

Dos and Don'ts in Pregnancy

Truths and Myths

Nathan S. Fox, MD

Pregnancy is a time of excitement and anxiety. The reality for pregnant women is that their actions could affect their pregnancies and their fetuses. As such, they need to know what they should and should not do to minimize risk and optimize outcomes. Whereas this advice used to come from doctors, a few books, and some family and friends, in the age of the internet, women are now bombarded with information and recommendations, which are often confusing at best and conflicting at worst. The objective of this review is to present current, evidence-based recommendations for some of the things that pregnant women should and should not routinely do during pregnancy.

(*Obstet Gynecol* 2018;131:713–21)

DOI: 10.1097/AOG.0000000000002517

Pregnant women are bombarded with advice. Among social media, web searches, direct marketing, family, and friends, it can be difficult for women to navigate the myriad of conflicting recommendations regarding what they should and should not do when they are pregnant. This leads to confusion at best and misinformation at worst regarding nearly all facets of life—eating, drinking, sleeping, working, travel, exercise, and sexual intercourse, to name a few. Women usually turn to their prenatal care providers for direction, but health care providers are also exposed to the same variety of opinions regarding routine advice for pregnancy. This article is meant to be an evidence-based review of common recommendations for pregnant women. It is not meant to be exhaustive nor is it meant to replace more expansive reviews of each topic. As such, a systematic review and meta-

analysis were not performed for each topic. Rather, quality systematic reviews are referenced (such as a Cochrane review) as are guidelines from several national or international organizations such as the American College of Obstetricians and Gynecologists (ACOG). Relevant studies are also referenced to support the “bottom line” conclusions of the author (Box 1). It is of course possible that in certain instances others could read the same studies and come to different conclusions in general or for a specific patient. However, the goal of this article is to combine these topics into one source that can be used as a starting point for discussion with pregnant women, and the article itself can be shared with pregnant women as well.

PRENATAL VITAMINS

Prenatal vitamins are designed to meet the daily mineral and vitamin (micronutrient) requirements of most pregnant women. However, except for folic acid and possibly vitamin D and iron, it is unknown whether meeting recommended dietary allowances improves outcomes or whether failing to meet these recommended allowances worsens outcomes. Additionally, for women with well-balanced, nutritious diets that meet the recommended allowances, supplementation is likely not required. If supplementation is required, there is no known best formulation. A simple multivitamin will normally suffice, including nonprescription vitamins.

From the Maternal-Fetal Medicine Associates, PLLC, and the Department of Obstetrics, Gynecology, and Reproductive Science, Icahn School of Medicine at Mount Sinai, New York, New York.

Continuing medical education for this article is available at <http://links.lww.com/AOG/B71>.

The author has indicated that he has met the journal's requirements for authorship.

Corresponding author: Nathan S. Fox, MD, 70 East 90th Street, New York, NY 10128; email: nfox@mfmnyc.com.

Financial Disclosure

The author did not report any potential conflicts of interest.

© 2018 by American College of Obstetricians and Gynecologists. Published by Wolters Kluwer Health, Inc. All rights reserved.

ISSN: 0029-7844/18



A Cochrane review of randomized trials in low- and middle-income countries where micronutrient deficiencies are common found that micronutrient supplementation reduced the risk of low birth weight and small for gestational age, but there were no other differences in maternal or neonatal outcomes.¹ These trials are likely not generalizable to higher income countries. For this reason, health authorities in the United Kingdom do not recommend supplementation aside from folic acid in the first trimester and vitamin D throughout pregnancy.

Folic acid deficiency is associated with fetal neural tube defects; therefore, women who do not consume at least 400–800 micrograms of folic acid daily should be advised to take folic acid supplementation from prepregnancy until the end of the first trimester.² Women with a history of a fetal neural tube defect should take 4,000 micrograms (4 mg) daily.²

Iron supplementation is advised as a result of the risk of maternal anemia at birth.³ However, if dietary iron is adequate (30 mg/d) and anemia is part of routine prenatal screening (which it usually is in the United States), there is no known benefit to supplemental iron in the absence of anemia.

Vitamin D deficiency is associated with several adverse outcomes such as preterm birth and preeclampsia, but it is currently unknown whether supplementation improves outcomes.^{4–6} The National Academy of Medicine (previously known as the Institute of Medicine) recommends that all women younger than 70 years consume 600 international units of vitamin D daily and recommends the same for pregnant women.⁵ Currently, ACOG does not recommend routine screening for vitamin D deficiency nor does it recommend supplementation beyond the dose in a standard prenatal vitamin (usually 200–600 international units).⁶

The recommended daily allowance of calcium for women age 19–50 years is 1,000 mg/d, including during pregnancy.⁵ For women with low calcium intake, calcium supplementation has been shown to reduce the incidence of hypertensive disorders of pregnancy⁷ but not the incidence of other adverse outcomes.⁸ Therefore, women should be sure to consume through diet or supplements at least 1,000 mg of calcium per day. Most multivitamins and prenatal vitamins have only approximately 200–300 mg of calcium.

