

Recommendations for Preconception Counseling and Care

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Given that nearly one-half of pregnancies are unintended, preconception care should be considered an integral part of primary care for women of reproductive age. Common issues in preconception care include family planning, achieving a healthy body weight, screening and treatment for infectious diseases, updating appropriate immunizations, and reviewing medications for teratogenic effects. Women who want to become pregnant should take folic acid supplements to reduce the risk of neural tube defects. Control of chronic diseases is essential for optimizing pregnancy outcomes. Family physicians should work with patients to control conditions such as diabetes mellitus, hypertension, and seizure disorders while simultaneously offering family planning services to avoid unintended pregnancies. Bariatric surgery is increasingly common and may improve fertility in many women with previous insulin resistance. Family physicians should counsel women undergoing bariatric surgery to prevent pregnancy during rapid weight loss and provide assistance with contraception. In addition, patients have special nutritional requirements after bariatric surgery. (*Am Fam Physician*. 2013;88(8):499-506. Copyright © 2013 American Academy of Family Physicians.)



► **Patient information:** A handout on this topic is available at <http://familydoctor.org/familydoctor/en/pregnancy-newborns/your-body/things-to-think-about-before-youre-pregnant.html>.

CME This clinical content conforms to AAFP criteria for continuing medical education (CME). See the CME Quiz on page 497.

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The Centers for Disease Control and Prevention defines preconception care as a set of interventions aimed at identifying and modifying biomedical, behavioral, and social risks to a woman's health or pregnancy outcome through prevention and management. The goal is to ensure that the woman is as healthy as possible before conception to promote her health and the health of her future children. Preconception care is integral to primary care for women in their reproductive years. It is not a single medical visit, but rather should be incorporated into every medical decision and treatment recommendation for these women.¹

Nearly one-half of all pregnancies in the United States are unintended. Family planning is an essential component of preconception care and allows optimal opportunity for health promotion and preventive care. Primary care clinicians should consider asking all patients of reproductive age about intention to

become pregnant and providing contraceptive counseling tailored to patients' intentions.^{1,2}

The Centers for Disease Control and Prevention's U.S. medical eligibility criteria for contraceptive use can assist clinicians in counseling patients about contraceptive choices, and provides evidence-based guidance on the safety of contraceptive methods for women with specific characteristics and medical conditions.³ All women and men should be encouraged to develop a reproductive life plan, including individual goals about childbearing and a plan for achieving them.¹ Reproductive life planning tools are available for patients and clinicians at <http://www.cdc.gov/preconception/reproductiveplan.html>.

For primary care physicians, caring for a woman of reproductive age should include identifying health risks to her and her future children, and implementing interventions to reduce these risks. General issues in preconception care are summarized in *Table 1*.⁴⁻⁹

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SORT: KEY RECOMMENDATIONS FOR PRACTICE

<i>Clinical recommendation</i>	<i>Evidence rating</i>	<i>Reference</i>
Ask women of reproductive age about intention to become pregnant. Provide contraceptive counseling tailored to patients' intentions.	C	1, 2
Advise folic acid supplementation (400 mcg daily) to reduce the risk of neural tube defects.	A	1, 21, 22, 25
Assess body mass index, and counsel women who are overweight, obese, or underweight about achieving a healthy body weight before becoming pregnant.	C	1, 27
Counsel women with diabetes mellitus about the importance of glycemic control before conception. Assist patients in achieving an A1C level as close to normal as possible to reduce the risk of congenital anomalies.	A	37, 38, 45-47
Check for use of teratogenic medications as part of preconception care, and change to safer medications if possible. Use the fewest medications at the lowest dosages needed to control disease.	C	6
Screen patients who wish to become pregnant for sexually transmitted infections and other communicable diseases as indicated.	C	1, 10
Update hepatitis B; influenza; measles, mumps, rubella; Tdap; and varicella immunizations as needed in patients who wish to become pregnant.	C	1, 11

Tdap = tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis.

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to <http://www.aafp.org/afpsort>.

