery through a range of community health workers and health promotion groups. Such evidence-based available interventions as immunization to mothers, clean and skilled care at delivery, newborn resuscitation, exclusive breastfeeding, clean umbilical cord care, and management of infections in newborns require facility-based and outreach services. *Implementation of community-based interventional care packages is associated with a trend for reduction in maternal mortality* (RR 0.77, 95% CI 0.59–1.02) *and with significant reductions in maternal morbidity* (RR 0.75, 95% CI 0.61–0.92), *neonatal mortality* (RR 0.76; 95% CI 0.68–0.84), *stillbirths* (RR 0.84, 95% CI 0.74–0.97), *and perinatal mortality* (RR 0.80; 95% CI 0.71–0.91). It also increases the referrals to health facility for pregnancy-related complication by 40% and improves the rates of early breastfeeding by 94% [113].

Preparation for Labor and Delivery

Perineal massage with sweet almond oil for 5–10 minutes daily from 34 weeks until delivery is associated with a significantly higher chance of intact perineum compared with no massage in nulliparous, but probably not multiparous women [114–116]. The type of the oil used during the second stage of labor for prevention of perineal tears has no effect on the integrity of the perineum; accordingly it seems that there is no perfect oil [117]. For perineal massage in labor, see Chapter 8.

Women should be provided with written information and instruction regarding what to expect during labor and delivery, how to obtain care when labor begins, and the value of a support person during the labor process (see Chapters 7 and 8).

Labor and delivery classes should be encouraged. compared with no such training, 9 hours of *antenatal classes with training to prepare for labor and delivery are associated with arriving to L and D ward more often in active labor* (RR 1.45, 95% CI 1.26–1.65) *and using less epidural analgesia* (RR 0.84, 95% CI 0.73–0.97) [118].

Compared with standard antenatal education, antenatal education focusing on natural childbirth preparation with training in breathing and relaxation techniques is not associated with any effects on maternal or perinatal outcomes, including similar incidences of epidural analgesia, childbirth, or parental stress, in nulliparous women and their partners [119].

Compared with conventional therapy, intensive counseling therapy for fear of childbirth does not affect the incidence of cesarean but is associated with reduced pregnancy-and birth-related anxiety and concerns, and shorter labors in one RCT [120].

In a small RCT, *a specific antenatal education program is associated with a reduction in the mean number of visits to the labor suite before the onset of labor* [4]. It is unclear whether this results in fewer women being sent home because they are not in labor [120] (see also Chapter 7).

Depression in Pregnancy and the Postpartum Period

Between 14% and 23% of pregnant women will experience a depressive mood disorder while pregnant [122–129]. Maternal anxiety, life stress, history of depression, lack of social support, unintended pregnancy, public insurance, domestic violence, lower income, lower education, smoking, single status, and poor relationship quality were associated with a greater likelihood of antepartum depressive symptoms in bivariate analyses. Life stress, lack of social support, and domestic violence continued to demonstrate a significant association in multivariate analyses [123,124]. Identification of risk factors and screening for depression will facilitate referral for treatment (see Chapter 21 in *Maternal–Fetal Evidence Based Guidelines*).

Between 5% and 7% of women will experience postpartum depression. Risk factors include antenatal depressive symptoms, a history of major depressive disorder, or previous postpartum major depression [123]. If left untreated, postpartum major depression can lead to poor mother–infant bonding, delays in infant growth and development, and an increased risk of anxiety or depressive symptoms in the infant later in life. *Identifying mothers at-risk assists the prevention of postpartum depression compared with intervening on the general population*. The provision of *intensive postpartum support provided by public health nurses or midwives* is associated with 32% less postpartum depression. Interventions with *only a postnatal component* appeared to be more beneficial than interventions that also incorporated an antenatal component. *Individual-based interventions* may be more effective than those that are group based. Women who received multiple-contact intervention are just as likely to experience postpartum depression as those who received a single-contact intervention [125]. *There is insufficient evidence to assess the effectiveness of antidepressants given immediately postpartum in preventing postnatal depression in all women or just in high-risk women* [126]. Norethisterone enanthate, a synthetic progestogen, 200 mg intramuscularly (IM) administered once within 48 hours of delivery to unselected women is associated with a significantly higher risk of developing postpartum depression at 6 weeks [127]. A pilot randomized controlled trial showed that *prenatal yoga* may be of benefit in *prevention of postpartum depression* in low-risk women [128]. Moreover, prenatal yoga was also found to be a feasible and acceptable intervention and was associated with reductions in symptoms in women with symptoms of anxiety and depression [129] (see Chapter 21 in *Maternal–Fetal Evidence Based Guidelines*).

