

## Report from the CDC

# Comparison of Guidelines Available in the United States for Diagnosis and Management of Diabetes before, during, and after Pregnancy

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### ABSTRACT

Women with preexisting diabetes are at increased risk of adverse pregnancy outcomes and birth defects. Women with gestational diabetes are at increased risk for adverse outcomes, including neonatal hypoglycemia, hyperbilirubinemia, macrosomia, increased risk of obesity and diabetes in the offspring later in life, and increased risk for other maternal comorbidities. Studies have shown that tight glycemic control before and during pregnancy can decrease the risk for adverse outcomes, congenital malformations, and maternal complications resulting from maternal preexisting diabetes. It is important to identify women with gestational diabetes and provide preconception care to minimize the risk of a future pregnancy complicated by type 2 diabetes. To reduce the risk of adverse consequences for both the woman and her baby, it is important to effectively manage diabetes before, during, and after pregnancy. Several professional organizations have developed guidelines in an effort to establish some consistency in the diagnosis and treatment of diabetes and to decrease the risk of adverse outcomes. The objectives of this paper are to (1) compare the guidelines for women with preexisting (types 1 and 2) and gestational diabetes available to healthcare providers in the United States, highlighting the similarities and differences among them, and (2) discuss how differences among the guidelines might affect efforts to address the challenges of controlling and preventing diabetes and resulting complications during pregnancy.

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## INTRODUCTION

**T**HE PREVALENCE OF DIABETES in the United States is increasing, and it is often diagnosed in women of childbearing age.<sup>1</sup> It is estimated that more than 1.85 million women of childbearing age have diabetes and that one third of those women are undiagnosed.<sup>2</sup> Of the women affected by preexisting diabetes, about 90%–95% have type 2 diabetes, and 5%–10% have type 1 diabetes. In addition, each year about 3%–8% of all pregnant women develop gestational diabetes during pregnancy.<sup>3</sup>

Gestational diabetes mellitus (GDM) is defined as the condition of glucose or carbohydrate intolerance in a woman initially diagnosed during pregnancy and accounts for about 90% of glucose intolerance during pregnancy. GDM is associated with various adverse outcomes, including neonatal hypoglycemia, hyperbilirubinemia, macrosomia, which can lead to birth trauma or cesarean delivery, increased risk of obesity or diabetes in the offspring later in life; and increased risk for other maternal comorbidities.<sup>4–6</sup> In theory, GDM should disappear once the baby is born, but it may represent undiagnosed type 2 diabetes or be a marker for increased risk for developing type 2 diabetes later on.<sup>7,8</sup> GDM recurs at a rate of 35%–50%, and as many as 70% of affected women will progress to type 2 diabetes in their lifetime.<sup>9–11</sup>

Preexisting diabetes mellitus, types 1 and 2, occurs in 1% of all pregnancies in the United States and is associated with adverse pregnancy outcomes and congenital malformations.<sup>12,13</sup> Additionally, pregnancy can exacerbate a woman's preexisting complications from diabetes, such as vasculopathy, nephropathy, and retinopathy.<sup>14</sup> Studies have shown, however, that tight glycemic control before and during pregnancy can decrease the risk for adverse outcomes, congenital malformations, and maternal complications resulting from diabetes.<sup>13,15–20</sup> Unfortunately, one study showed that women with diabetes were less likely to plan their pregnancies than were women with no diabetes.<sup>21</sup>

To reduce the risk of adverse consequences for both the woman and her baby, it is important to manage the diabetes effectively before, during, and after pregnancy.<sup>13,15</sup> In an effort to establish some consistency in the diagnosis and treatment of diabetes, healthcare providers from several professional organizations have developed guidelines for those organizations. The objectives

of this paper are to (1) compare the guidelines for women with preexisting (types 1 and 2) diabetes and GDM available to healthcare providers in the United States, highlighting the similarities and differences among them, and (2) discuss how differences among the guidelines might affect efforts to address the challenges of controlling and preventing diabetes and resulting complications during pregnancy.