Table 1. General Issues in Preconception Care

<i>Issue</i>	<i>Recommendations</i>
Environmental exposures	Assess for workplace exposures to toxicants; industries that are known to use toxic chemicals include clinical and laboratory health care, dry cleaning, printing, manufacturing, and agriculture Assess for household exposures to potentially harmful agents such as heavy metals, solvents, and pesticides Counsel patients about avoiding mercury exposure by not consuming large fish (e.g., shark, swordfish, tilefish, king mackerel) and limiting other fish intake ⁴
Family genetic history	Screen for personal or family history of congenital anomalies or genetic disorders Refer couples for genetic counseling when risk factors are identified, and provide carrier testing when appropriate to determine risk to future pregnancy ⁵
Medications	Assess for the use of teratogenic medications For women with chronic diseases, switch to safer medications when possible, and use the fewest medications at the lowest dosages needed to control the disease ⁶
Psychiatric illness	Screen for depression and anxiety disorders Counsel patients about the risks of untreated depression during pregnancy, as well as the risks of treatment ⁷
Psychosocial factors	Screen for intimate partner violence Evaluate the patient's safety, and provide referral to appropriate resources ⁸
Substance use	Screen for alcohol use, and provide referral for women with alcohol dependence Screen for tobacco use, and provide smoking cessation treatment when needed; counsel patients about the effect of smoking on pregnancies and child health Provide brief behavioral interventions to reduce tobacco, alcohol, and drug use ⁹

Information from references 4 through 9.

Screening and treatment for infectious diseases, and providing appropriate immunizations are also important in these patients (Table 2).^{1,10-20}

Nutritional Considerations

FOLIC ACID

Folic acid supplementation of 400 mcg daily started before pregnancy and continued until six to 12 weeks postconception reduces the rate of neural tube defects by nearly 75%.^{1,21,22} One study showed that women receiving preconception counseling from their primary care physicians are five times more likely to take folic acid before conception.²³ Women taking folic acid antagonists or who have carried a fetus affected by a neural tube defect or other birth defects linked with folic acid deficiency (e.g., oral facial cleft, structural heart disease, limb defect, urinary tract anomaly, hydrocephalus) should take 4 to 5 mg of folic acid daily starting three months before conception and continuing until 12 weeks postconception.^{24,25} Women with certain health risks (e.g., epilepsy, insulin-dependent diabetes mellitus, obesity with a body mass index [BMI] greater than 35 kg per m², family history of a neural tube defect) should also take this higher dosage.²⁴

OVERWEIGHT

In the United States, 26% of women 20 to 39 years of age are overweight (BMI of 25 to 29.9 kg per m²), and 29% are obese (BMI of 30 kg per m² or higher).²⁶ Women who are overweight or obese are at risk of diabetes, gestational diabetes, and hypertension. These conditions are associated with adverse pregnancy outcomes, including macrosomia, shoulder dystocia, operative delivery, congenital anomalies, intrauterine growth restriction, spontaneous abortion, stillbirth, preeclampsia, and eclampsia.²⁷

There are numerous effective interventions for women who are overweight or obese. A systematic review found that out of five commercial diets, Weight Watchers was the least costly, and women maintained a 3.2% weight loss two years after intervention. The review noted that medically supervised programs are more expensive and have higher rates of

Table 2. Infectious Disease Screening and Immunizations in Preconception Care

<i>Screening/ immunization</i>	<i>Recommendations</i>
Infectious disease	
Chlamydia ¹²	Screen all women younger than 25 years and women who are at risk of infection Treat infected patients
Gonorrhea ¹³	Screen high-risk women Treat infected patients
Herpes simplex virus infection	Counsel about the risk of vertical transmission
Human immunodeficiency virus infection ¹⁴	Universal screening Counsel about the risk of vertical transmission (treatment reduces this risk)
Syphilis ¹⁵	Screen high-risk women Treat infected patients
Tuberculosis	Screen high-risk women Treat women with active and latent disease before pregnancy
Immunization	
Hepatitis B ¹⁶	Vaccinate all high-risk women before pregnancy Counsel chronic carriers about prevention of vertical transmission
Influenza ¹⁷	Vaccinate all women who will be pregnant during influenza season and women at risk of influenza-related complications
Measles, mumps, rubella ¹⁸	Screen for immunity Vaccinate all nonimmune women who are not pregnant Counsel patients to avoid pregnancy for three months after vaccination
Tetanus, diphtheria, pertussis ¹⁹	Tetanus vaccination may protect against neonatal tetanus Vaccinate with Tdap during pregnancy (optimal timing is 27 to 36 weeks' gestation) to reduce the risk of neonatal pertussis
Varicella ²⁰	Screen for immunity Vaccinate all nonimmune women who are not pregnant Counsel patients to avoid pregnancy for one month after vaccination

Tdap = tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis.

