Screening for Gestational Diabetes Mellitus

Clinical Recommendations

The Women's Preventive Services Initiative recommends screening pregnant women for gestational diabetes mellitus after 24 weeks of gestation (preferably between 24 and 28 weeks of gestation) in order to prevent adverse birth outcomes. Screening with a 50-g oral glucose challenge test (followed by a 3-hour 100-g oral glucose tolerance test if results on the initial oral glucose challenge test are abnormal) is preferred because of its high sensitivity and specificity.

The Women's Preventive Services Initiative suggests that women with risk factors for diabetes mellitus be screened for preexisting diabetes before 24 weeks of gestation—ideally at the first prenatal visit, based on current clinical best practices.

Implementation Considerations

The Women's Preventive Services Initiative recommends screening pregnant women for gestational diabetes mellitus after 24 weeks of gestation to prevent adverse birth outcomes. Risk factors for diabetes mellitus that may help identify women for early screening include, but are not limited to, those identified by the Institutes of Medicine (now National Academies of Sciences, Engineering, and Medicine). The optimal test for screening prior to 24 weeks of gestation is not known. However, acceptable modalities may include a 50-g oral glucose challenge test, a 2-hour 75-g oral glucose tolerance test, a hemoglobin A1c test, a random plasma glucose test, or a fasting plasma glucose test. If early screening is normal, screening with a 50-g oral glucose challenge test should be conducted at 24 to 28 weeks of gestation as described above.

EVIDENCE MAP

Screen pregnant women for gestational diabetes mellitus (GDM) after 24 weeks of gestation, preferably between 24 and 28 weeks of gestation, in order to prevent adverse birth outcomes.

Systematic Reviews	Additional Studies	USPSTF
2013 USPSTF review of 5 RCTs and 6 cohort studies compared diet modification, glucose monitoring, and insulin as needed with no treatment.[1] Treatment of GDM reduced shoulder dystocia, macrosomia, and preeclampsia.	None	USPSTF[2]: screening for gestational diabetes mellitus (GDM) in asymptomatic pregnant women after 24 weeks of gestation. (Level B; 2014)

Screening with the 50-g oral glucose challenge test (OCT), followed by the 3-hour 100-g oral glucose tolerance test (OGTT) for women with abnormal results on the initial OCT, is preferred because of its high sensitivity and specificity.

Systematic Reviews	Additional Studies	USPSTF
2013 USPSTF review of 51 cohort studies of screening tests for GDM (50 g OGCT, fasting glucose, HbA1c) indicated highest sensitivity and specificity for the 50 g OGCT at either the 130 mg/dL or 140 mg/dL threshold).[3]	None	USPSTF: not specifically addressed in recommendation.

Women with risk factors for diabetes mellitus should be screened for preexisting diabetes before 24 weeks of gestation—ideally at the first prenatal visit.

Systematic Reviews	Additional Studies	USPSTF
None	None; studies are ongoing.	USPSTF[2]: Current evidence is insufficient to assess the balance of benefits and harms of screening for GDM in asymptomatic pregnant women before 24 weeks of gestation. (Level I; 2014)

Evidence map continued on page 99.

The optimal test for screening prior to 24 weeks of gestation is not known; acceptable modalities may include a 50-g oral glucose challenge test, a 2-hour 75-g oral glucose tolerance test, a hemoglobin A1c test, a random plasma glucose test, or a fasting plasma glucose test.		
Systematic Reviews	**Additional Studies**	**USPSTF**
None	None	Not addressed
Appropriate diabetes care (e.g., diet modification, glucose monitoring, counseling, education, and medication) for women diagnosed with diabetes mellitus or gestational diabetes mellitus are necessary to achieve optimal outcomes for both the mother and infant.		
Systematic Reviews	**Additional Studies**	**USPSTF**
2013 USPSTF review of 5 RCTs and 6 cohort studies compared diet modification, glucose monitoring, and insulin as needed with no treatment.[1] Treatment of GDM reduced shoulder dystocia, macrosomia, and preeclampsia.	Postprandial glucose levels are predictive for adverse fetal outcomes.[4] Adherence with insulin therapy is higher for patients enrolled in insurance plans with reduced or no co-payments for insulin.[5,6]	USPSTF: not specifically addressed in recommendation.