NUTRITION AND WEIGHT GAIN

The National Academy of Medicine recommends weight gain in pregnancy based on the prepregnancy body mass index (calculated as weight (kg)/[height

(m)]²; Table 1).⁹ These recommendations are supported by mostly retrospective data showing a direct correlation between maternal weight gain and birth weight. Several observational studies have shown that weight gain below or above the National Academy of Medicine recommendations is associated with adverse pregnancy outcomes. One recent meta-analysis demonstrated that weight gain below the National Academy of Medicine recommendations is associated with a higher risk of preterm birth and small-for-gestational-age newborns; weight gain above the National Academy of Medicine recommendations is associated with a higher risk of macrosomia and cesarean delivery.¹⁰

Women are also advised to eat an additional 350–450 calories per day in the second and third trimesters. It is unclear whether women need to consume additional calories in the first trimester. However, these recommendations as well as the baseline caloric requirements are highly dependent on a woman's activity level, her height and weight, and her own metabolism history. Therefore, recommendations need to be individualized. General dietary recommendations for women should include eating plenty of fruits and vegetables, whole grains, dairy, and a variety of proteins. A good nutrition resource for pregnant women is a website run by the U.S. Department of Agriculture, www.choosemyplate.gov.

For women who eat well-balanced diets with adequate caloric intake yet have weight gain below or above the National Academy of Medicine recommendations, it is unknown whether they should increase or decrease their intake to meet the National Academy of Medicine weight gain recommendations. Because those recommendations were derived from observational data, they should be used as a general guide and not as an overriding requirement.

ALCOHOL

High alcohol intake in pregnancy has been associated with fetal malformations and developmental delays,

Table 1. National Academy of Medicine* Recommendations for Weight Gain in Pregnancy

Prepregnancy BMI Category (kg/m ²)	Recommended Weight Gain (lbs)
Underweight (less than 18.5)	28–40
Normal weight (18.5–24.9)	25–35
Overweight (25.0–29.9)	15–25
Obese (30 or greater)	11–20

BMI, body mass index.

* Previously known as the Institute of Medicine.



Box 1. Dos and Don'ts in Pregnancy

Prenatal Vitamins

- Pregnant women should consume the following each day through diet or supplements:
 - Folic acid 400–800 micrograms (until the end of the first trimester)
 - Iron 30 mg (or be screened for anemia)
 - Vitamin D 600 international units
 - Calcium 1,000 mg
- Prenatal vitamins are unlikely to be harmful. Therefore, they may be used to ensure adequate consumption of several vitamins and minerals in pregnancy. However, their necessity for all pregnant women is uncertain, especially for women with well-balanced diets.
- There is no known ideal formulation for a prenatal vitamin.

Nutrition and Weight Gain

- Pregnant women should be advised to eat a healthy, well-balanced diet and typically should increase their caloric intake by a small amount (350–450 calories/d).
- Women with higher prepregnancy BMIs do not need to gain the same amount of weight as women with normal or low BMIs.

Alcohol

- Although current data suggest that consumption of small amounts of alcohol during pregnancy (less than seven to nine drinks/wk) does not appear to be harmful to the fetus, the exact threshold between safe and unsafe, if it exists, is unknown. Therefore, alcohol should be avoided in pregnancy.

Artificial Sweeteners

- Artificial sweeteners can be used in pregnancy.
- Data regarding saccharin are conflicting. Low (typical) consumption is likely safe.

Caffeine

- Low-to-moderate caffeine intake in pregnancy does not appear to be associated with any adverse outcomes.
- Pregnant women may have caffeine but should probably limit it to less than 300 mg/d (a typical 8-ounce cup of brewed coffee has approximately 130 mg of caffeine. An 8-ounce cup of tea or 12-ounce soda has approximately 50 mg of caffeine), but exact amounts vary based on the specific beverage or food.

Fish Consumption

- Pregnant women should try to consume two to three servings per week of fish with a high DHA and low mercury content.

Box 1. Dos and Don'ts in Pregnancy (*continued*)

Fish Consumption (*continued*)

- For women who do not achieve this, it is unknown whether DHA and n-3 PUFA supplementation are beneficial, but they are unlikely to be harmful.

Raw and Undercooked Fish

- In line with current recommendations, pregnant women should generally avoid undercooked fish. However, sushi that was prepared in a clean and reputable establishment is unlikely to pose a risk to the pregnancy.

Other Foods to Avoid

- Pregnant women should avoid raw and undercooked meat.
- Pregnant women should wash vegetables and fruit before eating them.
- Pregnant women should avoid unpasteurized dairy products.
- Unheated deli meats could also potentially increase the risk of Listeria, but the risk in recent years is uncertain.
- Pregnant women should avoid foods that are being recalled for possible Listeria contamination.

Smoking, Nicotine, and Vaping

- Women should not smoke cigarettes during pregnancy. If they are unable to quit entirely, they should reduce it as much as possible.
- Nicotine replacement (with patches or gum) is appropriate as part of a smoking cessation strategy.

Marijuana

- Marijuana use is not known to be associated with any adverse outcomes in pregnancy.
- However, data regarding long-term neurodevelopmental outcomes are lacking; therefore, marijuana use is currently not recommended in pregnancy.

Exercise and Bedrest

- Pregnant women should be encouraged to exercise regularly.
- There is no known benefit to activity restriction or bedrest for pregnant women.

Avoiding Injury

- Pregnant women should wear lap and shoulder seatbelts while in a motor vehicle and should not disable their airbags.



Box 1. Dos and Don'ts in Pregnancy (continued)

Oral Health

- Oral health and dental procedures can continue as scheduled during pregnancy.

Hot Tubs and Swimming

- Although data are limited, pregnant women should probably avoid hot tub use in the first trimester.
- Swimming pool use should not be discouraged in pregnancy.

Insect Repellants

- Topical insect repellants (including DEET) can be used in pregnancy and should be used in areas with high risk for insect-borne illnesses.