## MATERIALS AND METHODS

We conducted literature searches for diabetes and pregnancy guidelines using Ovid MEDLINE 1950–2007, diabetes association websites, obstetric association websites, the Cochrane database, the World Health Organization (WHO) website, Google Scholar Search, and references from journal papers on diabetes and pregnancy. Keywords used to search for guidelines included diabetes, guidelines, pregnancy, gestational diabetes, preexisting diabetes, and preconception care.

We reviewed the most recent edition of all English language practice guidelines and excluded clinical practice guidelines from other countries. We examined a total of six guidelines, five from the United States and one from the WHO. Guidelines were reviewed in two main categories, GDM diagnosis and management and preexisting diabetes management. Within GDM diagnosis and management, we examined guidelines for screening and diagnosing GDM target blood glucose during pregnancy, monitoring during pregnancy, delivery, and postpartum instructions. Within preexisting diabetes management, we examined guidelines for preconception care (including preconception examinations, target blood glucose values, and counseling), target blood glucose during pregnancy, hemoglobin A1C (a measure of average blood glucose control over several months prior to test) goals, monitoring during pregnancy, delivery, and postpartum instructions.

## RESULTS

### *GDM guidelines*

We reviewed six guidelines that address the diagnosis and management of GDM. The guidelines originated from the American College of Obstetricians and Gynecologists (ACOG),<sup>12,22</sup>

American Diabetes Association (ADA),<sup>23,24</sup> Joslin Diabetes Center (Joslin),<sup>25</sup> WHO,<sup>26</sup> International Diabetes Center,<sup>27</sup> and U.S. Preventive Services Task Force.<sup>28</sup> With the exception of the U.S. Preventive Services Task Force, all recommend assessing the risk for GDM for all women. Of those guidelines recommending that women be screened for GDM, three suggest that low-risk women need not be tested for GDM, whereas the others recommend that all women be tested for GDM at some point during their pregnancy. In general, low-risk women are Caucasian, have a normal prepregnancy body mass index (BMI), are <25 years old, and have no family history of diabetes and no prior adverse pregnancy outcomes. Women with a prior history of GDM or a strong family history of diabetes, women who are obese, and women from a high-risk racial or ethnic group are classified as high risk. The racial and ethnic groups described as being high risk vary slightly, but they generally include black or African descent, Hispanic/Latina, American Indian or Alaskan Native, Asian, Native Hawaiian or Pacific Islander, and indigenous Australian. Guidelines that recommend screening suggest women who do not fall into high-risk or low-risk categories be screened at 24–28 weeks.

The guidelines differ somewhat regarding testing procedures (Table 1). Some guidelines favor using a two-step approach. Initially, they test blood glucose levels after a 50-g glucose load. If the results are positive from that test, they follow up with testing after a 3-day preparatory period with a 3-hour 100 g glucose load. All four guidelines that recommend the 3-hour oral glucose tolerance test (GTT) indicate that two or more of their stated blood glucose limits must be met or exceeded to confirm the diagnosis. The WHO guidelines recommend a 75-g glucose load and delineate different values for positive diagnosis of GDM (Table 1). Most guidelines use either the Carpenter/Coustan Conversion or the National Diabetes Data Group Conversion for hourly blood glucose values following the glucose challenge (Table 1). The ACOG and ADA guidelines state that the physician can choose one of two threshold values for the 50-g glucose load—130 mg/dL and 140-mg/dL. The values used to determine the level above which women will be tested further for diabetes differ in sensitivity. Using a cutoff value of 130 mg/dL provides 90% sensitivity, and a 140-mg/dL cutoff value provides 80% sensitivity.

There is little consensus regarding target blood glucose levels during pregnancy. However, Joslin and the ADA suggest that insulin therapy be started when blood glucose levels exceed 105 mg/dL (plasma values). None of the guidelines suggest the use of oral hypoglycemic agents for GDM. Joslin specifically recommends against oral hypoglycemic therapies, and the ACOG states that data were inconclusive to recommend their use. There is also disagreement about the frequency of blood sugar monitoring for women with gestational diabetes. The recommended monitoring schedule ranges from once daily to six or seven times a day. Some guidelines spell out other monitoring, such as blood pressure, urine ketones, and urine protein analysis, which are standard practice in most prenatal office visits for all women.