Information from references 1, and 10 through 20.

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attrition, but are associated with greater weight loss (15% to 25%), compared with other types of programs.²⁸

Women who are overweight or obese are more likely to have difficulty with conception because of insulin resistance and oligomenorrhea. Weight loss and medications can improve these symptoms, as well as fertility.^{29,30}

BARIATRIC SURGERY

There were 220,000 bariatric surgeries in 2008; one-half were performed in women of reproductive age.³¹ Many women undergoing gastric surgery have a history of oligomenorrhea or amenorrhea from insulin resistance, and they should be advised that fertility may return as they lose weight. Women are generally directed to prevent pregnancy for 12 to 18 months after surgery to stabilize weight loss and optimize nutrition status,³² but observational studies have shown that the time from surgery to conception does not increase obstetric and neonatal complications.³³ Oral contraceptives may be less effective after malabsorptive bariatric surgery.

There is little evidence-based data to guide preconception care of women who have had bariatric surgery. These patients are at risk of nutrient deficiencies, including vitamins A, D, E, K, C, B₁, B₆, B₁₂; folic acid; and iron. It is generally recommended that they take at least two multivitamins per day in addition to extra iron (approximately 65 mg), folic acid (400 mcg), vitamin D (400 to 800 IU), and vitamin B₁₂ (350 mcg). Women should be assessed for common nutrient deficiencies before pregnancy with a complete blood count.^{31,32}

UNDERWEIGHT

Low prepregnancy weight (BMI less than 18.5 kg per m²) is associated with preterm birth and low birth weight. Low body weight is also associated with nutrient deficiencies, osteoporosis, amenorrhea, infertility, and arrhythmias. Infants whose mothers had low prepregnancy body weight are at higher risk of gastroschisis. Women with low BMI should be assessed for eating disorders and counseled about how being underweight can affect their health and pregnancy.^{1,34}

Chronic Medical Conditions

Table 3 includes preferred medications for chronic diseases and those to avoid during pregnancy.^{1,6,30,35-42}

DIABETES

Diabetes is the most common serious disease to affect the maternal-fetal dyad. The disease affects nearly 10% of women of reproductive age,⁴³ and about 1% of pregnancies are complicated by pregestational diabetes.³⁷

Pregestational diabetes increases the risk of miscarriage, congenital fetal anomalies, and perinatal death.⁴⁴

Glucose is teratogenic at high levels, and rates of congenital fetal anomalies are directly related to glycemic control in the first trimester. Good glycemic control during organogenesis reduces rates of congenital malformations.⁴⁴⁻⁴⁶ Preconception A1C levels should approach those considered normal in patients without diabetes; national organizations recommend varying targets of 7% or lower.^{38,47} Pregnancy is associated with higher rates of hypoglycemia, decreased hypoglycemic awareness, increased rates of diabetic ketoacidosis, and the progression of diabetic retinopathy and nephropathy.³⁸

Preconception counseling improves pregnancy outcomes in women with diabetes and should be part of diabetes care for reproductive-aged women. Preconception care should include educating women about the impact of diabetes on pregnancy outcomes and the impact of pregnancy on diabetes,³⁸ optimizing glycemic control, screening for vascular complications of diabetes, evaluating medication use, and encouraging effective family planning.³⁷

HYPERTENSION

Chronic hypertension affects 3% of women of reproductive age.⁴³ Chronic hypertension in pregnancy is associated with higher rates of preterm birth, placental abruption, intrauterine growth restriction, preeclampsia, and fetal death.⁴⁸ Women with chronic hypertension are at risk of worsening hypertension and end-organ damage, and 25% of women with hypertension develop superimposed preeclampsia during pregnancy.⁴⁹