Hair Dyes

- Although data are limited, because systemic absorption is minimal, hair dye is presumed to be safe in pregnancy.

Travel

- Airline travel is safe in pregnancy.
- Pregnant women should be familiar with the infection exposures and available medical care for each specific destination.
- There is no exact gestational age at which women must stop travel. Each pregnant woman must balance the benefit of the trip with the potential of a complication at her destination.

Sexual Intercourse

- Pregnant women without bleeding, placenta previa at greater than 20 weeks of gestation, or ruptured membranes should not have restrictions regarding sexual intercourse.

Sleeping Position

- It is currently unknown whether, and at what gestational age, pregnant women should be advised to sleep on their side.

BMI, body mass index; DHA, docosahexaenoic acid; n-3 PUFA, omega-3 long-chain polyunsaturated fatty acids; DEET, N,N-diethyl-3-methylbenzamide.

including fetal alcohol syndrome.¹¹ However, the threshold for safe consumption is not known. A prospective cohort study of 2,900 pregnancies out of

Australia followed children until 14 years of age and did not find an association between light or moderate (up to 10 drinks/wk) alcohol consumption and child behavioral problems.¹² Another large prospective cohort study out of Australia found no association between less than one drink per day (on average) and child attention, learning, or cognitive abilities at age 14 years.¹³ A series of studies out of Denmark showed that low-to-moderate alcohol consumption (less than nine drinks/wk) was not associated with adverse neurodevelopmental outcomes at age 5 years.^{14–19} A 2007 meta-analysis confirmed that low to moderate alcohol consumption during pregnancy is not associated with adverse neonatal or child outcomes.²⁰ However, as a result of possible methodologic flaws in these studies, it cannot be concluded for certain that alcohol consumption at this level during pregnancy is safe. Therefore, all major health organizations recommend abstaining completely from alcohol during pregnancy.^{11,21,22}

ARTIFICIAL SWEETENERS

There is no evidence that the artificial sweeteners aspartame (NutraSweet), sucralose (Splenda), acesulfame potassium (Sunett), stevioside (Stevia), or saccharin (Sweet 'N Low) increase the risk of birth defects. Very high saccharin exposure in rats has been associated with an increased risk of bladder cancer in the offspring,²³ but another study did not show an increased risk.²⁴

CAFFEINE

Most data in humans suggest that low-to-moderate caffeine intake in pregnancy is not associated with any adverse outcomes^{25,26}; however, there are few studies of high methodologic quality.²⁷ Some animal studies suggest that high caffeine intake slightly increases the risk of spontaneous abortion, but the equivalent dose in humans would be greater than 10 cups of coffee per day. Observational studies in humans examining caffeine intake and pregnancy loss have mixed results, likely as a result of methodologic flaws inherent to observational studies. For example, observational studies are limited by confounding variables such as smoking, other food intake, and other lifestyle choices. There are few well-designed prospective trials that examine what amount of caffeine, if any, increases the risk of spontaneous abortion.

FISH CONSUMPTION

Observational studies suggest that fish consumption in pregnancy is associated with improved neurodevelopment in children.^{28–30} A randomized trial showed that a diet high in fish (and other healthy foods) lowered the risk of preterm birth.³¹ However, fish is also



a source of mercury exposure, and mercury can cause fetal neurologic damage.^{28–30,32} Therefore, consuming fish in pregnancy needs to balance the benefits of omega-3 long-chain polyunsaturated fatty acids and docosahexaenoic acid compared with the risk of mercury exposure.³³

Women should try to consume two to three servings per week of fish high in docosahexaenoic acid and omega-3 long-chain polyunsaturated fatty acids and low in mercury. These fish include anchovies, Atlantic herring, Atlantic mackerel, mussels, oysters, farmed and wild salmon, sardines, snapper, and trout. Other fish or seafood that have low mercury are safe, but might not provide high amounts of docosahexaenoic acid. These include shrimp, pollock, tilapia, cod, and catfish. Women should avoid fish with high mercury content, including king mackerel, shark, swordfish, marlin, and tilefish. The mercury content of commercial fish can be found at <http://www.stonybrook.edu/commcms/gelfond/fish/database.html>.³⁴ Another good resource can be found online at the U.S. Food and Drug Administration website <https://www.fda.gov/Food/FoodborneIllnessContaminants/Metals/ucm393070.htm>.

For women who do not consume two to three servings of fish per week, there is no clear evidence that supplementation with docosahexaenoic acid and omega-3 long-chain polyunsaturated fatty acids improve outcomes in children.^{35,36} However, they are also unlikely to be harmful.

RAW AND UNDERCOOKED FISH

Most health organizations advise women to avoid raw and undercooked fish during pregnancy.^{37,38} The concern is the result of the risk of foodborne illness such as bacteria or parasites.³⁹ However, the fish that typically make up sushi (tuna, salmon, yellow tail, snapper, flounder) rarely carry parasites aside from possibly *Anisakis* or *Diphyllobothrium latum* (fish tapeworm), which are uncommon in developed countries and are also not particularly dangerous. Therefore, the risk of infection from sushi in developed countries is likely not significant.⁴⁰

OTHER FOODS TO AVOID

Food restrictions in pregnancy are mostly meant to avoid exposure to toxoplasmosis and *Listeria*. To lower the risk of toxoplasmosis, pregnant women should avoid eating raw and undercooked meat, and they should wash all fruits and vegetables before eating them.^{41–43} To lower the risk of *Listeria*, pregnant women should avoid unpasteurized dairy products, raw sprouts, unwashed vegetables, and unheated deli meats.⁴⁴ How-

ever, outbreaks of *Listeria* have come from a variety of sources. *Listeria* outbreaks were mostly linked to deli meats in the 1990s. Recent outbreaks have been from ice cream, cantaloupes, hummus, and unpasteurized dairy products. Therefore, it is difficult to create a comprehensive list of foods to avoid during pregnancy to eliminate the risk of listeriosis without being overly restrictive. Therefore, pregnant women should also be aware of any regional outbreaks of listeriosis and avoid those specific foods recalled for potential *Listeria*.