Some practice guidelines have no specific recommendations for delivery procedures, whereas others recommend considering induction (or cesarean delivery, if indicated) from 38 to 40 weeks. Generally, recommendations for early delivery are based on estimated fetal weight and the presence of complications.

Postpartum instructions also vary from guideline to guideline. Some recommend a schedule of postpartum testing for diabetes, whereas others do not discuss postpartum follow-up. ADA and Joslin both stressed the importance of postpartum counseling to delay or prevent conversion to type 2 diabetes.

#### *Preexisting diabetes mellitus guidelines*

We reviewed three guidelines for management of preexisting diabetes before, during, and after pregnancy: ACOG, ADA, and Joslin. The practice guidelines for preconception care of women with preexisting diabetes generally agree that women should be seen by a team of specialists and should be assessed for preexisting complications of diabetes. Although guidelines from ACOG, ADA, and Joslin state that women should attain good glycemic control before getting pregnant, only two of the three guidelines also advise counseling women about the need for effective contraception until they reach appropriate glycemic control (Table 2).

For pregnant women with preexisting diabetes, all three guidelines recommend medical management by a team of specialists. The guidelines vary, however, on target blood glucose values,

TABLE 1. GUIDELINES FOR SCREENING, DIAGNOSIS, AND MANAGEMENT OF GESTATIONAL DIABETES MELLITUS (GDM) BY PROFESSIONAL ORGANIZATIONS

Organization	Screening	Diagnosis	Target blood glucose during pregnancy	Monitoring	Delivery	Postnatal care
American College of Obstetricians and Gynecologists (ACOG) (2001 <sup>12</sup> )	<p>Conduct risk assessment (timing not discussed) or practice universal screening at 24–28 weeks.</p> <p>Low risk<sup>a</sup>: may exclude from screen</p> <p>Moderate risk: 24–28 weeks</p> <p>High risk<sup>b</sup>: can screen early in pregnancy</p> <p>Screen test</p> <p>50-g 1-h GT: if &gt; 130 (or 140)<sup>c</sup> perform 100-g 3-h GTT</p>	<p>Using 100 g 3-h GTT, two abnormal values from either of the following criteria:</p> <p>Carpenter/Coustan</p> <p>Fasting <math>\geq 95</math></p> <p>1 h <math>\geq 180</math></p> <p>2 h <math>\geq 155</math></p> <p>3 h <math>\geq 140</math></p> <p>National Diabetes Data Group</p> <p>Conversion</p> <p>Fasting <math>\geq 105</math></p> <p>1 h <math>\geq 190</math></p> <p>2 h <math>\geq 165</math></p> <p>3 h <math>\geq 145</math></p>	<p>Not established because of lack of evidence but insulin recommended above these levels:</p> <p>Fasting &gt; 95</p> <p>1 h &gt; 130–140</p> <p>2 h &gt; 120</p>	<p>Daily testing (compared to studies but did not recommend number of times)</p> <p>Does not discuss urine ketone, blood pressure, or urine protein monitoring.</p> <p>Refers to ADA for MNT<sup>d</sup></p> <p>Active women should continue exercise</p>	<p>To term if not complicated and glucose control is good</p> <p>Cesarean may be considered if estimated fetal weight is <math>\geq 4500</math> g</p>	<p>Check blood glucose after immediate effects of pregnancy on glucose have subsided; timing is at discretion of provider</p> <p>Refers to ADA diagnostic values in nonpregnant state.</p> <p>Does not mention family planning</p>
ADA (2007) <sup>23,24</sup>	<p>Risk assessment at first prenatal visit.</p> <p>Low risk<sup>e</sup>: may exclude from screen</p> <p>Moderate risk: 24–28 weeks gestation</p> <p>High risk<sup>f</sup>: screen at first prenatal visit; if at first visit not GDM, screen again at 24–28 weeks using GTT (1-step approach) or 50-g oral glucose load and then 100-g GTT (2-step method)</p> <p>Screen test</p> <p>50-g GTT: <math>\geq 140</math> or <math>\geq 130</math></p>	<p>Fasting &gt; 126 or casual glucose &gt; 200 meets criteria if confirmed on subsequent day</p> <p>Two abnormal values from 100-g GTT</p> <p>Fasting <math>\geq 95</math></p> <p>1 h <math>\geq 180</math></p> <p>2 h <math>\geq 155</math></p> <p>3 h <math>\geq 140</math></p> <p>75-g GTT can be used but not as well validated</p>	<p>Fasting &lt; 105</p> <p>1 h &lt; 155</p> <p>2 h &lt; 130</p> <p>(Above these levels, insulin therapy is recommended)</p>	<p>Daily (does not give schedule)</p> <p>Postprandial more important than preprandial</p> <p>Urine ketone monitoring; blood pressure monitoring; urine protein monitoring</p> <p>MNT and visit with RD<sup>g</sup></p> <p>Recommends calorie distribution for obese women and exercise for all women</p>	<p>Deliver at 38 weeks</p>	<p>Check blood glucose 6 weeks after delivery; if normal, recheck at 3-year intervals; IFG (Impaired Fasting Glucose) or IGT (Impaired Glucose Tolerance) women tested annually</p> <p>Counseling to prevent conversion to type 2</p> <p>Discuss family planning</p>

