

Preconception Counseling to Prevent the Complications of Obesity during Pregnancy

Merri M. Paden, MD

Daniel M. Avery Jr., MD

Abstract

Obesity is epidemic in proportions in the United States, and obesity rates continue to rise each year. The group with the fastest rising obesity rate is young women in the reproductive years between the ages of 19 and 28. Obstetricians and gynecologists see many women who fall into the overweight and obese categories. Without intervention these numbers will continue to rise, putting patients and offspring at risk for numerous complications during pregnancy. Obstetricians and gynecologists often function as primary care providers because many women see only their OB/GYN for health care needs.

Obstetricians and gynecologists have an opportunity to incorporate nutrition and exercise education into the primary care regimen of the women they see, because pregnancy and the postpartum period present a unique opportunity to impact the health of women for the rest of their lives. Lifestyle, nutrition, and weight loss counseling are not traditional components of OB/GYN care but can complement services of other primary care specialties such as internal medicine and family medicine. Pre-pregnancy body mass index, weight gain during pregnancy, and weight loss in the first year postpartum are all independent predictors of body mass index 15 years after pregnancy.⁵

Introduction

Obesity is epidemic in proportion in the United States, and obesity rates continue to rise each year. According to the CDC 34% of adult Americans were obese in 2008, and another 34% were overweight.¹ Perhaps even more alarming, 18% of adolescents ages 12-18 were obese, along with 20% of children ages 6-11 and 10% ages 2-5.¹ In 2009 there were 33 states with an obesity

percentage above 25%.² Obstetricians and gynecologists see more and more patients who fall into the overweight and obese categories. This specialty has an opportunity to impact this epidemic, because the fastest growing obesity group in the United States is young women between the ages of 19 and 28 years.³ A 2007 study by Kim et al. analyzed data from the Pregnancy Risk Assessment Monitoring System, which compared the rate of pre-pregnancy obesity in 1993 and 2003 in nine states. This study found a 69% increase in the prevalence of pre-pregnancy obesity in this time from 13% in 1993 to 22% in 2003.⁴

Without intervention these numbers will probably continue to rise, putting women and their offspring at risk for numerous complications during pregnancy. Obstetrician and gynecologists have an opportunity to incorporate nutrition and exercise education into the primary care regimen of their patients. Pregnancy and postpartum present unique opportunities to impact the health of women for the rest of their lives. Many women retain a significant amount of weight after pregnancy, predisposing them to become overweight or obese as they gain more weight with age. Pre-pregnancy body mass index, weight gain during pregnancy, and weight loss in the first year postpartum are all independent predictors of body mass index 15 years after pregnancy.⁵ Almost half of women who are in the normal body mass index range before pregnancy who gain more than the recommended amount during pregnancy will be overweight later in life.⁶ Due to these factors the time period before pregnancy is an excellent opportunity for weight loss and management counseling.

Obesity and excessive weight gain during pregnancy put both mother and baby at risk for many complications. Maternal risks include increased risk of gestational diabetes, type 2 dia-

betes mellitus, and pregnancy-related hypertensive disorders. Parturition risks include an increase rate of cesarean delivery, decreased success of vaginal delivery after cesarean delivery, and an increase in operative morbidity and mortality including anesthesia complications, excessive loss of blood, postoperative infections, postpartum wound breakdown, and postpartum thrombophlebitis. Obese women are also more likely to suffer from infertility, spontaneous miscarriage, stillbirth, and preterm birth.⁷ Babies of obese mothers are more often macrosomic, >4500g, which puts them at risk for shoulder dystocia which can lead to cervical plexus injuries, clavicle fracture, fetal hypoxia with or without neurological damage, and even fetal death.⁸ Maternal complications of shoulder dystocia include postpartum hemorrhage, rectovaginal fistula, third or fourth degree episiotomy tear, and uterine rupture.⁸ Fetal anomalies are more common in obese patients, with the risk of neural tube defects, ventral wall defects, heart defects, and facial defects increased.⁹ Unfortunately, ultrasound is more difficult in women who are obese. Specifically, it is more difficult to visualize the fetal heart, diaphragm, kidneys, spine, and umbilical cord.¹⁰ Further complicating our issue of obesity, babies born to obese mothers are more likely to suffer from childhood obesity.⁷