SMOKING, NICOTINE, AND VAPING

Cigarette smoking is harmful to maternal health, which is reason enough to recommend smoking cessation or reduction during pregnancy. In regard to pregnancy specifically, cigarette smoking is associated with spontaneous pregnancy loss, placental abruption, premature rupture of membranes, preterm birth, low birth weight, and stillbirth.^{45–49} Interestingly, it is also associated with a reduction in the risk of preeclampsia,⁴⁸ although it is not recommended for this purpose as a result of the numerous adverse effects.

Although some of the adverse effects of smoking are the result of nicotine exposure, nicotine products are considered acceptable as part of a smoking cessation program.⁴⁹ This is because nicotine exposure is likely lower when used as a patch or gum than when smoked and because smoking cessation would reduce exposure to other toxins in cigarettes, second-hand smoke, and would be overall beneficial for maternal health. Whether nicotine products as part of smoking cessation reduce the incidence of adverse outcomes in pregnancy is unclear.⁵⁰ Other pharmacologic interventions to aid with smoking cessation such as bupropion and varenicline have demonstrated efficacy and appear to be safe, but data are limited.⁴⁹

Electronic nicotine delivery systems such as electronic cigarettes and vaporizers are another method of smoking reduction. However, these methods tend to effectively deliver high amounts of nicotine and their effects on pregnancy outcomes are unknown. Logically, they should not be more dangerous than smoking, but it is possible they are not as safe as other nicotine replacements such as patches and gum. More research is needed to determine the role, if any, of electronic nicotine delivery systems for smoking cessation in pregnant women.^{49,51}

MARIJUANA

Marijuana (*cannabis*) is the most common illicit substance used during pregnancy. Current evidence demonstrates that marijuana use in pregnancy is not independently associated with preterm birth or low



birth weight; associations seen in smaller studies appear to be the result of confounding factors such as smoking, other drug use, reduced folic acid intake, and socioeconomic status.^{52,53} Marijuana also does not appear to increase the risk of birth defects, but studies examining this have been small. Also, doses are not regulated and could vary significantly. Current recommendations are to avoid marijuana use in pregnancy as a result of concerns regarding fetal neurodevelopment.^{22,54}

EXERCISE AND BEDREST

As a result of the benefits of regular exercise and the data supporting safety of exercise in pregnancy, women with uncomplicated pregnancies should engage in regular aerobic and strength conditioning exercise.⁵⁵ It is probably prudent for women to avoid exercises with a higher risk of injury such as contact sports, downhill skiing, and horseback riding. Women should try to achieve on average 20–30 minutes of moderate-intensity exercise four to five times per week. Pregnant women do not need to ensure their heart rates remain below a specific threshold. Rather, moderate intensity is best defined as 13–14 on a 20-point scale (somewhat hard to hard) or the level at which women can still talk while exercising.⁵⁵

Bedrest, or activity restriction, is associated with several risks and has not been shown to be beneficial in pregnancy. Therefore, it is not recommended for the prevention of preterm birth or pregnancy loss.^{56,57} Activity restriction has not been shown to be beneficial for women with hypertensive disorders of pregnancy, premature rupture of membranes, fetal growth restriction, or placenta previa.

AVOIDING INJURY

Pregnant women should continue to use three-point seatbelts during pregnancy. The lap belt should be placed across the hips and below the uterus. Although there is potential for injury from a seatbelt, the risk is low and, because seatbelts significantly reduce the risk of major injuries from collisions, the overall effect is beneficial.

Although airbags also can reduce the risk of injury, deployment of an airbag itself has a higher risk of injury. Although ACOG recommends not disabling airbags,⁵⁸ it is unclear whether they are beneficial, harmful, or neither in pregnancy.⁵⁹

ORAL HEALTH

Oral health and routine dental procedures should continue as scheduled during pregnancy. These include cleanings, extraction, scaling, root canal, radiographs (assuming the abdomen and thyroid are

shielded), and restoration and fillings. A report from a working group of the Health Resources and Services Administration in collaboration with ACOG, the American Dental Association, and the National Maternal and Child Oral Health Resource Center can be found at https://www.mchoralhealth.org/materials/consensus_statement.php.

HOT TUBS AND SWIMMING

Hot tubs have the potential to increase maternal body temperature, which is considered a risk for miscarriage and birth defects.⁶⁰ One study of 1,063 women found that hot tub or whirlpool use after conception was associated with a twofold increased risk of pregnancy loss at less than 20 weeks of gestation.⁶¹ There was a dose-dependent relationship between frequency of hot tub use and risk of miscarriage (adjusted hazard ratio 1.7 for less than once a week, 2.0 for once a week, and 2.7 for more than once a week). Additionally, hot tub use in the first 4 weeks from the last menstrual period had a higher risk (adjusted hazard ratio 2.3) than hot tub use only after 4 weeks from the last period (adjusted hazard ratio 1.5).

