More than 8 million women in the United States have gestational diabetes mellitus (GDM); it is observed in 7% of all pregnancies. The American Diabetes Association (ADA) position statement on the Diagnosis and Classification of Diabetes Mellitus lists GDM or delivery of a baby weighing > 9 lb as a risk factor for developing diabetes later in life. Women who have had a pregnancy complicated by GDM are 40–60% more likely to develop diabetes within 15–20 years. Other risk factors for developing diabetes include a family history of type 2 diabetes, the degree of abnormality of the glucose tolerance test, the degree of obesity, and certain ethnicities. Table 1 lists risk factors for developing type 2 diabetes. It is important for health care providers to take a proactive approach to create awareness in women with GDM that their own and their child’s lifelong risk for developing type 2 diabetes is increased.

In addition to creating awareness, regular follow-up, including testing for pre-diabetes and diabetes, should be promoted on an ongoing basis after a pregnancy that is complicated by GDM. If overweight, women with a history of GDM should be counseled to reduce their risk for diabetes through lifestyle changes and medications if necessary. Children of women with a history of GDM should also be encouraged to establish and maintain healthy lifestyles to avoid excess weight gain and reduce their risk for type 2 diabetes.

This article describes a program that addresses both the diabetes medical nutrition therapy and diabetes self-management education (DSME) needs of women with GDM while integrating information about how to reduce the risk of developing diabetes later in life.

Background
The Joslin Diabetes Center (JDC), an education affiliate at Swedish Medical Center, is located in Seattle, Wash. This center has a referral base of > 120 health care providers, many of whom regularly refer women diagnosed with GDM. The center offers two GDM group classes every week. One-on-one appointments are provided for individuals with special needs. During the past 4 years, > 300 women annually have participated in the GDM programs at this site.

Women referred to the GDM program come from diverse ethnic and socioeconomic backgrounds. The ethnic populations receiving care include Southeast Asians, Pacific Islanders, Latinos/Hispanics, and African Americans. A majority of the women enrolled in one-on-one GDM appointments do not speak English as a first language. These women are seen in paired appointments with a registered dietitian and a registered nurse, both of whom are certified diabetes educators, along with a medically trained interpreter fluent in the woman’s native language.

Women enrolled in the GDM program offered at the center are, as a group, highly motivated and eager to learn how to manage the condition. The majority of women referred for GDM education receive education within 1 week of diagnosis. Many attend the program with a significant other or support person.

Two-Part GDM Classes
The group GDM education classes are composed of a 2-hour introductory class and a 1-hour follow-up class taught by the dietitian and the nurse. The same curriculum is used with women with special needs, who are seen on an individual basis. This center uses blood glucose targets recommended by the American College of Obstetricians and Gynecologists (ACOG) and shown in Table 2.

Introductory class
Topics covered during the class are pertinent to managing GDM during pregnancy (Table 3).
As part of the class, women are counseled to use blood glucose self-monitoring results to evaluate their ability to tolerate the amount of carbohydrates recommended in the meal plan. If they achieve postprandial blood glucose results significantly lower than the ACOG goal of < 120 mg/dl 2 hours after eating, they are advised to increase the carbohydrate as tolerated. The meal plan should not be more restrictive than it has to be.

It is not uncommon for women who are unable to achieve desirable postprandial control to reduce their carbohydrate intake to suboptimal levels with the hope of avoiding insulin therapy. The Dietary Reference Intakes (DRI) recommends 175 g of carbohydrate per day for pregnant women. Women who are not able to achieve the recommended postprandial blood glucose goals may need to have insulin therapy initiated.

At the completion of the initial 2-hour class, participants are counseled to call the nurse information phone line if they have questions, if they are spilling ketones, or if they are experiencing elevated blood glucose levels. They are instructed to return for the follow-up class the next week with their blood glucose monitors and log books.