Obstetricians and gynecologists have the opportunity to care for women throughout their lives, long after their pregnancies are over. Coordinating care among providers improves the overall safety and outcomes for health of women. While lifestyle, nutrition, and weight loss counseling are not traditional components of the scope of practice for OB/GYN, they serve an expanded role in primary care. Obstetricians and gynecologists can complement and even multiply the care of internal medicine and family medicine physicians who are trained in comprehensive care. Such counseling is even more important in women who only see obstetricians and gynecologists for health care. After pregnancy we must continue to counsel and educate our patients on weight control because the health consequences of obesity, especially chronic obesity, are numerous. Patients who are overweight or obese are more likely to suffer from high blood pressure, type 2 diabetes, high cholesterol, heart disease, stroke, gallstones, sleep apnea, infertility, depression, and arthritis. Obesity increases the risk of certain cancers including breast and colon cancer.¹¹ The risk of endometrial cancer is about five times higher in obese women than women of normal weight.¹²

Pre-conception Counseling

The goal of preconception counseling is to improve pregnancy-related outcomes by identifying and modifying any health risks of the potential mother before conception and educating her on methods to reduce these risks.¹³ Obesity is a modifiable risk factor for gestational complications. Weight loss is inadvisable during pregnancy, so the attainment of a healthy weight must occur prior to pregnancy. Counseling should begin before pregnancy to allow the patient to conceive at a healthy weight. Entering pregnancy at an ideal weight provides the patient with the best opportunity to have a healthy pregnancy and to gain weight appropriately during gestation. Pre-pregnancy body

mass index is the most important predictive factor for weight gain during pregnancy and future obesity.¹⁴ Furthermore, weight loss prior to pregnancy reduces the risk of developing diabetes, hypertensive disorders, thromboembolic disease, preterm labor, and cesarean section.¹⁵ Reduction of these risks can be a coordinated effort of obstetricians/gynecologists with family medicine physicians, family medicine/obstetric physicians, and internal medicine physicians. A healthy pre-pregnancy weight also helps reduce the risk to the future child. Organ development occurs in the first three to seven weeks of pregnancy so maternal nutrition and weight status during the early stages when a woman may not even know she is pregnant are very important.¹⁶ This is especially true considering the first prenatal visit is often at eight weeks into the pregnancy.

An important goal for obstetricians and gynecologists may be to provide a higher rate of preconception counseling. Although it provides many benefits to the mother and child, many physicians still do not routinely provide preconception counseling. The Center for Disease Control's Select Panel on preconception health recommends that all women should receive preconception counseling to allow them to conceive at their healthiest.¹⁷ One study surveying obstetricians and gynecologists all over the United States revealed that 87.3% believed preconception counseling is an important issue and 83.5% agreed it has a positive influence on pregnancy, but only 20% say it is a high priority in their practice.¹⁸ When asked how often they recommend preconception counseling to obese women, 61.5% said always, 27% said usually, 9.5% said sometimes, and 2% said never.¹⁸ When asked how important they felt discussing obesity, physical activity, and nutrition during preconception counseling, 82.7%, 68.3%, and 82.2% ranked them as very important respectively.¹⁸ When asked why they thought preconception counseling was very important but not a high priority in their practice, the majority answered that they did not have enough time to provide it, and they were not compensated for the time.¹⁸

Obstetricians, gynecologists, and primary care physicians who treat reproductive age women could consider every encounter as an opportunity to discuss reproductive plans. A 2004 survey indicated that 84% of women ages 18-44 had sought medical care in the previous year, and more than one-third of women had more than one primary care health provider.^{19,20} The inter-conception period is also a great time for counseling to avoid any risks of complications in a subsequent pregnancy, especially for women who experienced an adverse outcome in a prior pregnancy.¹⁵ Approximately 50% of pregnancies in the United States are unplanned, so simply establishing patient care when a woman decides to begin attempting to conceive is not enough.²¹ In women during the reproductive age, who do not practice contraception, assessment of the risks for pregnancy is important because pregnancy can occur unexpectedly. This is also an opportunity to prescribe contraception to avoid unplanned pregnancies.¹³