Swimming pools are typically maintained below normal body temperature. Their use does not appear to be associated with birth defects or adverse outcomes.^{62,63}

INSECT REPELLANTS

Topical insect repellants can be used in pregnancy because they are not associated with adverse fetal effects.^{64,65} These include permethrin clothing and N, N-diethyl-3-methylbenzamide (DEET). As a result of the risk of mosquito-borne illnesses, including West Nile and Zika virus, these insect repellants are recommended in high-risk areas.^{66,67}

HAIR DYES

Most of the studies of hair dye exposure in pregnancy evaluate outcomes in cosmetologists as compared with the general population. Studies are mixed as to whether cosmetology as a profession is associated with pregnancy loss or low-birth-weight neonates and it is also unclear whether any observed associations found were the result of exposure to chemicals or long work hours.^{68–70} Data on safety for specific chemicals are limited, but for an individual pregnant woman, exposure to hair dye results in minimal systemic absorption, so they are presumed to be safe in pregnancy.

TRAVEL

Airline travel is considered safe in pregnancy,⁷¹ but it is probably prudent for women to take precautions to



lower their risk of thrombosis, including compression stockings or periodic walking. Cosmic radiation is below the threshold level for fetal concerns.⁷² Pregnant women may go through security metal detectors as well. The radiation exposure from the newer backscatter units is 5 microrem, which is 1/600 the amount of cosmic radiation from the flight itself (3 millirem).⁷³

In regard to the travel destination, pregnant women should be aware of the potential infection exposures (including Zika virus) as well as available medical care at each individual destination. Also, as pregnancy progresses, the risk of several pregnancy complications increases. Therefore, although there is no exact gestational age after which women cannot travel, each pregnant woman must balance the benefit of the trip with the potential risk of a complication at her destination.

SEXUAL INTERCOURSE

Sexual intercourse and orgasm are not associated with an increased risk of pregnancy complications or preterm birth.^{74,75} For women with vaginal bleeding or ruptured membranes, it is unknown whether sexual intercourse increases the risk of bleeding or infection. Although there are no data to support it, most authorities recommend avoiding sexual intercourse after 20 weeks of gestation in the setting of placenta previa.⁷⁶

SLEEPING POSITION

Women are frequently advised to sleep on their sides, most typically the left side. There is biological plausibility to this recommendation, because an enlarged uterus could compress the maternal great vessels while she is in supine position, which could in turn decrease uteroplacental blood flow. Several retrospective studies have found an association between supine maternal sleep position and stillbirth.⁷⁷⁻⁷⁹ However, these studies are limited by the potential for recall bias among women with recent stillbirths. Additionally, it is unclear whether recommending side sleeping actually reduces the risk of stillbirth, by how much, and at what gestational age this recommendation should be given, if at all.

DISCUSSION

Pregnant women should be informed about what they should and should not do during pregnancy. Often, it is difficult to know for certain what advice is based on good evidence. However, for several common questions, there are data on which to make recommendations. Ultimately, most recommendations are general guidelines and should be individualized to each specific patient as appropriate.

REFERENCES

- Haider BA, Bhutta ZA. Multiple-micronutrient supplementation for women during pregnancy. *The Cochrane Database of Systematic Reviews* 2017, Issue 4. Art. No.: CD004905. DOI: 10.1002/14651858.CD004905.pub5.
- US Preventive Services Task Force, Bibbins-Domingo K, Grossman DC, Curry SJ, Davidson KW, Epling JW Jr, et al. Folic acid supplementation for the prevention of neural tube defects: US Preventive Services Task Force recommendation statement. *JAMA* 2017;317:183-9.
- Cantor AG, Bougatsos C, Dana T, Blazina I, McDonagh M. Routine iron supplementation and screening for iron deficiency anemia in pregnancy: a systematic review for the U. S. Preventive Services Task Force. *Ann Intern Med* 2015;162:566-76.
- De-Regil LM, Palacios C, Lombardo LK, Peña-Rosas JP. Vitamin D supplementation for women during pregnancy. *The Cochrane Database of Systematic Reviews* 2016, Issue 1. Art. No.: CD008873. DOI: 10.1002/14651858.CD008873.pub3.
- Institute of Medicine. Report brief: dietary reference intakes for calcium and vitamin D. Available at: <http://www.nationalacademies.org/hmd/~media/Files/Report%20Files/2010/Dietary-Reference-Intakes-for-Calcium-and-Vitamin-D/Vitamin%20D%20and%20Calcium%202010%20Report%20Brief.pdf>. Retrieved August 7, 2017.
- Vitamin D: screening and supplementation during pregnancy. Committee Opinion No. 495. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2011;118:197-8.
- Hofmeyr GJ, Lawrie TA, Atallah AN, Duley L, Torloni MR. Calcium supplementation during pregnancy for preventing hypertensive disorders and related problems. *The Cochrane Database of Systematic Reviews* 2014, Issue 6. Art. No.: CD001059. DOI: 10.1002/14651858.CD001059.pub4.
- Buppasiri P, Lumbiganon P, Thinkhamrop J, Ngamjarus C, Laopaiboon M, Medley N. Calcium supplementation (other than for preventing or treating hypertension) for improving pregnancy and infant outcomes. *The Cochrane Database of Systematic Reviews* 2015, Issue 2. Art. No.: CD007079. DOI: 10.1002/14651858.CD007079.pub3.
- Institute of Medicine. Weight gain during pregnancy: reexamining the guidelines. Available at: <http://www.nationalacademies.org/hmd/~media/Files/Report%20Files/2009/Weight-Gain-During-Pregnancy-Reexamining-the-Guidelines/Report%20Brief%20-%20Weight%20Gain%20During%20Pregnancy.pdf>. Retrieved August 7, 2017.
- Goldstein RF, Abell SK, Ranasinha S, Misso M, Boyle JA, Black MH, et al. Association of gestational weight gain with maternal and infant outcomes: a systematic review and meta-analysis. *JAMA* 2017;317:2207-25.
- Williams JF, Smith VC; Committee on Substance Abuse. Fetal alcohol spectrum disorders. *Pediatrics* 2015;136:e1395-406.
- Robinson M, Oddy WH, McLean NJ, Jacoby P, Pennell CE, de Klerk NH, et al. Low-moderate prenatal alcohol exposure and risk to child behavioural development: a prospective cohort study. *BJOG* 2010;117:1139-50.
- O'Callaghan FV, O'Callaghan M, Najman JM, Williams GM, Bor W. Prenatal alcohol exposure and attention, learning and intellectual ability at 14 years: a prospective longitudinal study. *Early Hum Dev* 2007;83:115-23.
- Falgreen Eriksen HL, Mortensen EL, Kilburn T, Underbjerg M, Bertrand J, Støvring H, et al. The effects of low to moderate prenatal alcohol exposure in early pregnancy on IQ in 5-year-old children. *BJOG* 2012;119:1191-200.



