

SCREENING FOR TYPE 2 DIABETES AFTER GESTATIONAL DIABETES WOMEN'S PREVENTIVE SERVICES INITIATIVE EVIDENCE UPDATE

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CURRENT WPSI RECOMMENDATIONS

Clinical Recommendations (2018)¹

The Women's Preventive Services Initiative recommends women with a history of gestational diabetes mellitus who are not currently pregnant and who have not previously been diagnosed with type 2 diabetes mellitus should be screened for diabetes mellitus. Initial testing should ideally occur within the first year postpartum and can be conducted as early as 4–6 weeks postpartum (**Table 1**).

Table 1. Preferred Testing Strategy Based on Postpartum Timeframe

Postpartum Timeframe	Testing Strategy		
	Oral Glucose Tolerance Test	Fasting Plasma Glucose	Hemoglobin A1c
4 weeks-6 months	Preferred	Acceptable	Consider only when recommended alternatives are not feasible
After 6 months	Acceptable	Acceptable	Acceptable

Women with a negative initial postpartum screening test result should be rescreened at least every 3 years for a minimum of 10 years after pregnancy. For women with a positive postpartum screening test result, testing to confirm the diagnosis of diabetes is indicated regardless of the initial test (e.g., oral glucose tolerance test, fasting plasma glucose, or hemoglobin A1c). Repeat testing is indicated in women who were screened with hemoglobin A1c in the first 6 months postpartum regardless of the result.

Implementation Considerations

In addition to the follow-up screening for women with a history of gestational diabetes mellitus recommended above, the WPSI recommends all women should adhere to diabetes mellitus screening guidelines for the general population. Guidelines for general population screening are available from the U.S. Preventive Services Task Force and American Diabetes Association.

Compared with other tests, hemoglobin A1c is less accurate in the first months after pregnancy. In addition, hemoglobin A1c levels may be inaccurate in women with conditions such as anemia, renal failure, certain hemoglobinopathies (e.g., thalassemia and sickle cell disease or trait) or women who have had a recent transfusion. However, given the low rates of postpartum testing with fasting plasma glucose and 2-hour 75-gram oral glucose tolerance tests, hemoglobin A1c may be considered as an alternative for appropriately counseled patients when other tests are not feasible. By 6 months postpartum, the physiologic changes related to pregnancy have usually resolved; therefore, all standard screening tests are acceptable after 6 months.

EVIDENCE SUMMARY

New Evidence

New evidence published since the previous Women's Preventive Services Initiative (WPSI) recommendation is summarized in **Table 2**.

Table 2. New Evidence Since the 2018 WPSI Recommendation

Benefits and harms of screening for type 2 diabetes after gestational diabetes
Systematic Reviews
Results of a systematic review in 2021 to update the USPSTF recommendation on screening for prediabetes and type 2 diabetes did not explicitly address screening women with previously diagnosed gestational diabetes. A separate systematic review to update the USPSTF's recommendations on screening for gestational diabetes in 2021 was restricted to studies of pregnant, not postpartum, women.
Risk for type 2 diabetes after a diagnosis of gestational diabetes
Systematic Reviews
Six systematic reviews of observational studies indicated combined risk estimates ranging from 7.43 (95% CI, 4.79–11.51) to 9.51 (95% CI, 7.14–12.67). Risk was highest 3 to 6 years after pregnancy and continued to be elevated beyond 10 years after pregnancy. In one analysis, one third of women with previous gestational diabetes developed diabetes within 15 years after pregnancy.
Risk factors for type 2 diabetes among women developing diabetes after a diagnosis of gestational diabetes
Systematic Reviews
Six systematic reviews of observational studies indicated increased risk with age; family history of diabetes; higher BMI; diagnosis of gestational diabetes early in pregnancy; increased fasting glucose and HbA1c levels during pregnancy; use of insulin during pregnancy; multiparity; hypertensive disorders in pregnancy; and preterm delivery.

Abbreviations: BMI, body mass index; CI, confidence interval; HbA1c, hemoglobin A1c test; USPSTF, US Preventive Services Task Force; WPSI, Women's Preventive Services Initiative

Current Recommendations

The WPSI currently recommends diabetes screening in women with a history of gestational diabetes who are not currently pregnant and who have not previously been diagnosed with type 2 diabetes. Initial testing should ideally occur within the first year postpartum and can be conducted as early as 4–6 weeks postpartum. Health insurance plans are now required to cover diabetes screening in women with previous gestational diabetes.²

Recommendations from the U.S. Preventive Services Task Force (USPSTF) do not include screening for type 2 diabetes after a pregnancy in which gestational diabetes was diagnosed. In their updated recommendation on screening for prediabetes and type 2 diabetes in 2021,³ the USPSTF recommended clinicians screen adults aged 35 to 70 years who have overweight or obesity (B recommendation) and *consider* screening women with a history of gestational diabetes at an earlier age. However, postpartum screening was not explicitly recommended.