Risk assessment and initial management should begin with the patient's plan for reproduction including her reproductive,

medical, surgical, allergy, genetic, family, psychological and social histories, and medications use. Follow-up visits can be scheduled to discuss and treat any identified conditions or risk factors.²² Conditions may fall outside the physician's scope, experience, and resources, and coordination of care with other physicians may be necessary. It is important to counsel patients on health risks that may affect a future pregnancy and impact long-term health and well-being.

Strategies for Weight Control, Diet, and Exercise Counseling before Conception

Obstetricians and gynecologists are the primary care provider for many women and usually see them each year for annual well-woman examinations. Just as the pap smear is viewed as a routine screening test, so might the calculation of the patient's body mass index. Many electronic medical records automatically compute body mass index (BMI) at each visit along with vital signs, so that it could be readily available to the physician. All women should have their body mass index calculated at least annually and be counseled on its meaning.²³ Table 1 presents the meaning of the body mass index ranges. There are three classes of obesity for patients with body mass indices above 30 (Table 2). It is also important to measure waist circumference in all patients, but especially obese patients because a waist circumference greater than thirty-five inches in females further increases the risk of developing diabetes, hypertension, dyslipidemia, and metabolic syndrome.²⁴ Since this recommendation falls outside the scope, training, and experience of most obstetricians and gynecologists, coordination and management among primary care physicians and other specialists would be important. Patients at risk of being overweight or obese patients should have their blood pressure taken, their blood glucose screened, and a lipid panel drawn.²⁵ There should also be a discussion about future plans for pregnancy and the risks of being overweight or obese during pregnancy.¹⁷

Table 1²⁶ Body Mass Index Ranges

BMI	Weight Category
Less than 18.5	Underweight
18.5-24.9	Normal weight
25-29.9	Overweight
30 and higher	Obese

Table 2²⁶ Classes of Obesity

BMI	Obesity Class
30-34.9	Class I
35-39.9	Class II
40.0+	Class III

Diet, Exercise, and Weight Loss Counseling at Preconception Visits

Physicians should gauge the patient's readiness to change before counseling in order to best individualize their counseling efforts. The American College of Obstetrics and Gynecology recommends using the stages of change model to do so. There are five stages we experience when making an important change in our lives. The first is the pre-contemplation phase. During this phase the patient is not aware that there is a problem and is not interested in change. At this time it is appropriate for the physician to educate the patient on her weight status and reasons why it would be beneficial to lose weight. The second phase is the contemplation phase where the patient is aware a problem exists and is thinking about making changes. This is a good time for the physician to discuss anything that is hindering the patient from changing and help her work through these problems and gain support. The preparation phase occurs when the patient realizes a change would be beneficial to her, and she is making small changes or deciding how to change. The physician should now educate the patient on small changes to lose weight slowly. The action phase is in place when the patient has enacted some changes in her life. The physician is now an important source of support for the patient and can also help her make further changes that she may not have been ready for previously. When the patient's initial goal has been met, the patient enters the maintenance phase. At this point the physician should assess the progress and help the patient to maintain her changes or move forward by setting new goals and increasing change.²³

When counseling begins, all patients should have a dietary assessment and be counseled on the components of a healthy diet. Patients should be screened on what a typical day is like for them nutritionally. Because most physicians lack time to fully assess this topic with each patient, a questionnaire could be used, and patients could fill it out while waiting to see their physician. The questionnaire should assess how many servings are consumed each day of the major food groups. The components of a healthy diet include fresh fruits and vegetables of all color selections; lean protein such as chicken, fish, turkey, and lean cuts of pork and beef; nuts; low and no fat dairy; and whole grain breads. Meats and vegetables should be grilled, broiled, or baked instead of fried.²⁷ Overweight and obese women should be encouraged to reduce their caloric intake. Resources such as mypyramid.gov can help give patients a good idea of how many calories they need each day and how many servings of the different food groups they need.