**Follow-up class**
The 1-hour follow-up class includes a question-and-answer session and a review of log book test results (i.e., blood glucose and ketones). In addition, the following topics are discussed.
- Future risk of developing type 2 diabetes after diagnosis of GDM for themselves and their children
- Recommended follow-up care with their health care provider after birth of the child
- Prevention of type 2 diabetes
  - Diabetes Prevention Program (DPP) results
  - Role of breastfeeding
  - Nutrition recommendations for lactation
  - Effect of contraceptive medications on blood glucose

Women who are unable to achieve desirable glycemic control even when following the prescribed GDM meal plan, as evidenced by their blood glucose records, stay for an additional 1-hour class. These women are instructed on how to use insulin to achieve more desirable glycemic control throughout the remainder of their pregnancy. Insulin orders are obtained by the nurse from the women’s health care providers. The dietitian adjusts meal plans based on the insulin therapy prescribed.

**Lactation**
The positive health affects of breastfeeding should be strongly encouraged by health care professionals for all

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**Table 2. ACOG Blood Glucose Targets**

<table>
<thead>
<tr>
<th></th>
<th>Target</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting</td>
<td>&lt; 95 mg/dl</td>
</tr>
<tr>
<td>2-hour postprandial</td>
<td>&lt; 120 mg/dl</td>
</tr>
</tbody>
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**Table 3. Curriculum for Introductory GDM Class**

The 1st hour of the introductory class is taught by the nurse educator and has the following objectives:
- Describe the physiological changes during pregnancy that can alter glucose homeostasis—role of insulin and placental hormones
- Describe how the OGTT is used to diagnose GDM
- Describe the effect of hyperglycemia on the mother and fetus
- Describe how to treat GDM with healthy eating, physical activity, and possibly the use of medication
- Assess the postprandial blood glucose response to a carbohydrate-controlled meal plan with blood glucose self-monitoring results
- Demonstrate use and operation of home blood glucose monitor and ability to record test results in a log book
- Describe how to test urine for ketones and the role of ketone testing to evaluate adequacy of nutritional intake
- Understand their risk and the risk of their child for development of diabetes later in life

The 2nd hour of the introductory class is taught by the dietitian educator and has the following objectives:
- Describe how food nutrients (carbohydrates, protein, fat, and fiber) affect blood glucose
- Identify the desired portion size of one carbohydrate choice of some common foods
- Demonstrate how to read Nutrition Facts food labels
- Describe the clinical treatment goals of the American Dietetic Association’s nutrition practice guidelines for the treatment of GDM:
  - To achieve and maintain normoglycemia
  - To consume adequate energy to promote appropriate gestational weight gain and avoid maternal ketosis
  - To consume food providing nutrients necessary for maternal and fetal health
- Develop a meal plan using carbohydrate choice guidelines
  - Breakfast: two carbohydrate choices
  - Morning snack: one to two carbohydrate choices
  - Lunch: three to four carbohydrate choices
  - Afternoon snack: one to two carbohydrate choices
  - Dinner: three to four carbohydrate choices
  - Bedtime snack: one to two carbohydrate choices
women, especially those with a history of GDM. Breastfeeding is associated with weight loss and reduced insulin resistance. Research has revealed that women who breastfeed may have a decreased risk of developing diabetes later in life. Lactose is the only carbohydrate found in breast milk, and it requires glucose for synthesis. The estimated mean concentration of lactose in 1 liter of breast milk is 72 g. The estimated energy output in milk production is ~ 500 kcal/day in the first 6 months and 400 kcal/day in the second 6 months of lactation. Breastfeeding not only is an effective method for mothers to increase their energy expenditure, but it also is more economical and more convenient than bottles and formula. Breastfeeding has positive health benefits for children, such as boosting the immune system, promoting a leaner body composition during infancy, and possibly reducing the risk of obesity later in life. Breastfeeding also enhances bonding between mothers and their children. Overall nutrition needs during lactation are greater than during pregnancy. The DRI caloric recommendation to support lactation during infants’ first 6 months is 500 kcal per day higher than for nonpregnant women, and 400 kcal per day after 6 months. Adequate protein is also important while nursing. The DRI is 71 g per day, which is 15 g more than for nonpregnant women 19–50 years of age. Nursing mothers should try to drink ~ 8 cups of water per day and at least 1 cup of water each time they breastfeed their baby. Nursing mothers should also try to eat a wide variety of foods, such as whole grains, fruits, and vegetables, because low vitamin and mineral intake can affect the nutritional quality of breast milk.

