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OBESITY IN SPECIAL POPULATIONS: PREGNANCY

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PERINATAL COMPLICATIONS ASSOCIATED WITH MATERNAL OVERWEIGHT/OBESITY

The average maternal weight at the time of first pregnancy has increased by over 20% since 1980.¹ Nearly 25% of women presenting for their first prenatal visit now weigh over 200 pounds and more than 10% of newly expectant mothers exceed 300 pounds.¹ Perinatal overweight and obesity is associated with a number of complications including gestational diabetes mellitus, hypertensive disorders of pregnancy, cesarean delivery, pulmonary disease, obstructive sleep apnea, and difficulty with anesthesia (1–3). In addition, overweight and obese women are more likely to exceed recommended perinatal weight gain guidelines (see Box 1 for the Institute of Medicine [IOM] Guidelines) and keep additional weight on after the delivery.² Current CDC data suggest excessive weight gain is reported in roughly 59% of overweight women and 56% of obese women and increases the risks for preterm delivery, hypertensive disorders of pregnancy, gestational diabetes, vascular disease, and postpartum weight retention.^{3–9}

Box 1

IOM¹⁰ Recommendations for Gestational Weight Gain

Weight (BMI)	Amount of Weight Gain (pounds [lb], kg)
Underweight (<18.5)	28–40 lb (13–18 kg)
Normal weight (18.5–24.9)	25–35 lb (11–16 kg)
Overweight (25.0–29.9)	15–25 lb (7–11 kg)
Obese* (30 and above)	11–20 lb (5–9 kg)

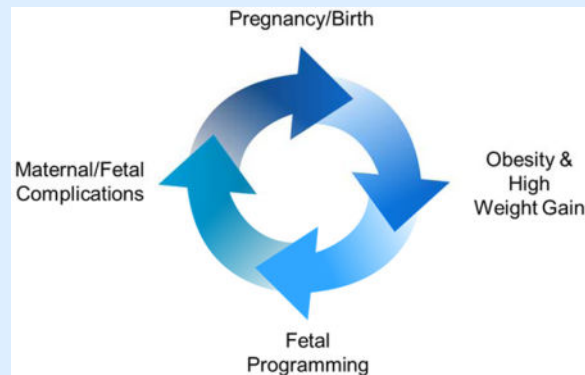
* Prior guidelines recommended 15–25 pounds but this range was dropped to 11–20 pounds in 2009; BMI = body mass index.

The rate of overweight and obese women exceeding the gestational weight gain recommendations is predicted to increase in the future due to the lack of a “gold standard” treatment to prevent high perinatal weight gain. When the 2009 IOM report on gestational weight gain¹⁰ was released, there was insufficient evidence to provide weight gain

guidelines for women with BMI status > 35 . Since then, several studies have been published but results and recommendations remain equivocal. One large-scale population cohort study¹¹ suggests that more restrictive weight gain limits in obese women may not harm maternal health or fetal growth. Findings from another study¹² of severely obese pregnant women found the range of gestational weight gain to prevent small-and large-for-gestational-age births may vary by severity of obesity. As a result, ACOG¹³ has stated that an obese woman with an appropriately growing fetus who is gaining less weight than recommended by the guidelines will not experience additional health benefits if she tries to conform with guideline-based weight gain. However, without conclusive evidence from randomized trials, many clinicians are hesitant to recommend that overweight and obese women gain less than the minimum range (i.e., 15 pounds for overweight, 11 pounds for obese) recommended by the IOM guidelines.¹⁰