Pregnancy outcome is related to the degree of hypertension.⁵⁰ There is no evidence that treating mild to moderate hypertension in pregnancy improves perinatal outcomes.⁴⁸ Treating severe hypertension (systolic blood pressure of 180 mm Hg or higher, or diastolic blood pressure of 110 mm Hg or higher) improves pregnancy outcomes.⁵¹

Caring for women of reproductive age with hypertension should include educating them about the risks of hypertension during pregnancy and that their medication regimen may need to be changed before conception. Women with long-standing hypertension who are planning pregnancy should be assessed for retinopathy, renal disease, and ventricular hypertrophy.³⁷

THYROID DISEASE

Thyroid disease can significantly impact pregnancy outcomes. Hypothyroidism affects 2.5% of women of reproductive age, and even more have subclinical disease.⁵²

Table 3. Medication Guidelines for Common Medical Conditions in Women Considering Pregnancy

<i>Medical condition</i>	<i>Medication guidelines</i>	<i>Comments</i>
Acne	Isotretinoin should be avoided	Isotretinoin is associated with miscarriage and birth defects ¹
Asthma	Inhaled corticosteroids and beta agonists are preferred	Use of oral corticosteroids in the first trimester is associated with reduced birth weight, increased risk of oral cleft, and higher rates of preeclampsia ³⁵ Inhaled corticosteroids are recommended for preventive treatment and may avoid the need for oral treatment ³⁶ When oral corticosteroids are indicated for treatment of severe asthma, the risk of uncontrolled severe asthma to the mother and fetus is greater than the risk of oral corticosteroids ³⁷
Diabetes mellitus	Most oral antidiabetic agents should be discontinued and insulin started; metformin (Glucophage) may be continued in the preconception period ³⁰ ACE inhibitors, ARBs, and statins should be avoided	ACE inhibitors and ARBs are associated with fetal renal anomalies and fetal death ^{37,38} Adverse effects in animal studies; limited data in humans ³⁸
Hypertension	ACE inhibitors, ARBs, and atenolol (Tenormin) should be avoided	ACE inhibitors and ARBs are associated with fetal renal anomalies and fetal death ^{37,38} ; adverse effects in animal studies, limited data in humans ³⁸ Atenolol is associated with lower birth weight ³⁹
Hyperthyroidism	Propylthiouracil is preferred in the first trimester; methimazole (Tapazole) is preferred in the second and third trimesters	Possible teratogenicity in the first trimester with methimazole; propylthiouracil-associated hepatotoxicity in subsequent trimesters ⁴⁰
Seizure disorder	Many major antiepileptic drugs (e.g., valproate [Depacon], phenytoin [Dilantin], carbamazepine (Tegretol), phenobarbital) are teratogenic	Rates of congenital anomalies are related to higher doses and polytherapy Monotherapy should be used when possible at the lowest effective dosage ^{6,41}
Thrombophilia	Heparin or low-molecular-weight heparin is preferred Warfarin (Coumadin) should be avoided	Warfarin is teratogenic ^{1,37,42}

ACE = angiotensin-converting enzyme; ARB = angiotensin receptor blocker.

Information from references 1, 6, 30, and 35 through 42.

Many patients with hypothyroidism are inadequately treated. Hypothyroidism in the first trimester is associated with cognitive impairment in children. Hypothyroidism (clinical and subclinical) in pregnant women increases the risk of preterm birth, low birth weight, placental abruption, and fetal death.^{53,54}

Women who are adequately treated before pregnancy and those diagnosed and treated early in pregnancy have no increased risk of perinatal morbidity.⁵⁵ It is essential to monitor women on thyroid replacement therapy and educate them about its impact on pregnancy. During

pregnancy, thyroid replacement dosages typically need to be increased by four to six weeks' gestation, possibly by 30% or more. Routine screening for subclinical hypothyroidism is not recommended; however, women with risk factors and symptoms of thyroid diseases should be screened, and subclinical hypothyroidism should be treated.⁴⁰