Breastfeeding

Breastfeeding is the best feeding method for most infants and should be strongly encouraged (see Chapter 30). *Counseling and education during pregnancy have been shown to facilitate breastfeeding success* [130]. Breastfeeding education and/or support increased exclusive breastfeeding rates and decreased no breastfeeding rates at birth and at 1–5 months. Combined individual and group counseling appeared to be superior to either individual counseling alone or group counseling alone. Attitudes of the health-care provider are highly associated with breastfeeding success. Antigen avoidance diet during lactation by high-risk women may reduce the child's risk of developing atopic eczema, and may reduce atopic eczema in children already with atopic eczema during the first 12–18 months, although more trials are needed.

INTERVENTIONS FOR COMMON PREGNANCY COMPLAINTS

Itching

The differential diagnosis of itching in late pregnancy (>32 weeks) is presented in Chapter 10 in *Maternal–Fetal Evidence Based Guidelines.* If the itching is not due to liver disease, and if there is no rash, aspirin (600 mg qid) has been reported to decrease itching [124], but because of potential detrimental fetal effects (closure of ductus arteriosus and oligohydramnios) should not be used. If there are both itching and a rash, chlorpheniramine 4 mg tid decreased itching in a small trial [131]. However, aspirin 600 mg four times a day appears to be more effective than chlorpheniramine 5 mg three times a day for relief of itching when no rash is present in a small crossover trial [132].

Stretch Marks

Some stretch marks (striae gravidarum) develop in about 50% of women by the end of pregnancy. There is no-high quality evidence to support the use of any topical preparation in the prevention of stretch marks during pregnancy [133,134]. There is also no proven treatment for stretch marks once they have developed [134]. Olive oil is not effective in preventing the occurrence of striae gravidarum or affecting its severity [134]. There is available product that has been shown to prevent the formation of SG. Massage with either Trofolastin cream or Verum ointment is associated in small RCTs with a decrease in the development of SG [134]. A small randomized trial showed that a specific anti-stretch mark cream (emollient and moisturizer containing hydroxyprolisilane C, rosehip oil, *Centella asiatica*, triterpenes, and vitamin E) had a small effect in reducing severity (but not the incidence) of striae during pregnancy [135] (see Chapter 43 in *Maternal–Fetal Evidence Based Guidelines*).

Leg Cramps

Leg cramps are reported to occur in a reported 34% of pregnant women in the midtrimester [136,137]. *Magnesium lactate or citrate chewable tablets 5 mmol in the morning and 10 mmol in the evening for 3 weeks are associated with one-third of women not having persistent leg cramps* compared with 94% of placebo controls having persistent cramps. Multivitamin with mineral

supplement might decrease leg cramps, but it is unclear which one of the 12 ingredients (or combination) is beneficial. Sodium chloride is associated with a slight reduction although consideration must be given to potential effect on blood pressure. *Calcium supplements do not decrease leg cramps compared with placebo*. However, it is unclear whether any of the interventions studied (i.e., oral magnesium, oral calcium, oral vitamin B or oral vitamin C) provide an effective treatment for leg cramps due to poor study design and trials being too small to address the question satisfactorily.

Calf stretching prior to bedtime does not decrease nocturnal leg cramps in nonpregnant patients [137].

Back and Pelvic Pain

Back pain is common in pregnancy, given weight gain and its uneven distribution as well as the softening effects of pregnancy hormones on the musculature.