Furthermore, the offspring of overweight and obese women are at increased risk for morbidity and mortality.¹⁰ Multiple fetal complications including premature birth, congenital abnormalities, macrosomia (birth weight of $> 4,000$ grams regardless of gestational age), birth trauma (e.g., shoulder dystocia, fracture of clavicle, damage to the brachial plexus) and stillbirth are associated with maternal obesity and excessive gestational weight gain. Women who are obese (BMI > 30 kg/m²) are theorized to have elevated circulating levels of insulin (maternal hyperinsulinemia) and a relative state of insulin resistance. According to the ‘fetal origin of obesity’ hypothesis,¹⁴ infants of these obese mothers (or mothers with an excess perinatal weight gain) are exposed to elevated levels of glucose readily crossing the placenta which leads to a state of fetal hyperinsulinemia and excess fetal growth.^{15,16} Maternal obesity more than doubles the risk that a child will become obese by age four¹⁷ and this risk is highest if mothers are obese in the first trimester.¹⁷ Women who are obese at the time of conception are more likely to deliver infants who are not only large-for-gestational age^{18,19} but who also have accelerated weight gain in the first year of life.^{20, 21} Furthermore, excess maternal weight gain in the first trimester has more influence on infant weight than weight gain in the second and third trimesters.²²

Evidence also suggests the maternal perinatal metabolic state “programs” metabolism in the fetus. This sets the stage for the trajectory for weight gain during infancy, childhood, and into adulthood. It also predicts risk for obesity, diabetes, and cardiovascular disease;^{23,24} see Box 2. Physiological parameters in the developing embryo and fetus can be “reset” by environmental events (e.g., over-nutrition, poor glycemic control). These metabolic changes can persist into adulthood to produce a transgenerational non-genetic weight disorder.^{24,25}

Box 2**Intergenerational Cycle of Obesity**

A child's growth trajectory is governed by control systems based on their genetic constitution and fueled by energy absorbed from the in utero environment.²⁶ Infants who are born with either a low birth weight (small-for-gestational age; SGA) or excess birth weight (large-for-gestational age; LGA) are at particular risk for cardiovascular risk and obesity as adults.²⁷ Excess maternal perinatal weight gain is associated with an LGA delivery, regardless of pre-pregnancy BMI.^{28–31} Infants with a birth weight of over 4000 grams have a two-fold greater risk of adult obesity.³² On the opposite end of the spectrum are infants who are SGA. These infants with a birth weight of less than 2500 grams have a 1.9 times greater chance of becoming obese as adults compared with normal birth weight infants. According to the 'thrifty genotype' hypothesis, infants exposed to relative malnutrition while in utero are programmed to store nutrients.^{20, 33} Whether due to alterations in pancreatic beta cell function or changes in the hypothalamic-pituitary axis,³⁴ SGA infants, when exposed to relative caloric excess outside of the womb, rapidly store calories, gain weight ('adiposity rebound'),³⁵ and are at high risk for obesity and cardiovascular disease as adults. When plotted graphically, this represents a "U-shaped curve" with each end of the curve (SGA and LGA) being at higher risk for obesity (similar to the phenomenon seen with elderly patients and BMI). Therefore, identifying effective population-level weight management treatment and prevention strategies with capabilities for wide-scale dissemination from conception through adulthood is a critical national priority.

MANAGEMENT OF OBESITY IN PREGNANCY

Managing perinatal overweight and obesity is challenging. Providers must balance the risks of appropriate fetal growth, obstetric complications, and maternal weight gain to optimize fetal outcomes¹³. Because of a deficiency in evidence, there is a lack of standard recommendations for proper management of perinatal obesity. Independent recommendations based on best-available evidence from multiple professional organizations are presented in Box 3.