15. Underbjerg M, Kesmodel US, Landrø NI, Bakketeig L, Grove J, Wimberley T, et al. The effects of low to moderate alcohol consumption and binge drinking in early pregnancy on selective and sustained attention in 5-year-old children. *BJOG* 2012; 119:1211–21.
16. Skogerbø Å, Kesmodel US, Wimberley T, Støvring H, Bertrand J, Landrø NI, et al. The effects of low to moderate alcohol consumption and binge drinking in early pregnancy on executive function in 5-year-old children. *BJOG* 2012;119:1201–10.
17. Kesmodel US, Bertrand J, Støvring H, Skarpsness B, Denny CH, Mortensen EL, et al. The effect of different alcohol drinking patterns in early to mid pregnancy on the child's intelligence, attention, and executive function. *BJOG* 2012;119:1180–90.
18. Bay B, Støvring H, Wimberley T, Denny CH, Mortensen EL, Eriksen HL, et al. Low to moderate alcohol intake during pregnancy and risk of psychomotor deficits. *Alcohol Clin Exp Res* 2012;36:807–14.
19. Skogerbø Å, Kesmodel US, Denny CH, Kjaersgaard MI, Wimberley T, Landrø NI, et al. The effects of low to moderate alcohol consumption and binge drinking in early pregnancy on behaviour in 5-year-old children: a prospective cohort study on 1628 children. *BJOG* 2013;120:1042–50.
20. Henderson J, Gray R, Brocklehurst P. Systematic review of effects of low-moderate prenatal alcohol exposure on pregnancy outcome. *BJOG* 2007;114:243–52.
21. At-risk drinking and alcohol dependence: obstetric and gynecologic implications. Committee Opinion No. 496. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2011;118:383–8.
22. American College of Obstetricians and Gynecologists. Frequently asked questions: tobacco, alcohol, drugs, and pregnancy. Available at: <https://www.acog.org/Patients/FAQs/Tobacco-Alcohol-Drugs-and-Pregnancy#amount>. Retrieved September 27, 2017.
23. Taylor JM, Weinberger MA, Friedman L. Chronic toxicity and carcinogenicity to the urinary bladder of sodium saccharin in the in utero-exposed rat. *Toxicol Appl Pharmacol* 1980;54:57–75.
24. Schmähl D, Habs M. Absence of carcinogenic response to cyclamate and saccharin in Sprague-Dawley rats after transplacental application. *Arzneimforschung* 1980;30:1905–6.
25. Brent RL, Christian MS, Diener RM. Evaluation of the reproductive and developmental risks of caffeine. *Birth Defects Res B Dev Reprod Toxicol* 2011;92:152–87.
26. Peck JD, Leviton A, Cowan LD. A review of the epidemiologic evidence concerning the reproductive health effects of caffeine consumption: a 2000–2009 update. *Food Chem Toxicol* 2010; 48:2549–76.
27. Jahanfar S, Jaafar SH. Effects of restricted caffeine intake by mother on fetal, neonatal, and pregnancy outcomes. The Cochrane Database of Systematic Reviews 2015, Issue 6. Art. No.: CD006965. DOI: 10.1002/14651858.CD006965.pub4.
28. Oken E, Wright RO, Kleinman KP, Bellinger D, Amarasiwardena CJ, Hu H, et al. Maternal fish consumption, hair mercury, and infant cognition in a U.S. cohort. *Environ Health Perspect* 2005;113:1376–80.
29. Oken E, Radesky JS, Wright RO, Bellinger DC, Amarasiwardena CJ, Kleinman KP, et al. Maternal fish intake during pregnancy, blood mercury levels, and child cognition at age 3 years in a US cohort. *Am J Epidemiol* 2008;167:1171–81.
30. Oken E, Østerdal ML, Gillman MW, Knudsen VK, Halldorsen TI, Strøm M, et al. Associations of maternal fish intake during pregnancy and breastfeeding duration with attainment of developmental milestones in early childhood: a study from the Danish National Birth Cohort. *Am J Clin Nutr* 2008;88: 789–96.