There is evidence that *exercise* (any exercise on land or in water) may reduce pregnancy-related low-back pain, improve functional disability and reduce sick leave. *Water gymnastics for 1 hour weekly starting at <19 weeks reduces back pain in pregnancy and allows more women to continue to work, with no adverse effects [138].*

Pregnancy-specific exercises, physiotherapy, and acupuncture starting <32 weeks for 10 sessions appear to reduce back and pelvic pain; individual acupuncture sessions are more beneficial than group physiotherapy sessions. Education, other exercises, massage, heat therapy, support belts, analgesic therapy, etc. have not been studied in a trial in pregnancy for back pain relief.

Constipation

Constipation is common in pregnancy, probably because of decreased bowel peristalsis (possibly related to increased progesterone). It is reported by nearly 70% of women in the midtrimester. In nonpregnant adults, *exercise, increase in water intake, dietary counseling, and certain foods (e.g., prunes)* have been shown to relieve constipation. If these self-help measures are inadequate, the pregnant woman should then try daily bran or wheat fiber supplements. There is insufficient evidence to comprehensively assess the effectiveness and safety of interventions (pharmacological and nonpharmacological) for treating constipation in pregnancy, due to limited data (few studies with small sample size and no meta-analyses). Compared with bulk-forming laxatives, stimulant laxatives (e.g., Senna 14 mg, or dioctyl sodium succinate 120 mg and dihydroxyanthroquinone 100 mg—Normax) appear to be more effective in improvement of constipation (moderate quality evidence), but are accompanied by an increase in diarrhea and abdominal discomfort. *Docusate sodium* is a similar *stimulant laxative*, and it is widely available. Additionally, *dietary fiber supplements* (e.g., 10 mg/day of either corn-based biscuits—"Fibermed"—or 23 g wheat bran) increase the frequency of defecation and are associated with softer stools [139]. These findings in pregnant women are consistent with nonpregnant evidence.

Varicosities and Leg Edema

A small RCT (n = 69) shows that rutoside capsules improve leg edema symptoms; however, there are insufficient data to confirm rutoside safety in pregnancy. Another small RCT (n = 43) demonstrates a reduction in leg edema with *reflexology*. Compression stockings are not effective compared with simple resting, but studies do not compare compression stockings to no compression stockings. Leg elevation, compression hosiery, and swimming have not been studied for leg edema/varicosities relief in pregnancy [140].

Hemorrhoids

Hemorrhoids are common during pregnancy with 13% of women complaining of them in the midtrimester. *Oral hydroxyethylrutosides decrease symptoms compared with placebo group in women with hemorrhoids and reduce the signs identified by the health-care provider* [141]. Rutosides are associated with mild side effects such as GI discomfort, and their safety data in pregnancy are still insufficient. Constipation is a predisposing factor for hemorrhoids and should be treated. Sitz baths, ice, or ointments have been insufficiently studied for treatment of hemorrhoids in pregnancy. A small RCT showed that Hai's Perianal Support toilet seat device reduced the symptoms of hemorrhoids in pregnancy and improved the well-being of pregnant women [142].

Heartburn

Heartburn is common during pregnancy with 53% of women complaining of it in the midtrimester. There is no large-scale RCT to assess heartburn relief in pregnancy [143].

A consensus document has recommended that *lifestyle and dietary modifications* should remain the first-line treatment for heartburn in pregnancy. The measures include reducing and avoiding intake of reflux-inducing foods (e.g., greasy and spicy foods, tomatoes, highly acidic citrus products, and carbonated drinks) and substances such as caffeine. Nonsteroidal anti-inflammatory drugs (NSAIDs) should also be avoided. Other lifestyle changes to reduce the risk of reflux, such as avoiding lying down within 3 hours after eating, are advised. However, if heartburn is severe enough to warrant this action, medication should begin after consultation with a health-care professional. *Antacids, H_2 blockers, and proton pump inhibitors* all have acceptable safety profiles for the pregnant woman [143–145].

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