Currently, standards and practices for screening for type 2 diabetes after gestational diabetes vary. Although follow-up testing is recommended beginning at the 4 or 6 week postpartum visit by the American College of Obstetricians and Gynecologists (ACOG),⁴ the ADA,⁵ and other groups⁶⁻⁸ (**Table 3**), only 35% to 57% of women with previous gestational diabetes are tested for type 2 diabetes during the first year postpartum.⁹

Table 3. Postpartum Screening Recommendations of Professional Organizations

Organization	Recommendation
American College of Obstetricians and Gynecologists (ACOG) ⁴	All women with gestational diabetes should be screened 4 to 12 weeks postpartum for type 2 diabetes, impaired fasting glucose, or impaired glucose tolerance. Women with positive screening results should be referred for preventive or medical therapy, and women with negative screening results should receive follow-up testing every 1-3 years. A fasting plasma glucose test or a 75-g, 2-hour OGTT is appropriate for postpartum screening.
American Diabetes Association (ADA) ⁵	A 75-g OGTT is recommended at the 4- to 12-week postpartum visit. Test women with gestational diabetes every 1-3 years if her 4- to 12-week OGTT is normal. The frequency of screening is based on the presence of risk factors: family history, pre-pregnancy BMI, or need for insulin or oral medications during pregnancy. Ongoing screening may be done with any glycemic test (HbA1c, fasting plasma glucose, OGTT) using nonpregnancy cut points.
Canadian Diabetes Association (CDA) ⁶	Women who have had gestational diabetes should be screened for type 2 diabetes 6 weeks to 6 months postpartum with a 2-hour 75-g OGTT; before a future pregnancy; and every 3 years or more often, depending on the presence of other risk factors for type 2 diabetes.
Fifth International Workshop Conference on Gestational Diabetes ⁷	Follow-up for women with gestational diabetes should be performed with a 75-g OGTT at 6-12 weeks postpartum.
British National Institute for Health and Care Excellence (NICE) ⁸	Women with gestational diabetes should be offered testing with a fasting plasma glucose test at 6-13 weeks postpartum, then with yearly fasting plasma glucose tests.

Abbreviations: BMI, body mass index; HbA1c, hemoglobin A1c test; OGTT, oral glucose tolerance test.

Screening for type 2 diabetes in nonpregnant adults is performed in the United States by fasting plasma glucose (FPG), 2-hour plasma glucose following oral glucose tolerance test (OGTT), or hemoglobin A1c (HbA1c).¹⁰ Although the HbA1c test is considered a diagnostic test for type 2 diabetes by the ADA and the World Health Organization (WHO), it may be less sensitive than

FPG or OGTT when using the currently recommended diagnostic cut point of greater than or equal to 6.5%.¹⁰⁻¹³ An advantage of HbA1c is that it does not require fasting prior to collection.

Background

Gestational diabetes is defined as glucose intolerance detected during pregnancy. Gestational diabetes increases risks for maternal and fetal complications including preeclampsia,¹⁴ fetal macrosomia causing shoulder dystocia and birth injury, and neonatal hypoglycemia.¹⁵ Women diagnosed with gestational diabetes have increased risk for developing type 2 diabetes after pregnancy.¹⁶ Follow-up screening of women with gestational diabetes provides early detection of women with continued glucose abnormalities, allowing for timely interventions to prevent progression and diabetes-related complications. Although screening for gestational diabetes is a long-established part of prenatal care that typically involves testing after 24 weeks gestation,¹⁷ screening for type 2 diabetes after gestational diabetes is not routinely performed.¹⁸