Exercise is crucial to optimal health, and, because most Americans do not meet the minimum requirements for physical activity, physicians must address this issue. Exercise provides health benefits for all women and is an important component of weight loss. Women who exercise on a regular basis are less likely to develop coronary artery disease, high blood pressure, diabetes, breast and colon cancer, osteoporosis, or suffer a stroke. Exercise also helps to stabilize mood and reduce symp-

toms of depression and anxiety.²⁸ Exercise prior to pregnancy benefits the patient during pregnancy by helping her to control her weight and helping with her mood, possibly reducing her risk of postpartum depression.¹⁷ As seen in the section above, overweight and obesity present the patient with numerous complications during pregnancy, and postpartum depression can be severe and life threatening so these are very important factors.

Current physical activity recommendations from the Centers for Disease Control are 150 minutes of moderate aerobic activity, such as brisk walking, each week and two days of strength training for all the major muscle groups of the body: arms, legs, back, abdomen, chest, shoulders, and hips. An alternative to this regimen is 75 minutes of vigorous aerobic activity, such as jogging, per week and strength training of all the major muscle groups two times per week. This may sound like a lot to patients who are not currently exercising, but they should be encouraged to start out slowly and work their way up. They can begin with 10-minute walking sessions and build their way up. Any exercise is preferable to being sedentary. As patients build up to the current minimum recommendations, they should be further encouraged to build up their exercise session times. The longer they exercise each week, the greater their health benefits will be. For even greater health benefits the Center for Disease Control recommends 300 minutes of moderate aerobic activity or 150 minutes of vigorous physical activity each week combined with two sessions of muscle strengthening exercises.²⁹ There are a variety of aerobic exercises that the patient can do to fulfill the weekly requirements. Table 3 lists several options.

Table 3³⁰ Aerobic Exercises

<p>Moderate Aerobic Exercise: Walking briskly, doubles tennis, biking on level ground or at 5-9 miles per hour, pushing a lawn mower, elliptical trainer, ballroom or line dancing, gardening, roller skating, hiking small hills, golf, softball, baseball.</p>
<p>Vigorous Aerobic Exercise: Swimming, jogging or running, riding a bike on hills or at a speed greater than 10 miles per hour, playing basketball, playing singles tennis, mountain climbing, backpacking, jumping rope, hiking uphill.</p>

Patients with a body mass index of 25 and above should be counseled on the basics of weight loss and referred to outside services for help with weight loss as necessary. The ultimate goal is for patients to be of a normal weight and body mass index prior to conception with further goals of maintaining the lower body weight and controlling any complications from overweight or obesity the patient may have. The loss of 10% of body weight should be the initial goal, because even this small amount of loss reduces the patient's risk of hypertension, diabetes, and hyperlipidemia.³¹ Further weight loss should be at a rate of one to two pounds per week to prevent excessive loss of lean body mass, dehydration and electrolyte disturbances, gallbladder disease, and psychological problems.³¹ Patients should understand that they are making healthy lifestyle chang-

es, which should be long-term, rather than a temporary change to lose weight.

Caloric balance is the basic concept all patients should know in order to help them lose weight. The patient must burn 3500 calories in excess of the calories they consume in order to lose one pound. It is recommended that patients aim for a 500-calorie deficit each day.³² The most effective approach to achieve this calorie deficit is by reducing caloric intake through diet and increasing caloric expenditure by increasing exercise. The resting energy expenditure equation is a good method to calculate how many calories a patient burns in a day and needs to consume to maintain their current weight. Using this equation, and subtracting 500 calories from the result, will give the patient a good idea of how many calories to consume for weight loss. Equation 1 shows the resting energy expenditure equation.