Hyperthyroidism can result in significant maternal and neonatal morbidity, and outcomes correlate with disease control. Guidelines recommend achieving euthyroidism before pregnancy.⁴⁰

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ASTHMA

Women with poorly controlled asthma before pregnancy are more likely to experience worsening symptoms during pregnancy.⁵⁶ Poorly controlled asthma poses risks to the fetus, such as neonatal hypoxia, intrauterine growth restriction, preterm birth, low birth weight, and fetal and neonatal death.⁵⁷ Preconception care should focus on optimizing asthma control with medications, and identifying and reducing exposure to allergens. Patients should be counseled on smoking cessation and avoidance of secondhand smoke exposure.⁶

THROMBOPHILIA

Women with thrombophilia are more likely to develop venous and arterial clots during pregnancy and are at risk of preeclampsia. Effects on the fetus include placental infarction, intrauterine growth restriction, placental abruption, recurrent miscarriage, fetal stroke, and fetal death.⁴² Warfarin (Coumadin), an anticoagulant commonly used in the treatment of thrombophilia, is teratogenic. It is important to educate women with thrombophilia about the risks of pregnancy so that they can make informed decisions about conception. Preconception care allows women to change to a treatment regimen that is safer for the fetus before pregnancy and to consider genetic testing for inherited thrombophilia.³⁷

SEIZURE DISORDERS

Seizure disorders are the most common neurologic diseases to affect pregnant women, and both the diseases and its treatments can adversely affect pregnancy. Approximately one-third of women with a seizure disorder will experience more frequent seizures in pregnancy. Seizure disorders are associated with miscarriage, low birth weight, developmental disabilities, microcephaly, and hemorrhagic disease of the newborn (induced by antiepileptic drugs). Seizure disorders increase the risk of congenital anomalies, whether or not the mother is taking medication.⁴¹ Given increased rates of neural tube defects with many antiepileptic drugs, supplementation with 4 mg of folic acid daily should be initiated at least one month before conception and continued in the first trimester.³⁷

Approach to the Patient

A 32-year-old woman with diabetes and hypertension presented for follow-up. She was interested in gastric bypass surgery. Her blood pressure was 154/89 mm Hg, her BMI was 41 kg per m², and her A1C level was 7.9%. She was taking metformin (Glucophage) and lisinopril (Zestril). She had never been pregnant and was not using contraception. She would like to have children, but had

been unable to conceive for many years and considered herself infertile.

The patient was encouraged to develop a reproductive life plan, and she and her partner determined that they wished to delay having children until she was healthier. After discussion of her contraceptive options, she elected to have an intrauterine device (Mirena) placed. She was counseled about dietary changes, physical activity, and weight loss, and was referred for evaluation for gastric bypass surgery. Her medications were titrated to optimize treatment of diabetes and hypertension, with a goal of discontinuing medications when she lost weight.

One year after surgery, the patient's BMI was 29 kg per m², and she no longer required medications for diabetes or hypertension. Her A1C level was 6.5%. She had been taking multiple vitamins, including folic acid, since her surgery to avoid nutrient deficiencies, and she wished to have her intrauterine device removed.

For more information on preconception care, visit <http://www.cdc.gov/ncbddd/preconception/default.htm> and <http://www.beforeandbeyond.org>.

Data Sources: A PubMed search was completed in Clinical Queries using the keyword preconception care, alone and with chronic disease, diabetes, hypertension, thyroid disease, seizure disorder, asthma, thrombophilia, obesity, underweight, bariatric surgery, weight loss, nutrition, folic acid, diet, immunization, and infectious disease. PubMed searches were completed using the term pregnancy with chronic disease, diabetes, hypertension, thyroid disease, seizure disorder, asthma, thrombophilia, immunization, and infectious disease. PubMed searches were completed using the term obstetrics with obesity, underweight, bariatric surgery, weight loss, nutrition, folic acid, and diet. Also searched were the Cochrane database, Essential Evidence Plus, the Agency for Healthcare Research and Quality evidence reports, and UpToDate. Search dates: December 15, 2011; February 1, 2012; and August 5, 2013.