The prevalence of gestational diabetes in the United States was reported as 7.6% in the National Health and Nutrition Examination Surveys (2007-2014), with 19.7% developing diabetes postpartum.¹⁹ Prevalence is higher among certain racial/ethnic groups including Black, Asian, Hispanic, and Native American women. Risk factors for gestational diabetes identified in the previous WPSI review included older maternal age, history of gestational diabetes in a prior pregnancy, obesity, strong immediate family history of type 2 diabetes or gestational diabetes, previous delivery of a large for gestational age infant, and a history of unexplained fetal death.²⁰ A systematic review of 28 studies published in 2002 examined the cumulative incidence of type 2 diabetes in women with gestational diabetes, and identified elevated fasting glucose during pregnancy as the most predictive risk factor.²¹

Update of Evidence

USPSTF Systematic Reviews

A systematic review to update the USPSTF's recommendation on screening for prediabetes and type 2 diabetes in 2021³ did not explicitly address screening women with previously diagnosed gestational diabetes.²² The review evaluated the effectiveness and harms of screening in subgroups defined by age, sex, race and ethnicity, socioeconomic status, or body mass index (BMI). The influence of additional specific risk factors, such as previously diagnosed gestational diabetes, was not evaluated.

Overall, results of the systematic review indicated no significant mortality benefit with diabetes screening in general adult populations, insufficient evidence to assess other health outcomes resulting from screening, and insufficient evidence of harms of screening. Evidence was stronger for benefits and harms of interventions for patients recently diagnosed with diabetes (not screen-detected). The USPSTF recommendation on screening for type 2 diabetes in adults aged 35 to 70 years who have overweight or obesity was based on this indirect evidence.

A separate systematic review to update the USPSTF's recommendations on screening for gestational diabetes in 2021²³ was restricted to studies of pregnant, not postpartum, women.²⁴

WPSI Update

The evidence review for the WPSI included two approaches that will be updated prior to the WPSI recommendation being finalized:

Literature surveillance: The USPSTF conducts ongoing literature surveillance searches of published studies relevant to their recommendations to track developments in the field. LitWatch reports issued since January 2021 were reviewed to determine whether studies relevant to screening for type 2 diabetes in women with previously diagnosed gestational diabetes have been published since the 2021 USPSTF reviews. No relevant studies were identified from the surveillance searches.

Targeted search: A targeted literature search was developed to address gaps in current evidence reviews for the 2022 WPSI recommendation update. The search addressed two questions:

1. *What is the risk for type 2 diabetes in women with previous gestational diabetes?*
2. *What are specific risk factors for type 2 diabetes in women with previous gestational diabetes?*

Six systematic reviews²⁵⁻³⁰ published after 2009 addressed these questions in addition to two systematic reviews^{31,32} included in the previous WPSI evidence review. Details of the systematic reviews are described in **Tables 4 and 5**. While the systematic reviews varied by search dates, database sources, and inclusion criteria, several studies were included in multiple reviews.

Six systematic reviews of observational studies evaluating risk for type 2 diabetes among women with previous gestational diabetes indicated risk estimates from meta-analysis ranging from 7.43 (95% CI, 4.79–11.51) to 9.51 (95% CI, 7.14-12.67).^{25,26,28-30,32} Risk was highest 3 to 6 years after pregnancy²⁸ and continued to be elevated beyond 10 years after pregnancy in studies with long-term follow-up.^{25,26,28,29} In one analysis, one third of women with previous gestational diabetes developed diabetes within 15 years after pregnancy.²⁵

Risks for type 2 diabetes varied among different racial and ethnic groups,^{25-27,29,30} although differences were not statistically significant in an analysis comparing risks across groups.²⁹ Several systematic reviews estimated higher risks for women who were older,^{26,30} had a family history of diabetes,^{27,30} or had higher BMI.^{25-27,30,31} Additional risk factors identified in a systematic review of 39 studies of 95,750 women include diagnosis of gestational diabetes early in pregnancy (risk ratio [RR] 2.13; 95% CI, 1.52-3.56), increased fasting glucose (RR 3.57; 95% CI, 2.98-4.04) and HbA1c levels (RR 2.56; 95% CI, 2.00-3.17) during pregnancy, use of insulin during pregnancy (RR 3.66; 95% CI, 2.78-4.82), multiparity (RR 1.23; 95% CI, 1.01-1.50), hypertensive disorders in pregnancy (RR 1.38; 95% CI, 1.32-1.45), and preterm delivery (RR 1.81; 95% CI, 1.35-2.43).²⁷ Gestational weight gain, macrosomia, or breastfeeding did not increase risk in studies included in this systematic review. Insulin use during pregnancy and earlier gestational age at diagnosis (<24 weeks) were also identified as risk factors in an earlier systematic review.³¹