Abbreviations: ACA=Affordable Care Act, AAFP=American Academy of Family Physicians, AAP=American Academy of Pediatrics, ADA=American Diabetes Association, ACOG=American College of Obstetricians and Gynecologists, BMI=body mass index, GDM=gestational diabetes mellitus, HbA1c=hemoglobin A1c, IADPSG=International Association of the Diabetes and Pregnancy Study Groups, IOM=Institute of Medicine, OGCT=oral glucose challenge test, OGTT=oral glucose tolerance test, USPSTF=U.S. Preventive Services Task Force

SUMMARY OF EVIDENCE

Introduction

Gestational diabetes mellitus (GDM) is defined as glucose intolerance detected during pregnancy. GDM increases risk for maternal and fetal complications including preeclampsia,[7] fetal macrosomia causing shoulder dystocia and birth injury, and neonatal hypoglycemia.[8] Women diagnosed with GDM have increased risk for developing type 2 diabetes mellitus after pregnancy.[9] Screening for GDM is a long-established part of prenatal care that typically involves an oral glucose test administered after 24 weeks gestation.[10]

Current Recommendations and Coverage of Services

The gap in services provided under the provisions of the Patient Protection and Affordable Health Care Act of 2010 previously identified by the Institute of Medicine (IOM) Committee was that screening for GDM was not included.[11] In 2014, the U.S. Preventive Services Task Force (USPSTF) issued recommendations for screening for GDM in asymptomatic women after 24 weeks of gestation, but determined that evidence was insufficient to support screening earlier in pregnancy (**Table 1**).[2]

Table 1. Summary of Recommendations Currently Covered by the Affordable Care Act

IOM Committee[11]	Screening for gestational diabetes in pregnant women between 24 and 28 weeks of gestation and at the first prenatal visit for pregnant women identified to be at high risk for diabetes.*
USPSTF[2]	Screening for gestational diabetes mellitus in asymptomatic pregnant women after 24 weeks of gestation (B recommendation; 2014).

*The IOM report described risk factors that have been associated with the development of GDM during pregnancy including history of GDM in a prior pregnancy, previous delivery of a large for gestational age infant, obesity, strong immediate family history of type 2 diabetes or GDM, and a history of unexplained fetal death.[11]
Abbreviations: IOM=Institute of Medicine; USPSTF=U.S. Preventive Services Task Force

Background

In 2010, the prevalence of GDM in the United States was reported as 4.6% on birth certificates, 8.7% on the Pregnancy Risk Assessment Monitoring System (PRAMS) questionnaire, and 9.2% by either source.[12] Prevalence is higher among certain racial/ethnic groups including black, Asian, Hispanic, and Native American women compared with white women. Risk factors for GDM include older maternal age, history of GDM in a prior pregnancy, previous delivery of a large for gestational age infant, obesity, strong immediate family history of type 2 diabetes or GDM, and a history of unexplained fetal death.[11]

GDM is associated with adverse health effects for pregnant women as well as their infants. GDM increases risk for gestational hypertension, preeclampsia, and cesarean delivery;7 and for developing diabetes later in life.[9] Approximately 15% to 60% of women with GDM develop type 2 diabetes within 5 to 15 years of delivery.[13] Effects of GDM on infants include macrosomia causing shoulder dystocia and birth trauma, and neonatal hypoglycemia.[8]

Screening for GDM has been an established part of prenatal care in the United States since the 1970s and is commonly performed at 24 to 28 weeks gestation. Several professional organizations have issued screening recommendations (**Table 2**).