(continued)

TABLE 1. GUIDELINES FOR SCREENING, DIAGNOSIS, AND MANAGEMENT OF GESTATIONAL DIABETES MELLITUS (GDM) BY PROFESSIONAL ORGANIZATIONS (CONT'D)

Organization	Screening	Target blood glucose during pregnancy			Delivery	Postnatal care
		Diagnosis	Monitoring			
Joslin (2005) <sup>25</sup>	Risk assessment at first prenatal visit. Low risk <sup>b</sup> : no screening Moderate risk: screen at 24–28 weeks High risk <sup>c</sup> : screen at first prenatal visit; if normal, screen again at 24–28 weeks Screen test 1-h post-50-g GTT > 140	3-h GTT (100 g) with 2 abnormal values Fasting > 105 1 h > 190 2 h > 165 3 h > 145	Plasma, whole Fasting < 100 1 h < 130 Insulin recommended if above these levels	4 times/day; may add preprandial monitoring Nocturnal (around 3 AM) Fasting urine ketone monitoring; blood pressure monitoring; urine protein monitoring All women: MNT and 3 visits with RD Recommends calorie distribution and exercise for all women	Not discussed	2-h 75-g GTT at 6 weeks postpartum Counseling to prevent conversion to type 2 diabetes Discuss family planning
WHO (1999) <sup>26</sup>	Risk assessment (timing not stated) High risk: screen in first trimester All other women screen 24–28 weeks. Risk assessment at first prenatal visit. Not high risk: 24–28 weeks With any risk factor <sup>k</sup> : first prenatal visit use 100 g GTT Screen test 1-h post-50-g GTT ≥ 140 Suspect if ≥ 120	GTT after overnight fasting with 75 g GDM: fasting ≥ 126 or 2 h ≥ 200 IGT: fasting ≤ 126 and 2 h ≥ 140 100 g GTT after overnight fast Fasting > 95 1 h > 180 2 h > 155 3 h > 140 Two abnormal values required; if fasting > 95, 2 h > 120, or one abnormal value, reevaluate for GDM later	Not discussed	Not discussed	Not discussed	Not discussed
International Diabetes Center (2003) <sup>27</sup>	Risk assessment at first prenatal visit. Not high risk: 24–28 weeks With any risk factor <sup>k</sup> : first prenatal visit use 100 g GTT Screen test 1-h post-50-g GTT ≥ 140 Suspect if ≥ 120	Preprandial and bedtime: 60–95 Postprandial: 1 h ≤ 140 2 h ≤ 120	6–7 times/day, 4 minimum Fasting and 1–2 h postprandial Urine ketones every morning until negative for 7 days, then every other morning. Blood pressure monitoring	Not discussed Fetal monitoring at 28 weeks with kick count and nonstress test at 34 weeks until end of pregnancy	Check fasting and 2 h after breakfast 1 day a week until postpartum visit Evaluate at postpartum visit: fasting > 120 and/or postprandial > 160 Does not mention family planning	

U.S. Preventive Services Task Force (2003) <sup>28</sup>	Not enough evidence to recommend screening	Insufficient evidence to recommend or routine screening for all pregnant women	Not enough evidence to make recommendation	Not enough evidence to make recommendation	Not enough evidence to make recommendation
		Experts recommend 50 g 1 h glucose challenge test 24–28 weeks → 100 g 3-h GTT; also can screen if member of high-risk group			

<sup>a</sup>Low risk, age < 25 years, BMI < 25, not member of high-risk racial or ethnic group, no previous history of abnormal glucose tolerance, no previous history of adverse obstetric outcomes usually associated with GDM, no known diabetes in first-degree relative.