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REFERENCES

1. Johnson K, Posner SF, Biermann J, et al.; CDC/ATSDR Preconception Care Work Group; Select Panel on Preconception Care. Recommendations to improve preconception health and health care—United States. *MMWR Recomm Rep*. 2006;55(RR-6):1-23.
2. Moos MK, Dunlop AL, Jack BW, et al. Healthier women, healthier reproductive outcomes: recommendations for the routine care of all women of reproductive age. *Am J Obstet Gynecol*. 2008;199(6 suppl 2): S280-S289.

3. Centers for Disease Control and Prevention. U.S. medical eligibility criteria for contraceptive use, 2010. *MMWR Recomm Rep*. 2010; 59(RR-4):1-86.
4. McDiarmid MA, Gehle K. Preconception brief: occupational/environmental exposures. *Matern Child Health J*. 2006;10(5 suppl):S123-S128.
5. Shapira SK, Dolan S. Genetic risks to the mother and the infant: assessment, counseling, and management. *Matern Child Health J*. 2006;10(5 suppl):S143-S146.
6. Cragan JD, Friedman JM, Holmes LB, Uhl K, Green NS, Riley L. Ensuring the safe and effective use of medications during pregnancy: planning and prevention through preconception care. *Matern Child Health J*. 2006;10(5 suppl):S129-S135.
7. Frieder A, Dunlop AL, Culpepper L, Bernstein PS. The clinical content of preconception care: women with psychiatric conditions. *Am J Obstet Gynecol*. 2008;199(6 suppl 2):S328-S332.
8. American College of Obstetricians and Gynecologists. Domestic violence. ACOG Education Bulletin 257. Washington, DC: ACOG; 1999.
9. Floyd RL, Jack BW, Cefalo R, et al. The clinical content of preconception care: alcohol, tobacco, and illicit drug exposures. *Am J Obstet Gynecol*. 2008;199(6 suppl 2):S333-S339.
10. Coonrod DV, Jack BW, Stubblefield PG, et al. The clinical content of preconception care: infectious diseases in preconception care. *Am J Obstet Gynecol*. 2008;199(6 suppl 2):S296-S309.
11. Coonrod DV, Jack BW, Boggess KA, et al. The clinical content of preconception care: immunizations as part of preconception care. *Am J Obstet Gynecol*. 2008;199(6 suppl 2):S290-S295.
12. U.S. Preventive Services Task Force. Screening for chlamydial infection: recommendations and rationale. *Am J Prev Med*. 2001;20(3 suppl): 90-94.
13. U.S. Preventive Services Task Force. Screening for gonorrhea. May 2005. <http://www.uspreventiveservicestaskforce.org/uspstf/uspstfsgono.htm>. Accessed February 29, 2012.
14. U.S. Public Health Service Task Force recommendations for the use of antiretroviral drugs in pregnant HIV-1-infected women for maternal health and interventions to reduce perinatal HIV-1 transmission in the United States. *MMWR Recomm Rep*. 2002;51(RR-18):1-38.
15. U.S. Preventive Services Task Force. Screening for syphilis infection. July 2004. <http://www.uspreventiveservicestaskforce.org/uspstf/uspstfsyph.htm>. Accessed August 27, 2013.
16. Mast EE, Weinbaum CM, Fiore AE, et al. A comprehensive immunization strategy to eliminate transmission of hepatitis B virus infection in the United States: recommendations of the Advisory Committee on Immunization Practices (ACIP) part II: immunization of adults [published correction appears in *MMWR Morb Mortal Wkly Rep*. 2007;56(42):1114]. *MMWR Recomm Rep*. 2006;55(RR-16):1-33.
17. Fiore AE, Uyeki TM, Broder K, et al. Prevention and control of influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices (ACIP), 2010 [published corrections appear in *MMWR Recomm Rep*. 2010;59(31):993, and *MMWR Recomm Rep*. 2010;59(35):1147]. *MMWR Recomm Rep*. 2010;59(RR-8):1-62.
18. Watson JC, Hadler SC, Dykewicz CA, Reef S, Phillips L. Measles, mumps, and rubella—vaccine use and strategies for elimination of measles, rubella, and congenital rubella syndrome and control of mumps: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep*. 1998;47(RR-8):1-57.
19. Updated recommendations for use of tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine (Tdap) in pregnant women—Advisory Committee on Immunization Practices (ACIP), 2012. *MMWR Morb Mortal Wkly Rep*. 2013;62(7):131-135.