Box 3**Recommendations for Managing Obesity in Pregnancy**

Organization	Recommendations
ACOG ^{13, 36}	<ul style="list-style-type: none"> • Preconception assessment and counseling are strongly encouraged and should include information on obesity risks and weight loss • At initial prenatal visit, record height and weight and calculate BMI (can use online BMI calculator available at: http://www.nilbisupport.com/bmi) • Review and discuss gestational weight gain guidelines • Discuss appropriate weight gain, diet, and exercise at the initial prenatal visit and periodically throughout pregnancy • Nutrition counseling should be offered to all overweight and obese pregnant women and they should be encouraged to follow an exercise program; nutrition and exercise counseling should continue postpartum and before attempting another pregnancy • Women who have undergone bariatric surgery should be evaluated for nutritional deficiencies and the need for vitamin supplementation • For women who will have cesarean section who have additional risk factors for thromboembolism, individual risk assessment may require thromboprophylaxis with pneumatic compression devices and unfractionated heparin or LMB heparin • Consideration should be given to using a higher dose of preoperative antibiotics for cesarean delivery prophylaxis • The use of suture closure of the subcutaneous layer after cesarean delivery in obese patients may lead to a significant reduction in the incidence of postoperative wound disruption • Anesthesiology consultation in early pregnancy • Individualize care and clinical judgment for the overweight or obese woman who wishes to gain less weight than recommended but has an appropriately growing fetus • Consultation with a weight-reduction specialist before attempting another pregnancy should be encouraged.
IOM ¹⁰	<ul style="list-style-type: none"> • Organizations should adopt the 2009 weight gain guidelines • Healthcare providers delivering prenatal care should offer them counseling on dietary intake and physical activity that is tailored to their lifestyle circumstances
NHLBI Obesity Education Initiative ³⁷	<ul style="list-style-type: none"> • Measure height, weight, and calculate BMI • Assess comorbidities • Discuss nutrition and physical activity; provide patients with copies of dietary information; encourage goal-setting • Intervention is based on overall risk assessment
National Institute for Health and Care Excellence ³⁸	<ul style="list-style-type: none"> • At first prenatal visit, discuss eating habits and physical activity levels and address any concerns • Advise that a healthy diet and physical activity will benefit woman and fetus and help her to achieve a healthy weight after birth; advise her to seek information on advice on diet and activity from a reputable source • Offer practical and tailored information including how to use increase fruit and vegetable intake • Dispel myths about what and how much to eat during pregnancy (e.g., no need to "eat for two" and explain energy needs are only an additional 200 calories/day)

Organization	Recommendations
	<ul style="list-style-type: none"> • Advise that moderate intensity activity will not harm the woman or her fetus and recommend that she achieve 30 minutes of moderate intensity activity per day • Give specific and practical advice about exercising in pregnancy: <ul style="list-style-type: none"> – Recreational exercise (e.g., swimming or brisk walking and strength conditioning) is safe and beneficial – If not a regular exerciser, begin with no more than 15 minutes of continuous exercise three times per week and increase gradually to 30 minute sessions; if a regular exerciser before pregnancy, should be able to continue with exercise routine with no adverse effects • If women find exercise to be difficult, encourage them to not be sedentary and move more in daily life (e.g., take the stairs, reduce sitting for long periods of time) • Measure weight and height at first visit and be sensitive to any concerns she may have about her weight; explain importance of actual vs. self-reported weight and the need to use this baseline for appropriate weight gain tracking; repeat weighing if clinical management can be influenced or if nutrition is a concern • Explain health risks associated with obesity and pregnancy • Offer to obese women a referral to a dietician or appropriately trained health professional for assessment and personalized advice on healthy eating and how to be physically active • Encourage obese women to lose weight after pregnancy
Royal Australian and New Zealand College of Obstetricians and Gynaecologists ³⁹	<ul style="list-style-type: none"> • Identification and management of obesity in the preconceptional period <ul style="list-style-type: none"> – monitor weight – encourage women to make lifelong and sustainable lifestyle changes – refer to dietician/exercise specialist – meet exercise guidelines – discuss risks of obesity for fertility and pregnancy outcomes, inform women that even modest gain of 1–2 BMI units between pregnancies may increase risks for hypertension, gestational diabetes, and macrosomia) – if woman has had bariatric surgery, refer to dietician – identification of depressive symptoms • Management of obesity in pregnancy <ul style="list-style-type: none"> – Documentation of BMI in pregnancy (women with high BMI should be offered referral to supportive services such as exercise specialist, etc. – Recommend IOM (2009) guidelines for gestational weight gain and monitor and discuss weight gain consistently throughout pregnancy – Recommend to meet exercise guidelines – Nutrition supplementation as needed – Glucose tolerance testing for gestational diabetes – Anesthetic assessment – Preeclampsia surveillance – Ultrasound assessments of fetal growth – Evaluate risk for venous thromboembolism