<sup>b</sup>High risk; not specifically stated.

<sup>c</sup>The two cutoffs have different sensitivities.

<sup>d</sup>MNT, medical nutrition therapy.

<sup>e</sup>Low risk, age < 25 years, weight normal before pregnancy, member of racial or ethnic group with low prevalence of GDM, no known diabetes in first-degree relatives, no history of abnormal glucose tolerance, no history of poor obstetric outcome.

<sup>f</sup>High risk, marked obesity, personal history of GDM, glycosuria, strong family history of diabetes.

<sup>g</sup>RD, registered dietitian.

<sup>h</sup>Low risk, white race, age < 25, weight normal before pregnancy, no history of abnormal glucose metabolism, no history of poor obstetric outcome.

<sup>i</sup>High risk, member of high-risk racial or ethnic group (black or African, Hispanic/Latina, American Indian or Alaskan native, Asian, Native Hawaiian or other Pacific Islander, indigenous Australian).

<sup>j</sup>High risk, older women, previous history of glucose intolerance, previous history of large for gestational age babies, women from certain high-risk ethnic groups, elevated fasting or casual blood glucose levels.

<sup>k</sup>Risk factors: BMI > 25, family history of type 2 diabetes, age > 25 years, multiparity, previous gestational diabetes, previous macrosomic infant or large for gestational age infant, previous impaired glucose tolerance with oral glucose tolerance test 2-hour glucose value 140–100 mg/dL, American Indian or Alaskan Native, Asian, African American, Hispanic, Pacific Islander.

TABLE 2. GUIDELINES FOR MANAGEMENT OF PREEXISTING DIABETES MELLITUS IN RELATION TO PREGNANCY BY PROFESSIONAL ORGANIZATIONS

Organization	Preconception examinations and goals	Target blood glucose during pregnancy (mg/dL)	Monitoring	Delivery	Postnatal care
ACOG (2005) <sup>22</sup>	No specific reference to team of specialists Look for underlying vasculopathy Retinal examination by ophthalmologist 24-h urine for creatinine and protein Electrocardiography. Thyroid function examination Recommend multivitamin with at least 400 $\mu$ g folic acid  Provide contraception counseling for types 1 and 2 prior to maintain good glycemic control Euglycemic control Specific values not given A1C 5%–6% (no more than 1% above normal)	Fasting $\leq$ 95 Premeal $\leq$ 100 1 h $\leq$ 140 2 h $\leq$ 120 At night: not to decrease below 60	Mentions increased insulin needs based on trimester  Check glucose level before and 1 or 2 h after each meal and before bed If on insulin pump, also check at 2 or 3 AM	Amniocentesis before 39 weeks for fetal lung maturity advised for poorly controlled patients If corticosteroids given to increase lung development, increase insulin over next 5 days and monitor closely Patients with vasculopathy, nephropathy, poor glucose control, or prior stillbirth may require early delivery To term if no complications Cesarean section considered if estimated fetal weight >4500 g Induction of labor: i.v. infusion of regular insulin to maintain hourly levels <110 mg/dL Continue basal infusion if on insulin pump	Encourage breastfeeding Increase 500 kcal energy intake for breastfeeding Discuss contraception options
ADA (2003 and 2007)	Complete preconception evaluation for medical and obstetric history Develop management plan; management with team of specialists	Fasting: 60–90 Premeal: 60–105 1 h: 100–120 Middle of night: 60–120	8 tests per day is ideal (4–8 recommended) Urinalysis at each visit Kidney function	No timing of delivery recommendations given Recommends dosage and timing of insulin during labor and delivery	No postnatal recommendations given