20. Marin M, Güris D, Chaves SS, Schmid S, Seward JF. Prevention of varicella: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR Recomm Rep*. 2007;56(RR-4):1-40.
21. National Collaborating Centre for Women's and Children's Health; National Institute for Health and Clinical Excellence. *Antenatal care: routine care for the healthy pregnant women*. London, England: RCOG Press; 2008.
22. Lumley J, Watson L, Watson M, Bower C. Periconceptional supplementation with folate and/or multivitamins for preventing neural tube defects. *Cochrane Database Syst Rev*. 2000;(2):CD001056.
23. Elsinga J, de Jong-Potjer LC, van der Pal-de Bruin KM, le Cessie S, Assendelft WJ, Buitendijk SE. The effect of preconception counselling on lifestyle and other behaviour before and during pregnancy. *Womens Health Issues*. 2008;18(6 suppl):S117-S125.
24. Wilson RD, Davies G, Désilets V, et al.; Genetics Committee and Executive and Council of the Society of Obstetricians and Gynaecologists of Canada. The use of folic acid for the prevention of neural tube defects and other congenital anomalies. *J Obstet Gynaecol Can*. 2003;25(11):959-973.
25. Prevention of neural tube defects: results of the Medical Research Council Vitamin Study. MRC Vitamin Study Research Group. *Lancet*. 1991;338(8760):131-137.
26. Hedley AA, Ogden CL, Johnson CL, Carroll MD, Curtin LR, Flegal KM. Prevalence of overweight and obesity among US children, adolescents, and adults, 1999-2002. *JAMA*. 2004;291(23):2847-2850.
27. Siega-Riz AM, Siega-Riz AM, Laraia B. The implications of maternal overweight and obesity on the course of pregnancy and birth outcomes. *Matern Child Health J*. 2006;10(5 suppl):S153-S156.
28. Tsai AG, Wadden TA. Systematic review: an evaluation of major commercial weight loss programs in the United States. *Ann Intern Med*. 2005; 142(1):56-66.
29. Neveu N, Granger L, St-Michel P, Lavoie HB. Comparison of clomiphene citrate, metformin, or the combination of both for first-line ovulation induction and achievement of pregnancy in 154 women with polycystic ovary syndrome. *Fertil Steril*. 2007;87(1):113-120.
30. Qublan HS, Yannakoula EK, Al-Qudah MA, El-Uri FI. Dietary intervention versus metformin to improve the reproductive outcome in women with polycystic ovary syndrome. A prospective comparative study. *Saudi Med J*. 2007;28(11):1694-1699.
31. Shankar P, Boylan M, Sriram K. Micronutrient deficiencies after bariatric surgery. *Nutrition*. 2010;26(11-12):1031-1037.
32. Landsberger EJ, Gurewitsch ED. Reproductive implications of bariatric surgery: pre- and postoperative considerations for extremely obese women of childbearing age. *Curr Diab Rep*. 2007;7(4):281-288.
33. Wax JR, Cartin A, Wolff R, Lepich S, Pinette MG, Blackstone J. Pregnancy following gastric bypass for morbid obesity: effect of surgery-to-conception interval on maternal and neonatal outcomes. *Obes Surg*. 2008;18(12):1517-1521.
34. Gardiner PM, Nelson L, Shellhaas CS, et al. The clinical content of preconception care: nutrition and dietary supplements. *Am J Obstet Gynecol*. 2008;199(6 suppl 2):S345-S356.
35. Schatz M. The efficacy and safety of asthma medications during pregnancy. *Semin Perinatol*. 2001;25(3):145-152.
36. National Asthma Education and Prevention Program (National Heart, Lung, and Blood Institute). Working Group on Asthma and Pregnancy. Working Group report on managing asthma during pregnancy: recommendations for pharmacologic treatment. NIH publication 04-5236. Bethesda, Md.: National Institutes of Health; 2005.
37. Dunlop AL, Jack BW, Bottalico JN, et al. The clinical content of preconception care: women with chronic medical conditions. *Am J Obstet Gynecol*. 2008;199(6 suppl 2):S310-S327.
38. National Collaborating Centre for Women's and Children's Health; National Institute for Clinical Excellence. *Diabetes in Pregnancy: Management of Diabetes and Its Complications from Preconception to the Postnatal Period*. London, England: RCOG Press; 2008.
39. Lydakis C, Lip GY, Beevers M, Beevers DG. Atenolol and fetal growth in pregnancies complicated by hypertension. *Am J Hypertens*. 1999;12(6): 541-547.