Table 2. Recommendations of Professional Organizations

American College of Obstetricians and Gynecologists (ACOG)[10]	All pregnant patients should be screened for GDM, whether by the patient's medical history, clinical risk factors, or laboratory screening test results to determine blood glucose levels. Screening is generally performed at 24-28 weeks of gestation. Early pregnancy screening is also suggested in women with risk factors (previous GDM, known impaired glucose metabolism, BMI ≥30); if GDM is not diagnosed, testing should be repeated at 24-28 weeks of gestation.
American Academy of Family Physicians (AAFP)[14]	Pregnant women without known diabetes mellitus should be screened for GDM after 24 weeks of gestation.
American Diabetes Association (ADA)[15]	Screening is recommended at 24-28 weeks in women who were not previously diagnosed with overt diabetes.
Endocrine Society[16]	Recommends universal testing for diabetes with a fasting plasma glucose, HbA1c, or an untimed random plasma glucose at the first prenatal visit (before 13 weeks gestation or as soon as possible thereafter) for women not known to already have diabetes.

Abbreviations: BMI=body mass index; GDM=gestational diabetes mellitus; HbA1c=hemoglobin A1c; USPSTF=U.S. Preventive Services Task Force

The two-step approach to testing is most commonly used and is endorsed by the American College of Obstetricians and Gynecologists (ACOG).[10] This involves the administration of 50 g of an oral glucose solution followed by a 1-hour venous glucose test. Women meeting or exceeding the screening threshold (130-140 mg/dL) then undergo a 100 g 3-hour diagnostic oral glucose tolerance test. Although the two-step method uses a standard protocol, results are variable because diagnostic thresholds differ. The one-step method proposed by the International Association of the Diabetes and Pregnancy Study Groups (IADPSG) uses a 75 g 2-hour oral glucose tolerance test. The diagnosis of GDM is determined when various threshold values are met.[17] While this method has been endorsed by the American Diabetes Association, a higher proportion of women are diagnosed with GDM using the one-step compared with the two-step method, and the effectiveness of treatment based on one-step diagnostic criteria is not known.

Treatment for GDM includes nutrition therapy, exercise, and glucose monitoring supplemented by pharmacologic therapy when glucose levels exceed targets. While preprandial glucose levels are monitored in nonpregnant adults with diabetes, postprandial levels are obtained in pregnant women with GDM because they are more predictive for adverse fetal outcomes.[4] Threshold levels of 140 mg/dL at 1 hour postprandial or 120 mg/dL at 2 hours postprandial are recommended.[18] Insulin, which does not cross the placenta, is the standard

pharmacologic treatment for GDM. Although oral hypoglycemic medications have demonstrated effective glycemic control in women with GDM, they are not approved by the U.S. Food and Drug Administration (FDA) for this purpose.

UPDATE OF EVIDENCE

A systematic review of screening and treatment for GDM was conducted for a National Institutes of Health Consensus Development Conference on Diagnosis of Gestational Diabetes Mellitus in 2013 and was used to update the USPSTF's clinical recommendations in 2014.[1,3]

Performance of Screening Tests

Data from 51 cohort studies were used to calculate the performance characteristics of screening tests including the 50 g oral glucose challenge test (OGCT), fasting plasma glucose levels, and hemoglobin A1c (HbA1c).[3] Studies used various screening thresholds for the initial test and various criteria for the diagnostic oral glucose tolerance test. Diagnostic criteria included the American Diabetes Association (ADA), Carpenter-Coustan (CC), Canadian Diabetes Association (CDA), IADPSG, National Diabetes Data Group (NDDG), and World Health Organization (WHO). Results indicated the highest sensitivity and specificity values for the 50 g OGCT at either the 130 mg/dL or 140 mg/dL threshold, which is the current standard of care in the United States (**Table 3**). Sensitivity and specificity values varied across diagnostic criteria, although the numbers of studies for each set of criteria also varied. Results for the fasting plasma glucose test indicated more variability in sensitivity and specificity than the OGCT, while HbA1c levels had poorer test characteristics than either OGCT or fasting plasma glucose.