Joslin (2005) <sup>25</sup>	<p>Tests: A1C, serum creatinine, and urinary protein or albumin, thyroid function, other tests based on medical history</p> <p>Mentions need for effective contraception until reaching appropriate glycemic control</p> <p>Euglycemic control</p> <p>Preprandial: 80–110 mg/dL</p> <p>2-h postprandial: &lt;155 mg/dL</p> <p>A1C &lt;1% above normal</p> <p>Team of specialists: meet with maternal fetal specialist, endocrinologist, diabetes specialist for counseling and guidance on management as well as medical assessments</p> <p>Contraception as pre-pregnancy plan not mentioned</p> <p>Euglycemic control</p> <p>Fasting 80–110</p> <p>Postprandial: 100–155</p> <p>A1C &lt;7% or normal</p>	A1C every 4–6 weeks	each trimester Eye status Thyroid panel
		Fasting 60–99 2 h 100–129	Endocrinologist every 1–4 weeks during pregnancy A1C every 4–8 weeks
		Negative urine ketones Normalization of hemoglobin A1C Avoidance of severe hypoglycemia	No timing of delivery recommendations given Recommends dosage and timing of insulin during labor and delivery
			Encourage breastfeeding Follow up with ophthalmology 6–8 weeks postpartum Discuss family planning

monitoring frequency, management of labor and delivery, and postpartum instructions. Only ACOG gives explicit recommendations for delivery timing. ADA and Joslin do not mention considering early delivery for women with pre-existing diabetes. ADA gives no postpartum recommendations, whereas ACOG and Joslin encourage breastfeeding and discussing contraceptive options. Joslin also recommends follow-up with the ophthalmologist 6–8 weeks postpartum.

## DISCUSSION

Success in a pregnancy complicated by abnormal blood glucose levels requires cooperation between the woman and her team of healthcare providers before, during, and after pregnancy. Various guidelines provide direction for clinicians who treat women with diabetes during pregnancy. Because women are likely to receive care from different providers who may use different guidelines, a patient might receive conflicting information about blood glucose targets, frequency of monitoring, delivery recommendations, and postpartum follow-up.

Our examination of the guidelines available in the United States to screen, diagnose, and treat women with diabetes during pregnancy revealed that although the guidelines for diagnosis are similar, there are some variations. Of the six guidelines for GDM, four of them—ACOG, ADA, Joslin, and International Diabetes Center—addressed the categories with more detail than did the other two—WHO and the U.S. Preventive Task Force. Although the other guidelines suggested screening women with moderate and high risk for diabetes, the U.S. Preventive Task Force stated that there was insufficient evidence to recommend or not recommend routine screening for all pregnant women.

The guidelines we reviewed generally agree that screening moderate-risk to high-risk women for GDM with a 50-g, 1-hour glucose tolerance test early in pregnancy is appropriate, but acceptable values vary. Women with borderline or slightly out-of-range results have a follow-up test, usually with a 100-g 3-hour glucose challenge. However, the physician might choose to use a 75-g 2-hour glucose challenge. The latter test is used extensively in other countries, but it has

gained little acceptance in the United States. Slight variations in the cutoff values for diagnosis mean that two women with the same response to a glucose challenge might be diagnosed differently from one practice to another.

There is little agreement in terms of monitoring blood glucose values for the woman with GDM. One healthcare provider on the team might ask the woman to self-test blood glucose up to seven times a day, whereas another healthcare provider on the team might say only that she needs to test daily. Target values for women with GDM also vary among guidelines. Women with GDM whose obstetrician uses ACOG guidelines might have no target values, but her endocrinologist who adheres to ADA guidelines might have very specific target values to adhere to. Recently, Joslin's guidelines have been updated, with tighter restrictions for target blood glucose levels during pregnancy.<sup>25,29</sup> It can be challenging for healthcare providers to keep up with the changes. An affected woman who has two or three pregnancies over several years might find the increasingly strict guidelines confusing and face difficulty with adherence, especially if she converts from GDM to type 2 diabetes.

Delivery recommendations for women with GDM vary, if they are discussed at all. ACOG suggests allowing women to go to term if there are no complications and there is good glycemic control but suggests considering cesarean delivery if estimated fetal weight is >4500 g. ADA recommends considering delivery at 38 weeks if there are no complications. Ultimately, an induced or scheduled delivery and its timing are determined by the provider's assessment of each individual woman's status.