Equation 1³¹ Resting Energy Expenditure

STEP 1
<p>FOR ADULT MEN</p> $REE = 10 \times \text{weight (kg)} + 6.25 \times \text{height (cm)} - 5 \times \text{age (years)} + 5$ <p>FOR ADULT WOMEN:</p> $REE = 10 \times \text{weight (kg)} + 6.25 \times \text{height (cm)} - 5 \times \text{age (years)} - 161$
STEP 2:
<p>Multiple the REE by an activity factor</p> <p>ACTIVITY FACTOR: 1.5 for women, 1.6 for men who perform light activity most days, and 1.6 for women, and 1.7 for men with higher activity levels</p> $REE \times \text{Activity Factor} =$ <p>Daily Caloric Need to Maintain Weight</p>

Reducing caloric intake is accomplished through dietary changes or a reduction in absorption of food consumed. There are many diet approaches patients can take, including low fat, low carbohydrate, and high protein diets. All diets provide roughly equal amounts of weight loss, provided the patient achieves the same calorie deficit.³³ Low carbohydrate diets may provide greater weight loss in the first three to six months, but loss at one year is similar between all diets.³⁴ The concept of reducing the energy density of the foods consumed is an important one. The energy density of a food is the amount of calories provided in a given weight of the food. Fruits and vegetables are low energy density foods so they keep you full longer by allowing you to consume more for a given calorie allowance.³² Eating less energy-dense foods helps by allowing you to eat more under the same calorie allowance. The most important concept for diet change is that the patient incorporates healthy foods and reduces their intake for calorie deficit. Food journals, daily weighing at home, and diet programs may be beneficial to some

patients. In the right circumstances pharmacologic agents and even surgical procedures can be explored for patients to reduce the amount of energy absorbed through calories consumed.

Weight loss is achieved when a calorie deficit is created, and physical activity helps burn additional calories above resting metabolic rate to create this deficit.³⁵ For weight loss, experts recommend an hour to an hour and a half of daily exercise.³⁶ The patient should acknowledge that their diet is a very important component of weight loss even if they are exercising, because an increase in caloric intake can offset the calories burned through exercising, causing the patient to maintain their weight or even gain weight. Exercise is difficult, and it takes a significant time commitment each day to burn calories, so patients should keep a strict diet to maintain a calorie deficit.³⁵ Losing weight through diet will also make exercise easier because it will then put less stress on the joints, and the patient will be able to move around more easily. Studies have revealed that more weight is lost through diet or diet and exercise combined than through exercise alone.³⁷

Lifestyle changes are very difficult for most patients to make. Most people require repeated motivation to make small changes in their diet and exercise regimen. This is not a reason for physicians to avoid the issues but a reason to continue to reinforce the importance of these changes. Recommendations should be made in the office, educational pamphlets should be sent home, and counseling should continue at every follow-up visit. These repeated discussions help keep the issues in the forefront of patients' minds and help them to realize it is important to their physician. Creating an action plan and assessing progress made through the plan can help patients and physicians assess change. A plan is made as a joint effort by the patient and physician, including a goal for weight loss and a plan of how to achieve it. The physician should ask their patients what changes they have made since their previous visit, revisit the action plan, and make changes to it as necessary.³⁸ Physician support is key throughout this process. The physician should always counsel their patients about weight loss in a non-judgmental, sensitive way. The physician and patient are a team in this process, and the patient should always know their physician will care for them even if goals are not met quickly or at all. Support at home is crucial as well. Patients should be encouraged to find a partner at home to help them with their health goals. If the rest of the family is sedentary and snacking on junk foods, it will be difficult for the patient to change, but women with support at home are more likely to be motivated to make healthy changes.³⁹

Merri M. Paden, MD, graduated from the University of Alabama School of Medicine. She now serves as a resident in OB/GYN, University of Alabama School of Medicine.

Daniel M. Avery, Jr., MD, is Professor and Chair of OB/GYN, University of Alabama School of Medicine, Tuscaloosa.