Table 3. Summary of Studies of Test Characteristics of Screening Tests for GDM

Screening Test	Threshold	Diagnostic critera	Studies, N	Sensitivity; specificity (%)
50 g OGCT	130 mg/dL	CC	6	99; 77
		NDDG	3	88; 66
	140 mg/dL	CC	9	85; 86
		ADA	3	88; 84
		NDDG	7	85; 83
		CDA	1	81; 69
		WHO	3	70; 89
Fasting glucose	85 mg/dL	CC	4	87; 52
	90 mg/dL	CC	4	77; 76
	92 mg/dL	CC	3	76; 92
	95 mg/dL	CC	5	54; 93
HbA1c	5.0%	CC	1	92; 28
	5.3%	IADPSG	1	12; 97
	5.5%	ADA	1	86; 61
	7.5%	ADA	1	82; 21

Abbreviations: ADA=American Diabetes Association; CC=Carpenter-Coustan; CDA=Canadian Diabetes Association; IADPSG=International Association of the Diabetes and Pregnancy Study Groups; HbA1c=hemoglobin A1c; n=sample size; NDDG=National Diabetes Data Group; OGCT=oral glucose challenge test; WHO=World Health Organization

Benefits and Harms of Treating GDM

Five randomized trials and six cohort studies compared diet modification, glucose monitoring, and insulin as needed with no treatment.[1] Only three outcomes associated with GDM were reduced with treatment. These included shoulder dystocia (risk ratio [RR] 0.42, 95% confidence interval [CI] 0.23 to 0.77, 3 trials); macrosomia (birthweight >4000 g) (RR 0.50, 95% CI 0.35 to 0.71, 5 trials); and preeclampsia (RR 0.62, 95% CI 0.43 to 0.89, 3 trials). No differences were found for neonatal hypoglycemia, cesarean delivery, small-for-gestational-age neonates, induction of labor, or admission to a neonatal intensive care unit, although studies were limited for most outcomes. Evidence was insufficient for maternal weight gain, birth injury, and long-term metabolic outcomes among offspring. No studies evaluated screening earlier than 24 weeks gestation or among high-risk women specifically.

Although there is limited evidence for GDM screening at less than 24 weeks' gestation, there is clinical justification for early screening in women at high risk for overt diabetes. The highest increase in prevalence of

diabetes has occurred in women of reproductive age 69, and the highest perinatal mortality rates of all forms of maternal diabetes occur in women with overt diabetes diagnosed during pregnancy[70].

Adherence to Treatment

A systematic review of factors affecting adherence to insulin therapy included 17 studies of patients with diabetes mellitus.[19] None of the studies specifically enrolled women with GDM, although treatment is similar regardless of pregnancy status. Results indicated that adherence to insulin therapy is generally poor, especially for women. Adherence was higher for patients using a pen devise rather than vial/syringe method of insulin administration. In two studies conducted in the U.S., adherence improved when patients were enrolled in insurance plans with reduced or no co-payments for insulin.[5,6] These findings are consistent with results from another review of 66 studies from Canada and the U.S. indicating that increasing the patient share of medication costs for a number of medical conditions was associated with lower adherence.[20]

CONCLUSIONS

Gestational diabetes mellitus increases risk for maternal and fetal complications including preeclampsia, fetal macrosomia causing shoulder dystocia and birth injury, and neonatal hypoglycemia. Women with GDM can be identified through screening. A comprehensive review of screening tests for GDM (50 g OGCT, fasting glucose, HbA1c) indicates highest sensitivity and specificity for the 50 g OGCT at either the 130 mg/dL or 140 mg/dL threshold. Treatment of GDM with diet modification, glucose monitoring, and insulin reduces shoulder dystocia, macrosomia, and preeclampsia compared to no treatment in RCTs and cohort studies. Available studies focus exclusively on screening and treatment for GCM after 24 weeks gestation and the effectiveness of screening earlier in pregnancy is not clear.

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