Organization	Recommendations
	<ul style="list-style-type: none"> – Advise on increased risks of obesity in pregnancy (e.g., emergency caesarean section, vaginal delivery [e.g., hemorrhage, infant shoulder dystocia]) • Management of obesity in postpartum <ul style="list-style-type: none"> – Offer support for breastfeeding – Offer nutritional and exercise advice following delivery for weight management and weight reduction when applicable
Royal College of Obstetricians and Gynaecologists ⁴⁰	<ul style="list-style-type: none"> • All maternity units should have a documented environmental risk assessment regarding availability of resources to care for pregnant women with BMI > 30. Risk assessment should include: <ul style="list-style-type: none"> – Accessibility including doorway widths and thresholds – Availability of properly sized equipment (e.g., large blood pressure cuffs, appropriate gown sizes, sit-on weighing scale, large chairs without arms, large wheelchairs, etc.) • All health professionals involved in prenatal care should receive education on maternal nutrition and its impact on maternal and fetal health
Society of Obstetricians and Gynaecologists of Canada ⁴¹	<ul style="list-style-type: none"> • Periodic health examinations prior to pregnancy to offer opportunities to discuss issue of weight loss before conception • Encourage women to enter pregnancy with a BMI < 30 and ideally <25 • Counsel women on pregnancy risks associated with obesity and long-term health risks associated with obesity • Obese women should receive counseling about weight gain, nutrition, and food choices • Inform obese women about fetal risks of congenital abnormalities and appropriate screening as applicable • Obstetric care providers should consider BMI for fetal anatomic assessment in 2nd trimester and consider assessment at 20–22 weeks for an obese woman • Consultation with anesthesiologist to review options prior to delivery • Evaluate risk for venous thromboembolism
United State Preventive Services Task Force ⁴²	<ul style="list-style-type: none"> • Screen for obesity • Offer referrals to patients with BMI > 30 to intensive behavioral interventions

The ACOG Committee Opinion on *Challenges for Overweight and Obese Women*³⁶ highlights multiple factors that can influence women's lifestyles. "Built environmental factors" influencing women's lifestyle in pregnancy are presented in Box 4.

Box 4

Built Environment Factors Impacting Lifestyle

- Access to healthy foods
- Residing in an area with limited grocery stores offering healthy foods at an economical price (also known as a "food desert")
- Easy access to fast food restaurants
- Large portion sizes at restaurants

- Designated areas for safe walking and other physical activities
- Lack of walking paths, trails, or sidewalks
- Lack of access to parks

Other psychological and behavioral factors impacting a woman's likelihood of adhering to recommended lifestyle changes include sociocultural beliefs, levels of motivation and enthusiasm for making and sustaining behavioral changes, behavioral health status (history of anxiety or depression), history of miscarriage or stillbirth, and available support from the patient's social network.^{43–45} Another barrier is limited time during routine clinical visits to discuss lifestyle habits and provide adequate counseling about appropriate weight gain, nutrition, and physical activity patterns. Several clinically useful resources for women in the preconceptional, perinatal, and postpartum periods are presented in Box 5.