When a woman experiences glucose intolerance for the first time during pregnancy, the healthcare provider has an opportunity to decrease the risk of adverse perinatal outcomes and educate the woman about the risk for type 2 diabetes later in life. Providing women at high risk for conversion with the tools to prevent or delay the onset of type 2 diabetes is especially important for those who might become pregnant later. Currently, the ADA favors postpartum testing for diabetes at 3-year intervals for euglycemic women and annually for prediabetic women, but perhaps women intending to have more children should have annual screening for diabetes as part of their routine healthcare.

Guidelines for managing women with preexisting diabetes during pregnancy appear more consistent than those for managing women with GDM. The major differences among the three guidelines we reviewed for managing preexisting diabetes during pregnancy include slight variations in the blood glucose values used to maintain tight control, the specificity of guidelines for labor and delivery, and the tests recommended throughout pregnancy. Slight variations in target blood glucose levels might create confusion for women who try to comply with expectations of several healthcare providers on the team. Women who are confused during their pregnancy might be less likely to seek advice from a healthcare provider and follow his or her recommendations. In addition, healthcare providers might also become frustrated if they are required to work with other healthcare providers who use different recommendations to manage a woman's pregnancy.

It might be beneficial for experts and organizations in the United States to convene to make consistent and comprehensive guidelines for the management of diabetes before, during, and after pregnancy. Currently, expert working groups are looking at recommendations for postpartum and interconception care. The overarching goal is for each woman with diabetes to have a safe and healthy pregnancy and a healthy outcome for both mother and baby.

It is important to identify women with GDM and provide interconception care to minimize the risk of a future pregnancy complicated by type 2 diabetes. It is also essential that women with preexisting diabetes obtain preconception and early pregnancy care. Women need guidance about diabetes and pregnancy management before, during, and after pregnancy to obtain tight glycemic control. To provide consistent guidance, healthcare providers should have comprehensive guidelines for diabetes management before, during, and after pregnancy.

Preconception care includes detailed personal and family history and physical and clinical examinations to assess any possible complications that might occur before and during pregnancy. Being aware of possible complications and putting prevention or treatment plans into action early can help reduce maternal and fetal complications associated with diabetes for all women.

Comprehensive patient education and follow-up of diet, exercise, and blood glucose self-monitoring are important in the management of preexisting diabetes and GDM, but they are not always available or affordable.<sup>30</sup> In fact, women at greatest risk for developing diabetes later in life are generally those with limited access to healthcare services.<sup>30-32</sup> Minority and low-income women are less likely to obtain healthcare before and during pregnancy. Working with insurance plans and healthcare agencies to ensure availability and affordability for all women is key. Providing healthcare to women of child-bearing age and facilitating outreach to underserved populations to increase the use of preconception and prenatal services is one way to ensure that women have access to essential services. Counseling should inform the patients of the risk for future diabetes for both offspring and women with GDM, the risk of congenital malformations, the risk of fetal and maternal pregnancy complications, and the need for pregnancy planning.

For a woman of reproductive age, each healthcare visit provides the opportunity to ask about her pregnancy plans and to educate her about a number of preconception behaviors that are important to her health and that of children she may have. Healthcare providers can discuss the need for good health habits for all women regardless of pregnancy intention. Those reminders of the need to prepare for pregnancy are even more important for a woman with preexisting diabetes or at high risk for GDM.

More research is needed to answer some questions about best practices. For example, it might be worthwhile to examine whether women with type 1 diabetes, type 2 diabetes, and GDM differ in their knowledge, motivation, and adherence to treatment and, if so, how to approach those differences. It is important to understand how to optimize and support compliance not only by creating consistent guidelines but also by understanding what women with preexisting diabetes need to control their diabetes and what women with GDM need to prevent conversion to type 2 diabetes. Although differences between guidelines may be small in some cases, these differences can foster confusion instead of compliance. Research is needed to examine barriers to compliance among women with preexisting and GDM. Examining the

use of the different guidelines among provider types may also be beneficial. In addition, more research is needed to determine which recommendations produce better pregnancy and long-term outcomes.

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