Potential Financial Conflicts of Interest: By AJCM® policy, all authors are required to disclose any and all commercial, financial, and other relationships in any way related to the subject of this article that might

create any potential conflict of interest. The author has stated that no such relationships exist.

Conclusion

Primary care physicians for women have the opportunity to address the current obesity crisis in America. Obstetricians and gynecologists can address nutrition, physical activity, and weight management in the preconception period. Physicians can be effective in reducing the rate of overweight and obesity in our patients. By addressing this sensitive subject, physicians can partner with patients to achieve a healthier life.

References

1. Obesity and Overweight. Centers for Disease Control and Prevention. 2010. 10 May 2011. <http://www.cdc.gov/nchs/fastats/overwt.htm>.
2. U.S. Obesity Trends: Trends State by State 1985-2009. Centers for Disease Control and Prevention. 2011. 10 May 2011. <http://www.cdc.gov/obesity/data/trends.html>.
3. Mokdad AH, Serdula MK et al. The spread of the obesity epidemic in the United States. 1991-1998. *JAMA*. 1999;282:1519-1522.
4. Shin K, Dietz P, England L, Morrow B, Callaghan W. Trends in Pre-pregnancy Obesity in Nine States. *Obesity*. 15.4 (2007): 986-993.
5. Rooney B, Schauburger CW, et al. Impact of perinatal weight change on long-term obesity and obesity-related illnesses. *Obstet Gynecol*. 2005;106:1349-1356.
6. Linne Y, Dye L, et al. Long-term weight development in women: A 15-year follow-up of the effects of pregnancy. *Obes Res*. 2004;12:1166-1178.
7. Leddy M, Power M, Schulkin J. The Impact of Maternal Obesity on Maternal and Fetal Health. *Reviews in Obstetrics and Gynecology*. 1.4 (2008): 170-178.
8. Baxley E, Gobbo R. "Shoulder Dystocia." *American Family Physicians*. 69.7(2004);1707-1714.
9. Nuthalapaty FS, Rouse DJ. The impact of obesity on obstetrical practice and outcome. *Clin Obstet Gynecol*. 2004;47:898-913.
10. Hendler I, Blackwell SC, et al. Suboptimal second-trimester ultrasonographic visualization of the fetal heart in obese women: should we repeat the examination? *J Ultrasound Med*. 2005;24:1205-1209.
11. Obesity: Complications. Mayo Clinic. 2011. 14 May 2011. <http://www.mayoclinic.com/health/obesity/DS00314/DSECTION=complications>.
12. Schouten LJ, Goldbohm RA, van der Brandt PA. Anthropometry, physical activity, and endometrial cancer risk: results from the Netherlands Cohort Study. *J Natl Cancer Inst*. 2004;96:1635-1638.
13. ACOG Committee Opinion number 313, September 2005. The importance of preconception care in the continuum of women's health care. *Obstet Gynecol*. 2005;106: 665-666.
14. Krummel DA. Postpartum weight control: a vicious cycle. *J Am Diet Assoc*. 2007;107:37-40.
15. Dunlop A, Jack B, Frey K. National Recommendations for Preconception Care: The Essential Role of the Family Physician. *JABFM*. 2007;20.1:81-84.
16. Williamson CS. Nutrition in pregnancy. *Nutrition bulletin*. 2006;31:28-59.
17. Moos M, Dunlop A, et al. Healthier Women, healthier reproductive outcomes: recommendations for the routine care of all women of reproductive age. *Am J Obstet Gynecol*. 2008;199:S280-S289.
18. Morgan M, Hawks D, et al. What Obstetrician-Gynecologists Think of Preconception Care. *Matern Child Health J*. 2006;10:S59-S65.
19. Salganicoff A, Ranji U, Wyn R. Women and health care: a national profile