Table 4. Systematic Reviews of Risk for Type 2 Diabetes after Gestational Diabetes

Author, Year	Scope of review	Databases searched	Search dates	Studies (n); women (N)	Results (95% CI)
New studies					
Dennison et al, 2021 ²⁵	Studies reporting progression to type 2 diabetes ≥6 months after pregnancy	MEDLINE, EMBASE	Inception to October 2019	129; 4.4 M	• RR for type 2 diabetes, 8.3 (6.5–10.6) • 17.0% (15.1–19.0%) developed type 2 diabetes overall • Percentage diagnosed with type 2 diabetes was 12% (8–16%) higher for each additional year after pregnancy • One third developed diabetes within 15 years after pregnancy • Rates were 18% (5–34%) higher per unit BMI at follow-up • Rates were 57% (39–70%) lower in White populations compared to others (adjusted for ethnicity and follow-up).
Li et al, 2020 ²⁶	Large cohort studies with sample size ≥300 and follow-up duration of ≥ 1 year were included.	PubMed, EMBASE	January 1991 to September 2018	28; 170,139	• Incidence of type 2 diabetes after GDM, 26.20 (23.31-29.10) per 1000 person-years • Increments per year of follow-up, 9.6% • Estimated risks, 19.72% at 10 years, 29.36% at 20 years, 39.00% at 30 years, 48.64% at 40 years, and 58.27% at 50 years • Increased risk with Asian women; older age; and higher BMI
Song et al, 2018 ²⁸	Cohort studies evaluating the risk and time of onset of diabetes postpartum in women with and without GDM	PubMed, Web of Science, Springer, JAMA, Ovid, Wiley Online Library, Science Direct, CNKI, Wanfang Med Online*	Inception to February 28, 2017	30; 2,626,905	• Risk for type 2 diabetes, unadjusted, 7.76 (5.10–11.81); risk, adjusted, 17.92 (16.96–18.94) • Risk <3 years after GDM, 5.37 (3.51–9.34) • Risk ≥3 to <6 years after GDM, 16.55 (16.08–17.04) • Risk ≥6 to <10 years after GDM, 8.20 (4.53–14.86)
You, et al, 2021 ³⁰	Prospective and retrospective cohort studies of women diagnosed with type 2 diabetes at 6 weeks or later after delivery	MEDLINE, EMBASE, CENTRAL	January 1, 2009 to July 31, 2019	39; 2,847,596	• Unadjusted RRs ranged from 1.32 (0.46-3.37) to 47.25 (2.95-758.01) with a pooled unadjusted RR of 8.92 (7.84-10.14) • Higher risks for older women, women with a family history of diabetes, Black and non-Hispanic White women, and women living in Europe and South-East Asia

Author, Year	Scope of review	Databases searched	Search dates	Studies (n); women (N)	Results (95% CI)
Vounzoulaki et al, 2021 ²⁹	Observational studies of progression to type 2 diabetes; postpartum follow-up ≥12 months; incident physician-based diagnosis; studies of patients with GDM and a control group	MEDLINE, EMBASE	January 2000 to December 2019	20; 1,332,373	• RR for type 2 diabetes, 9.51 (7.14-12.67) • Cumulative incidence, mixed ethnicity, 16.46% (16.16%-16.77%); RR, 8.60 (5.49-13.47) • Incidence, non-White population, 15.58% (13.30%-17.86%); RR, 10.38 (4.61-23.39) • Incidence, White population, 9.91% (9.39%-10.42%); RR, 16.28 (15.01-17.66) • No significant differences between racial/ethnic groups • RR by follow-up, 1-5 years, 17.06 (8.95-32.55); >5-10 years, 10.52 (6.20-17.83); >10 years, 8.09 (4.34-15.08)
Included in previous WPSI review					
Bellamy et al, 2009 ³²	Cohort studies of women who developed type 2 diabetes after GDM	MEDLINE, EMBASE	January 1, 1960, to January 31, 2009	20; 675,455	RR for type 2 diabetes, 7.43 (4.79–11.51)

Abbreviations: BMI, body mass index; CENTRAL, The Cochrane Central Register of Controlled Trials; CI, confidence interval; GDM, gestational diabetes mellitus; RR, risk ratio.