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40. De Groot L, Abalovich M, Alexander EK, et al. Management of thyroid dysfunction during pregnancy and postpartum: an Endocrine Society clinical practice guideline. *J Clin Endocrinol Metab.* 2012;97(8):2543-2565.
41. ACOG educational bulletin. Seizure disorders in pregnancy. Number 231, December 1996. Committee on Educational Bulletins of the American College of Obstetricians and Gynecologists. *Int J Gynaecol Obstet.* 1997;56(3):279-286.
42. Silver RM, Warren JE. Preconception counseling for women with thrombophilia. *Clin Obstet Gynecol.* 2006;49(4):906-919.
43. Maternal and Child Health Bureau. *Women's Health USA 2002.* Rockville, Md.: U.S. Department of Health and Human Services; 2002.
44. Kitzmiller JL, Buchanan TA, Kjos S, Combs CA, Ratner RE. Pre-conception care of diabetes, congenital malformations, and spontaneous abortions. *Diabetes Care.* 1996;19(5):514-541.
45. Kitzmiller JL, Gavin LA, Gin GD, Jovanovic-Peterson L, Main EK, Zigrang WD. Preconception care of diabetes: glycemic control prevents congenital anomalies. *JAMA.* 1991;265(6):731-736.
46. Pregnancy outcomes in the Diabetes Control and Complications Trial. *Am J Obstet Gynecol.* 1996;174(4):1343-1353.
47. American Diabetes Association. Standards of medical care in diabetes—2011. *Diabetes Care.* 2011;34(suppl 1):S11-S61.
48. Ferrer RL, Sibai BM, Mulrow CD, Chiquette E, Stevens KR, Cornell J. Management of mild chronic hypertension during pregnancy: a review. *Obstet Gynecol.* 2000;96(5 pt 2):849-860.
49. Report of the National High Blood Pressure Education Program Working Group on High Blood Pressure in Pregnancy. *Am J Obstet Gynecol.* 2000;183(1):S1-S22.
50. McCowan LM, Buist RG, North RA, Gamble G. Perinatal morbidity in chronic hypertension. *Br J Obstet Gynaecol.* 1996;103(2):123-129.
51. Sibai BM, Anderson GD. Pregnancy outcome of intensive therapy in severe hypertension in first trimester. *Obstet Gynecol.* 1986;67(4):517-522.
52. Klein RZ, Haddow JE, Faix JD, et al. Prevalence of thyroid deficiency in pregnant women. *Clin Endocrinol (Oxf).* 1991;35(1):41-46.
53. Leung AS, Millar LK, Koonings PP, Montoro M, Mestman JH. Perinatal outcome in hypothyroid pregnancies. *Obstet Gynecol.* 1993;81(3):349-353.
54. Casey BM, Dashe JS, Wells CE, et al. Subclinical hypothyroidism and pregnancy outcomes. *Obstet Gynecol.* 2005;105(2):239-245.
55. Tan TO, Cheng YW, Caughey AB. Are women who are treated for hypothyroidism at risk for pregnancy complications? *Am J Obstet Gynecol.* 2006;194(5):e1-e3.
56. Kircher S, Schatz M, Long L. Variables affecting asthma course during pregnancy. *Ann Allergy Asthma Immunol.* 2002;89(5):463-466.
57. Liu S, Wen SW, Demissie K, Marcoux S, Kramer MS. Maternal asthma and pregnancy outcomes: a retrospective cohort study. *Am J Obstet Gynecol.* 2001;184(2):90-96.