**Future Health Care**

As for any pregnancy, women with GDM should be advised to return to their health care provider for a 6-week postpartum checkup. The ADA recommends evaluation for the development of diabetes by completing a 75-g, 2-hour oral glucose tolerance test (OGTT) in the 6- to 12-week period after the birth of the child. It is also recommended that the fasting blood glucose level be checked at least every 3 years thereafter. Although still considered controversial, more aggressive guidelines may be published soon recommending yearly screening with at least a fasting glucose or glucose tolerance test. Screening should occur more often in individuals who are overweight and have one or more risk factors for diabetes (Table 1).

Women who are considering another pregnancy should be screened for diabetes before conception. Suggested screening methods include a fasting blood glucose test or a 75-g, 2-hour OGTT. If women who have had GDM become pregnant again, it is recommended that they be screened for GDM earlier than 24 weeks and repeatedly with a 50-g, 1-hour OGTT to evaluate their glucose tolerance.

If a primary care provider is assuming care after the pregnancy, be sure this provider receives information regarding the history of GDM during pregnancy. Women should be counseled to be vigilant regarding their blood glucose levels as they age. Blood pressure, cholesterol, and triglyceride levels should also be observed. Elevation of these levels may indicate movement toward pre-diabetes or the metabolic syndrome, particularly for women who have a family history of diabetes.

**Healthful Postpartum Lifestyle Strategies**

The prevalence of type 2 diabetes is three to seven times higher in obese than in normal-weight adults. Weight gain during adulthood is also directly correlated with an increased risk of type 2 diabetes. The DPP demonstrated that intensive lifestyle interventions (diet and exercise) reduced the incidence of type 2 diabetes by 58%. The goal of the intensive lifestyle group was to maintain a weight reduction of at least 7% of initial body weight through the use of a healthy low-calorie, low-fat diet and moderate exercise for at least 150 minutes per week (i.e., ~ 20 minutes per day).

Women with a history of GDM should try to achieve their prepregnancy weight within 6–12 months after delivery. If they are still overweight (BMI > 25 kg/m²) after 12 months, they should try to lose 7% of their body weight slowly and then strive to maintain that weight loss. Weight loss and maintenance strategies could include some of the following:

- **Follow a balanced meal plan:**
  - Try to include a carbohydrate food and a heart-healthy protein at each meal. Use the plate method to portion out meals. The plate method meal planning approach does not require measurement of food and therefore is an easy way to serve healthful portions of starchy foods, protein, and nonstarchy vegetables. The concept is very simple: fill half the plate with nonstarchy vegetables. On the other half of the plate, serve a palm-sized portion of heart healthy protein and fist-sized portion of starchy foods.
  - Space meals throughout the day.
  - Use added fats in moderation. Choose monounsaturated fats, such as canola or olive oil, instead of polyunsaturated fats. Small servings of nuts and all-natural nut butters can be heart-healthy snacks or protein choices at mealtime. Try to limit foods that include trans fats.
  - Eat second helpings of nonstarchy vegetables instead of starchy foods, such as rice, pasta, and potatoes.
  - Try to have two to three servings of calcium-rich foods each day: milk, yogurt, cheese, cottage cheese, fortified soy milk or tofu, sardines, dried fish, or 2 cups of dark leafy vegetables.
  - Drink water to reduce empty calories. Other options include seltzer, mineral water, and sugar-free, caffeine-free soft drinks. Try to use caffeinated beverages such as tea and coffee in moderation.
  - Use small (4 oz) glasses for fruit juice and other sugary beverages. If still thirsty, drink water.
  - Increase the fiber in the food plan. Choose whole-grain breads, cereals, and crackers with at least 3 g of fiber per serving. Choose whole fruits and fresh or frozen vegetables each day.