31. Khoury J, Henriksen T, Christophersen B, Tonstad S. Effect of a cholesterol-lowering diet on maternal, cord, and neonatal lipids, and pregnancy outcome: a randomized clinical trial. *Am J Obstet Gynecol* 2005;193:1292–301.
32. Castoldi AF, Coccini T, Ceccatelli S, Manzo L. Neurotoxicity and molecular effects of methylmercury. *Brain Res Bull* 2001; 55:197–203.
33. Mahaffey KR, Sunderland EM, Chan HM, Choi AL, Grandjean P, Mariën K, et al. Balancing the benefits of n-3 polyunsaturated fatty acids and the risks of methylmercury exposure from fish consumption. *Nutr Rev* 2011;69:493–508.
34. Karimi R, Fitzgerald TP, Fisher NS. A quantitative synthesis of mercury in commercial seafood and implications for exposure in the United States. *Environ Health Perspect* 2012;120:1512–9.
35. Makrides M, Gibson RA, McPhee AJ, Yelland L, Quinlivan J, Ryan P, et al. Effect of DHA supplementation during pregnancy on maternal depression and neurodevelopment of young children: a randomized controlled trial. *JAMA* 2010;304:1675–83.
36. Gould JF, Treyvaud K, Yelland LN, Anderson PJ, Smithers LG, McPhee AJ, et al. Seven-Year follow-up of children born to women in a randomized trial of prenatal DHA supplementation. *JAMA* 2017;317:1173–5.
37. American College of Obstetricians and Gynecologists. Frequently asked questions: nutrition during pregnancy. Available at: <https://www.acog.org/Patients/FAQs/Nutrition-During-Pregnancy#should>. Retrieved August 18, 2017.
38. U.S. Food & Drug Administration. Questions and answers from the FDA/EPA advice on what pregnant women and parents should know about eating fish. Available at: <https://www.fda.gov/Food/ResourcesForYou/Consumers/ucm534873.htm>. Retrieved August 17, 2017.
39. Villazanakretzer DL, Napolitano PG, Cummings KF, Magann EF. Fish parasites: a growing concern during pregnancy. *Obstet Gynecol Surv* 2016;71:253–9.
40. Nawa Y, Hatz C, Blum J. Sushi delights and parasites: the risk of fishborne and foodborne parasitic zoonoses in Asia. *Clin Infect Dis* 2005;41:1297–303.
41. Cook AJ, Gilbert RE, Buffolano W, Zufferey J, Petersen E, Jennum PA, et al. Sources of toxoplasma infection in pregnant women: European multicentre case-control study. European Research Network on Congenital Toxoplasmosis. *BMJ* 2000; 321:142–7.
42. Kapperud G, Jennum PA, Stray-Pedersen B, Melby KK, Eskild A, Eng J. Risk factors for *Toxoplasma gondii* infection in pregnancy. Results of a prospective case-control study in Norway. *Am J Epidemiol* 1996;144:405–12.
43. Baril L, Ancelle T, Goulet V, Thulliez P, Tirard-Fleury V, Carme B. Risk factors for *Toxoplasma* infection in pregnancy: a case-control study in France. *Scand J Infect Dis* 1999;31:305–9.
44. Centers for Disease Control and Prevention. Listeria (listeriosis) prevention. Available at: <https://www.cdc.gov/listeria/prevention.html>. Retrieved August 18, 2017.
45. Pineles BL, Hsu S, Park E, Samet JM. Systematic review and meta-analyses of perinatal death and maternal exposure to tobacco smoke during pregnancy. *Am J Epidemiol* 2016;184: 87–97.
46. Pineles BL, Park E, Samet JM. Systematic review and meta-analysis of miscarriage and maternal exposure to tobacco smoke during pregnancy. *Am J Epidemiol* 2014;179:807–23.