*Searches also included 5 additional sources: Lancet, Nature, Science, New England Journal of Medicine, Google Scholar

Table 5. Systematic Reviews of Risk Factors for Type 2 Diabetes after Gestational Diabetes

Author, year	Scope of review	Databases searched	Search dates	Studies (n); women (N)	Risk factors included	Results (RR; 95% CI)
New studies						
Rayanagoudar et al, 2016 ²⁷	Studies that assessed risk factors in women with GDM and progression to type 2 diabetes; no language restriction	MEDLINE, EMBASE	Inception to July 2015	39; 95,750	Maternal (age, BMI, ethnicity, parity, family history); pregnancy related (gestational age at GDM diagnosis, antenatal OGTT, HbA1c, insulin use in pregnancy, gestational weight gain, pregnancy-induced hypertension, preterm delivery); postpartum factors (birthweight, breastfeeding)	• BMI (RR 1.95; 1.60-2.31) • Family history of diabetes (RR 1.70; 1.47-1.97) • Non-White ethnicity (RR 1.49; 1.14-1.94) • Advanced maternal age (RR 1.20; 1.09-1.34) • Early diagnosis of GDM (RR 2.13; 1.52-3.56) • Increased fasting glucose (RR 3.57; 2.98-4.04) • Increased HbA1c (RR 2.56; 2.00-3.17) • Use of insulin (RR 3.66; 2.78-4.82) • Multiparity (RR 1.23; 1.01-1.50) • Hypertensive disorders in pregnancy (RR 1.38; 1.32-1.45) • Preterm delivery (RR 1.81; 1.35-2.43) • Gestational weight gain, macrosomia, or breastfeeding did not increase risk
Included in previous WPSI review						
Baptiste-Roberts et al, 2009 ³¹	Patients recruited from a hospital or hospital-based clinic; follow-up time 6 weeks to 12 years; English-language; from North America (10 studies), Asia (3), Europe (2), Australia (1)	MEDLINE, EMBASE, CENTRAL, CINAHL	Inception to January 2007	14; NR	Anthropometric measures; gestational age at diagnosis; method of glucose control during pregnancy; too few studies of other factors	Qualitative descriptions; risk increased with: • Increased BMI, weight, skin fold thickness; waist measures • Use of insulin during pregnancy • Earlier gestational age at diagnosis (<24 weeks)

Abbreviations: BMI, body mass index; CENTRAL, The Cochrane Central Register of Controlled Trials; CI, confidence interval; CINAHL, Cumulative Index to Nursing and Allied Health Literature; GDM, gestational diabetes mellitus; HbA1c, hemoglobin A1c; NR, not reported; OGTT, oral glucose tolerance test; RR, risk ratio.

CONCLUSIONS

Screening for type 2 diabetes after gestational diabetes was not explicitly evaluated in the 2021 USPSTF evidence review on screening for prediabetes and type 2 diabetes. Few studies have addressed screening for type 2 diabetes after gestational diabetes, and none provide evidence of benefits and harms of screening. Several studies included in the previous WPSI evidence review evaluated the discriminatory accuracy of screening tests, particularly comparing the performance of fasting blood glucose and HbA1c against OGTT, the reference standard. While the accuracy of HbA1c is lower than fasting blood glucose, this level of discriminatory accuracy may be acceptable in clinical practice when HbA1c is used in situations where fasting prior to collection is not feasible.

Several recent systematic reviews and meta-analyses of risk for type 2 diabetes after gestational diabetes and identification of specific risk factors provides new evidence to update the WPSI recommendation. Estimates from meta-analyses of observational studies of gestational diabetes and its association with subsequent type 2 diabetes indicate risks ranging from 7.43 (95% CI, 4.79–11.51) to 9.51 (95% CI, 7.14–12.67).^{25,28–30,32} In comparison, a meta-analysis of prospective cohort studies of risk factors for type 2 diabetes estimated adjusted risks of 7.28 (95% CI, 6.47–8.28) for obesity and 2.92 (95% CI, 2.57–3.32) for overweight compared with normal weight.³³ These results indicate similar magnitudes of risk for gestational diabetes as for obesity and overweight, which are specifically targeted by the USPSTF recommendation for diabetes screening in adults.

Gestational diabetes is a clinically significant risk factor for type 2 diabetes and incidence is increased for over 10 years after pregnancy. Follow-up screening of women with gestational diabetes provides early detection of type 2 diabetes and an opportunity to initiate interventions to prevent progression and diabetes-related complications. Future research that evaluates benefits of screening including long term clinical outcomes, and compares the effectiveness of different screening intervals and strategies would provide direct supporting evidence for screening recommendations.

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