- key findings from the Kaiser Women's Health Survey. Menlo Park, CA: Kaiser Family Foundation; 2005. <http://www.kff.org/womenshealth/upload/Women-and-Health-Care-A-National-Profile-Key-Findings-from-the-Kaiser-Women-s-Health-Survey.pdf>.
20. Weisman CS. Women's use of health care. In: Falik M, Collins K, eds. *Women's Health: the Commonwealth Fund Survey of Women's Health*. Baltimore, MD: Johns Hopkins University Press; 1996.
 21. Henshaw S. Unintended pregnancy in the United States. *Fam Plann Perspect*. 1998;30:24-9,49.
 22. Lu M. Recommendations for Preconception Care. *Am Fam Physician*. 2007;76.3:397-400
 23. ACOG Committee Opinion number 319, October 2005. The role of the Obstetrician-Gynecologist in the Assessment and Management of Obesity. *Obstet Gynecol*. 2005;106:895-899.
 24. Janssen I, Katzmarzyk P, et al. Body Mass Index, Waist Circumference, and Health Risk, Evidence in Support of Current National Institutes of Health Guidelines. *Arch Int Med*. 2002;162: 2074-2079.
 25. Kushner RF. *Roadmaps for Clinical Practice Case Studies in Disease Prevention and Health Promotion- Assessment and Management of Adult Obesity: A Primer for Physicians*. Chicago, Ill: American Medical Associations; 2003.
 26. Classification of Overweight and Obesity by BMI, Waist Circumference, and Associated Disease Risk. National Heart, Lung, and Blood Institute 2011. 11 May 2011. http://www.nhlbi.nih.gov/health/public/heart/obesity/lose_wt/bmi_dis.htm.
 27. Healthy Eating for a Healthy Weight. Centers for Disease Control and Prevention 2011. 13 May 2011. http://www.cdc.gov/healthyweight/healthy_eating/index.html.
 28. Physical Activity and Health: The Benefits of Physical Activity. Centers for Disease Control and Prevention 2011. 13 May 2011. <http://www.cdc.gov/physicalactivity/everyone/health/index.html>
 29. Physical Activity for Everyone: How much physical activity do adults need? Centers for Disease Control and Prevention. 2011. 13 May 2011. <http://www.cdc.gov/physicalactivity/everyone/guidelines/adults.html>.
 30. Physical Activity for Everyone: Measuring Physical Activity Intensity. Centers for Disease Control and Prevention 2011. 13 May 2011. <http://www.cdc.gov/physicalactivity/everyone/measuring/index.html>.
 31. Lyznicki J, Young D, et al. Obesity: Assessment and Management in Primary Care. *Am Fam Physician*. 2001;63:2185-2196.
 32. Thompson W, Cook D, et al. Treatment of Obesity. *Mayo Clin Proc*. 2007;82.1:93-102.
 33. Dansinger ML, Gleason JA, et al. Comparison of the Atkins, Ornish, Weight Watchers, and Zone diets for weight loss and heart disease risk reduction: a randomized trial. *JAMA*. 2005;293:43-53.
 34. Foster GD, Wyatt HR, et al. A randomized trial of a low-carbohydrate diet for obesity. *N Engl J Med*. 2003;348:2082-2090.
 35. Jakicic J, Otoo A. Treatment and Prevention of Obesity: What is the Role of Exercise? *Nutrition Reviews*. 2006;64.2:S57-S61.
 36. Physical Activity and Weight Control. Weight-Control Information Network, National Institute of Diabetes and Digestive and Kidney Diseases 2011. 13 May 2011. <http://win.niddk.nih.gov/publications/physical.htm>.
 37. Hagan RD, Upton SJ, Wong L, Whittam J. The effects of aerobic conditioning and/or calorie restriction in overweight men and women. *Med Sci Sports Exerc*. 1986;18:87-94.
 38. Handley M, MacGregor K, et al. Using Action Plans to Help Primary Care Patients Adopt Healthy Behaviors: A Descriptive Study. *J Am Board Fam Physicians*. 2006;19.3:224-231.
 39. Evenson K, Aytur S, Borodulin K. Physical Activity Barriers, and Enablers among Postpartum Women. *Journal of Women's Health*. 2009;18.12.1925-1934.

Dates are subject to change.