47. Raymond EG, Cnattingius S, Kiely JL. Effects of maternal age, parity, and smoking on the risk of stillbirth. *Br J Obstet Gynaecol* 1994;101:301–6.
48. Castles A, Adams EK, Melvin CL, Kelsch C, Boulton ML. Effects of smoking during pregnancy. Five meta-analyses. *Am J Prev Med* 1999;16:208–15.
49. Smoking cessation during pregnancy. Committee Opinion No. 721. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2017;130:e200–4.
50. Coleman T, Chamberlain C, Davey MA, Cooper SE, Leonardi-Bee J. Pharmacological interventions for promoting smoking cessation during pregnancy. The Cochrane Database of Systematic Reviews 2015, Issue 12. Art. No.: CD010078. DOI: 10.1002/14651858.CD010078.pub2.
51. Siu AL; U.S. Preventive Services Task Force. Behavioral and pharmacotherapy interventions for tobacco smoking cessation in adults, including pregnant women: U.S. Preventive Services Task Force Recommendation Statement. *Ann Intern Med* 2015;163:622–34.
52. Conner SN, Bedell V, Lipsey K, Macones GA, Cahill AG, Tuuli MG. Maternal marijuana use and adverse neonatal outcomes: a systematic review and meta-analysis. *Obstet Gynecol* 2016;128:713–23.
53. Chabarría KC, Racusin DA, Antony KM, Kahr M, Suter MA, Mastrobattista JM, et al. Marijuana use and its effects in pregnancy. *Am J Obstet Gynecol* 2016;215:506.e1–7.
54. Marijuana use during pregnancy and lactation. Committee Opinion No. 722. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2017;130:931–2.
55. Physical activity and exercise during pregnancy and the postpartum period. Committee Opinion No. 650. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2015;126:e135–42.
56. Society for Maternal Fetal Medicine, Habecker E, Sciscione A. SMFM consult series: activity restriction in pregnancy. Available at: http://contemporaryobgyn.modernmedicine.com/contemporary-obgyn/content/tags/bed-rest/smfmm-consult-activity-restriction-pregnancy?utm_source=TrendMD&utm_medium=cpc&utm_campaign=Contemporary_OB%25FGYN_TrendMD_0. Retrieved August 19, 2017.
57. Management of preterm labor. Practice Bulletin No. 171. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2016;128:e155–64.
58. American Congress of Obstetricians and Gynecologists frequently asked questions: car safety for pregnant women, babies, and children. Available at: <https://www.acog.org/Patients/FAQs/Car-Safety-for-Pregnant-Women-Babies-and-Children>. Retrieved August 17, 2017.
59. Schiff MA, Mack CD, Kaufman RP, Holt VL, Grossman DC. The effect of air bags on pregnancy outcomes in Washington State: 2002–2005. *Obstet Gynecol* 2010;115:85–92.
60. Dreier JW, Andersen AM, Berg-Beckhoff G. Systematic review and meta-analyses: fever in pregnancy and health impacts in the offspring. *Pediatrics* 2014;133:e674–88.
61. Li DK, Janevic T, Odouli R, Liu L. Hot tub use during pregnancy and the risk of miscarriage. *Am J Epidemiol* 2003;158:931–7.
62. Agopian AJ, Lupo PJ, Canfield MA, Mitchell LE; National Birth Defects Prevention Study. Swimming pool use and birth defect risk. *Am J Obstet Gynecol* 2013;209:219.e1–9.
63. Juhl M, Kogevinas M, Andersen PK, Andersen AM, Olsen J. Is swimming during pregnancy a safe exercise? *Epidemiology* 2010;21:253–8.
64. Wylie BJ, Hauptman M, Woolf AD, Goldman RH. Insect repellents during pregnancy in the era of the Zika virus. *Obstet Gynecol* 2016;128:1111–5.
65. McGready R, Hamilton KA, Simpson JA, Cho T, Luxemburger C, Edwards R, et al. Safety of the insect repellent N,N-diethyl-M-toluamide (DEET) in pregnancy. *Am J Trop Med Hyg* 2001;65:285–9.
66. Centers for Disease Control and Prevention. Zika virus prevention: prevent mosquito bites. Available at: <https://www.cdc.gov/zika/prevention/prevent-mosquito-bites.html>. Retrieved August 17, 2017.
67. American College of Obstetricians and Gynecologists, Society for Maternal-Fetal Medicine. Practice advisory interim guidance for care of obstetric patients during a Zika virus outbreak: prevention. Available at: <https://www.acog.org/About-ACOG/News-Room/Practice-Advisories/Practice-Advisory-Interim-Guidance-for-Care-of-Obstetric-Patients-During-a-Zika-Virus-Outbreak#prevention>. Retrieved August 19, 2017.
68. Rylander L, Axmon A, Torén K, Albin M. Reproductive outcome among female hairdressers. *Occup Environ Med* 2002;59:517–22.
69. Rylander L, Källén B. Reproductive outcomes among hairdressers. *Scand J Work Environ Health* 2005;31:212–7.
70. Zhu JL, Vestergaard M, Hjollund NH, Olsen J. Pregnancy outcomes among female hairdressers who participated in the Danish National Birth Cohort. *Scand J Work Environ Health* 2006;32:61–6.
71. Air-travel during pregnancy. Committee Opinion No. 443. American College of Obstetricians and Gynecologists. *Obstet Gynecol* 2009;114:954–5.
72. Barish RJ. In-flight radiation exposure during pregnancy. *Obstet Gynecol* 2004;103:1326–30.
73. Department of Homeland Security Office of Inspector General. Transportation Security Administration's use of backscatter units. Available at: https://www.oig.dhs.gov/assets/Mgmt/2012/OIG_12-38_Feb12.pdf. Retrieved August 20, 2017.
74. Sayle AE, Savitz DA, Thorp JM Jr, Hertz-Picciotto I, Wilcox AJ. Sexual activity during late pregnancy and risk of preterm delivery. *Obstet Gynecol* 2001;97:283–9.
75. Read JS, Klebanoff MA. Sexual intercourse during pregnancy and preterm delivery: effects of vaginal microorganisms. The Vaginal Infections and Prematurity Study Group. *Am J Obstet Gynecol* 1993;168:514–9.
76. Oyelese Y, Smulian JC. Placenta previa, placenta accreta, and vasa previa. *Obstet Gynecol* 2006;107:927–41.
77. McCowan LME, Thompson JMD, Cronin RS, Li M, Stacey T, Stone PR, et al. Going to sleep in the supine position is a modifiable risk factor for late pregnancy stillbirth; findings from the New Zealand multicentre stillbirth case-control study. *PLoS One* 2017;12:e0179396.
78. Stacey T, Thompson JM, Mitchell EA, Ekeroma AJ, Zuccollo JM, McCowan LM. Association between maternal sleep practices and risk of late stillbirth: a case-control study. *BMJ* 2011;342:d3403.
79. Gordon A, Raynes-Greenow C, Bond D, Morris J, Rawlinson W, Jeffery H. Sleep position, fetal growth restriction, and late-pregnancy stillbirth: the Sydney stillbirth study. *Obstet Gynecol* 2015;125:347–55.