Box 5

Online Resources for Managing Obesity

Organization	Resource and Website
American Congress of Obstetricians and Gynecologists	<ul style="list-style-type: none"> • Obesity and Pregnancy: http://www.acog.org/Patients/FAQs/Obesity-and-Pregnancy • Weight Control: Eating Right and Keeping Fit: http://www.acog.org/Patients/FAQs/Weight-Control-Eating-Right-and-Keeping-Fit • Exercise and Fitness: http://www.acog.org/Patients/FAQs/Exercise-and-Fitness
American Obesity Association	<ul style="list-style-type: none"> • Clinical guidelines on the identification, evaluation, and treatment of overweight and obesity in adults: http://obesity.procon.org/sourcefiles/NIHClinicalGuidelinesObesity.pdf
American Heart Association	<ul style="list-style-type: none"> • Weight management resources: http://www.heart.org/HEARTORG/GettingHealthy/WeightManagement/Weight-Management_UCM_001081_SubHomePage.jsp
Centers for Disease Control and Prevention	<ul style="list-style-type: none"> • Healthy places and topics: http://www.cdc.gov/healthyplaces/health_topics.htm • Division of Nutrition, Physical Activity, and Obesity resources: http://www.cdc.gov/nutrition/index.html
National Heart, Lung, and Blood Institute	<ul style="list-style-type: none"> • NHLBI obesity research: http://www.nhlbi.nih.gov/research/resources/obesity/ • Managing overweight and obesity in adults: http://www.nhlbi.nih.gov/sites/www.nhlbi.nih.gov/files/obesity-evidence-review.pdf
Shape Up America	<ul style="list-style-type: none"> • Weight, nutrition, and activity resources: http://shapeup.org/ • Pregnancy and weight gain: http://www.shapeup.org/resources/article_011314.html
USDA Steps to a Healthier You	<ul style="list-style-type: none"> • Choose MyPlate: http://www.choosemyplate.gov/food-groups/downloads/resource/MyPyramidBrochurebyIFIC.pdf

RECOMMENDATIONS

In the absence of widely accepted guidelines for managing overweight and obesity in pregnancy, the following principles apply:

- Measure maternal height and weight at each visit to calculate BMI and track during pregnancy
- Discuss maternal and fetal health risks associated with excess weight gain and obesity in pregnancy
- Provide counseling on appropriate weight gain, nutrition, and physical activity
- Encourage lifestyle and behavioral interventions that are socially and culturally appropriate based on individual patient preference
- Offer consultation with pain management or anesthesia service for obese women in early pregnancy to have a proactive plan available for labor and delivery
- Encourage appropriate weight loss prior to attempting another pregnancy

ACOG³⁶ also recommends maternity care providers discuss lifestyle modifications with all overweight/obese prenatal patients. Specifically, these conversations at each visit should include discussions about healthy lifestyle behaviors, physical activity, the range of food choices available in local neighborhoods, and safe weight management strategies for pregnancy and the postpartum period. Motivational interviewing techniques encourage patients to make a long-term commitment to healthy weight and lifestyle choices. Providers can also sponsor patients for free exercise or wellness programs at local hospitals or health facilities.

In summary, perinatal overweight and obesity is a major public health and clinical care issue that requires deliberate and immediate attention. Preconception and prenatal assessment and counseling should address the risks associated with obesity, recommendations for weight gain, proper nutrition and dietary intake, and physical activity. Nutrition and exercise guidance should be offered to all perinatal overweight and obese women with an emphasis on effective strategies to overcome barriers. All women should be encouraged to adopt a healthy lifestyle and achieve a healthy weight before becoming pregnant.

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KEY POINTS

- Perinatal overweight and obesity is associated with multiple maternal and fetal complications including gestational diabetes, hypertension, macrosomia, and cesarean delivery.
- Maternal obesity and high gestational weight gain are serious public health issues linked to elevated risks for long-term obesity and comorbid diseases in the offspring.
- Preconception assessment and counseling should include a discussion about obesity-related risks and information about proper nutrition, recommended levels of physical activity, and perinatal weight management guidance.
- Nutrition and exercise guidance should be offered to all overweight and obese women in the perinatal period.