- **Increase moderate exercise:**
  - Moderate exercise for at least 150 minutes per week (i.e., ~ 20 minutes per day). Space meals throughout the day.
  - Use added fats in moderation. Choose monounsaturated fats, such as canola or olive oil, instead of polyunsaturated fats. Small servings of nuts and all-natural nut butters can be heart-healthy snacks or protein choices at mealtime. Try to limit foods that include trans fats.
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  - Use small (4 oz) glasses for fruit juice and other sugary beverages. If still thirsty, drink water.
  - Increase the fiber in the food plan. Choose whole-grain breads, cereals, and crackers with at least 3 g of fiber per serving. Choose whole fruits and fresh or frozen vegetables each day.
Check out the new food pyramid (www.mypyramid.gov). Use the “Pyramid Plan” to create a food plan that is right for everyone in the family.

Be a role model for children. If parents choose to eat healthful foods, children will be more likely to eat them, too.

Moderate physical activity 5 days per week for at least 30 minutes is also a very important risk-reduction behavior. In the DPP, the majority of participants walked briskly to reduce their risk of diabetes. Additional strategies to increase levels of physical activity could include some of the following:

- Choose a physical activity that is enjoyable, perhaps one that the whole family can do together. The best time to perform physical activity is when it fits into the individual’s or family’s schedule.
- Use a pedometer to keep track of how many steps are taken each day. The long-term goal is 10,000 steps per day or 5 miles. Initially, the pedometer can be worn to determine the baseline number of steps taken each day. Then counsel patients to gradually increase their steps.
- Limit sedentary activities. Try to limit television and computer to no more than 2 hours per day.
- Set an example. If parents are physically active, children will be more likely to be active, too.

Contraception Considerations
The goal of contraception is to be effective, yet decrease the risk of diabetes later in life. Estrogen has no effect on carbohydrate metabolism.18 There is some evidence that progestin-only oral contraceptives may increase a woman’s risk of developing diabetes later in life, especially when used during the time the woman is breastfeeding.19 Whenever oral contraceptive agents are used, they should be combination pills in the lowest dose for the wanted effect. Intrauterine devices are a safe and effective method of birth control that do not affect glycemic control.

Educational Materials for Women With a History of GDM
In 2003, the National Diabetes Education Program (NDEP) launched the “Small Steps. Big Rewards. Prevent Type 2 Diabetes.” campaign to promote the findings from the Diabetes Prevention Program to audiences at high risk. This campaign features messages and materials for multicultural audiences to help them make lifestyle changes to reduce their risk for the disease. In April 2006, the NDEP launched the “It’s Never Too Early to Prevent Diabetes” campaign to alert women with a history of GDM—and their children—about their increased lifelong risk for developing type 2 diabetes. The NDEP has developed a new educational tip sheet, available in English and Spanish, that alerts them to this risk and directs the audience to learn more by obtaining comprehensive diabetes prevention materials and resources, including “Your GAME PLAN to Prevent Type 2 Diabetes.” The tip sheets and outreach efforts complement campaign materials that are tailored for other groups at risk for developing type 2 diabetes. In addition, the NDEP is developing materials targeting health care providers to alert them to this new information to help them support their patients. NDEP materials can be ordered online at www.ndep.nih.gov (click on the logo for “Small Steps. Big Rewards. Prevent Type 2 Diabetes”) or by calling 800-438-5383.

Summary
The incidence of GDM and subsequent type 2 diabetes is increasing as obesity and reduced levels of physical activity increase. In the past, we informed participants in our GDM programs of their increased risk of developing diabetes later in life in one or two sentences. Women with GDM must be fully and completely counseled about their risk; the need to monitor the risk, including regular follow-up; and the need for preventive measures (e.g., weight loss and physical activity), while striving to preserve their excitement regarding the pregnancy and impending parenthood.

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