Screening for Diabetes in Pregnancy

Women's Preventive Services Initiative Evidence Update December 1, 2022

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CURRENT WPSI RECOMMENDATIONS

Clinical Recommendations (2016)[1]

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

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 Institutes of Medicine (now National Academies of Science, 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 SUMMARY

New Evidence

New evidence published since the previous Women's Preventive Services Initiative (WPSI) recommendation is summarized in **Table 1**.

Table 1. New Evidence Since the 2016 WPSI Recommendation

Benefits and harms of screening for gestational diabetes after 24 weeks' gestation
A systematic review in 2021 to update the USPSTF recommendation reported inconclusive results for the few available studies of screening effectiveness or harms. Studies of screening methods showed that both 1-step and 2-step approaches are accurate. Treatment of gestational diabetes was significantly associated with decreased risk of primary cesarean deliveries, shoulder dystocia, macrosomia, birth injuries, and neonatal intensive care unit admissions, but not decreased preterm deliveries.
Benefits and harms of screening for gestational diabetes before 24 weeks' gestation
Results of a systematic review in 2021 to update the USPSTF recommendation found that the few available studies of screening and treatment of gestational diabetes in early pregnancy were inconclusive.
Accuracy of methods to estimate risk for diabetes during pregnancy that can be used to guide screening in early pregnancy
Seven prediction models of clinical risk factors for gestational diabetes obtained in early pregnancy have been validated in clinical populations of women with and without gestational diabetes later in pregnancy. Models varied by the risk factors included and how they were scored within the model, although most models included previous history of gestational diabetes, family history of type 2 diabetes, maternal age, BMI, race and ethnicity, and previous macrosomia. Across the models, AUROC values ranged from 0.70 (95% CI, 0.68–0.73) to 0.82 (95% CI, 0.82-0.83).

Abbreviations: AUROC, area under the receiver operating characteristic curve; BMI, body mass index; CI, confidence interval; USPSTF, US Preventive Services Task Force.

Current Recommendations

The WPSI currently recommends universal screening for gestational diabetes after 24 weeks' gestation (preferably between 24 and 28 weeks) and screening women with risk factors for diabetes before 24 weeks. Risk factors associated with the development of gestational diabetes during pregnancy include 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 (macrosomia), and a history of unexplained fetal death.[2] The rationale for earlier screening is supported by the potential benefits of detecting preexisting undiagnosed type 2 diabetes and early gestational diabetes that would not be identified until universal screening was conducted later in pregnancy.

In 2021, the U.S. Preventive Services Task Force (USPSTF) updated their recommendation for universal screening for gestational diabetes after 24 weeks' gestation (B recommendation) but determined that evidence was insufficient to support screening earlier in pregnancy.[3] Several additional professional organizations have issued screening recommendations (**Table 2**).

Table 2. Gestational Diabetes Screening Recommendations of Professional Organizations

Organization	Early pregnancy	At 24 weeks or m
American College of Obstetricians and Gynecologists (ACOG)[4]	Early pregnancy screening is suggested in overweight and obese women with additional diabetic risk factors (previous GDM, physical inactivity, 1st degree relative with diabetes, high-risk race or ethnicity, previous infant ≥4,000g, hypertension, HDL <35 mg/dL, TCL >250 mg/dL, polycystic ovarian syndrome, history of cardiovascular disease, and other clinical conditions associated with insulin resistance); if GDM is not diagnosed, testing should be repeated at 24-28 weeks gestation.	All pregnant patients should be scre whether by the patient's medical his factors, or laboratory screening test blood glucose levels. Screening is ge 24-28 weeks of gestation.
American Academy of Family Physicians (AAFP)[5]	There is insufficient evidence to assess the balance of benefits and harms of screening for gestational diabetes in asymptomatic pregnant persons before 24 weeks.	Pregnant women without known dia be screened for GDM after 24 week
American Diabetes Association (ADA)[6]	Test for undiagnosed prediabetes and diabetes at the first prenatal visit in those with risk factors using standard diagnostic criteria.	Test for gestational diabetes mellitu gestation in pregnant women not pr have diabetes.
Endocrine Society[7]	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.	None
British National Institute for Health and Care Excellence (NICE)[8]	For women who have had gestational diabetes in a previous pregnancy, offer early self-monitoring of blood glucose or a 75-g 2-hour OGTT as soon as possible after booking, and a further 75-g 2-hour OGTT at 24-28 weeks if the results of the first OGTT are normal.	Offer a 75-g 2-hour OGTT at 24 to 28 with any of the other risk factors for (BMI >30 kg/m2, previous infant we gestational diabetes, first-degree re ethnicity with a high prevalence of d
Canadian Diabetes Association (CDA)[9]	In women at high risk of undiagnosed type 2 diabetes, early screening (<20 weeks) with an HbA1C should be done to identify women with potentially overt diabetes to guide fetal surveillance and early maternal treatment, including self-monitoring of blood glucose, interventions that promote healthy behaviors and healthy weight gain.	All pregnant women without known should be screened for gestational d 28 weeks of pregnancy.

Abbreviations: BMI, body mass index; GDM, gestational diabetes mellitus; HbA1c, hemoglobin A1c; HDL, high-density lipoprote tolerance test; TCL, triglycerides level.

Background

Screening for gestational diabetes 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, while screening earlier in pregnancy is not routine practice. Gestational diabetes is defined as glucose intolerance detected during pregnancy. Gestational diabetes increases risk for maternal and fetal complications including preeclampsia,[10] fetal macrosomia causing shoulder dystocia and birth injury, and neonatal hypoglycemia.[11] Gestational diabetes also increases risk for developing type 2 diabetes later in life.[12]

Birth certificate data indicate that among births in the United States in 2020, the overall rate of gestational diabetes mellitus was 7.8 per 100 births, representing an increase of 30% from 2016.[13] The rate was highest for non-Hispanic Asian women (14.9%), followed by non-Hispanic American Indian or Alaska Native (11.8%), non-Hispanic Native Hawaiian or other Pacific Islander (10.6%), Hispanic (8.5%), non-Hispanic White (7.0%), and non-Hispanic Black (6.5%) women. Rates increased with increasing maternal age, pre-pregnancy BMI, and multiple pregnancies.

Testing methods and diagnostic thresholds vary in clinical practice. The 2-step approach (Carpenter and Coustan criteria) to testing is most commonly used and is endorsed by the American College of Obstetricians and Gynecologists (ACOG).[4] 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 (135-140 mg/dL) then undergo a 100 g 3-hour diagnostic oral glucose tolerance test (OGTT). Although the 2-step method uses a standard protocol, results are variable because diagnostic thresholds differ. The 1-step method proposed by the International Association of the Diabetes and Pregnancy Study Groups (IADPSG) uses a 75 g 2-hour OGTT. The diagnosis of gestational diabetes is determined when various threshold values are met.[14] While this method has been endorsed by the American Diabetes Association, a higher proportion of women are diagnosed with gestational diabetes using the 1-step compared with the 2-step method, and the effectiveness of treatment based on 1-step diagnostic criteria is not known.

Treatment for gestational diabetes 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 gestational diabetes because they are more predictive for adverse fetal outcomes.[15] Threshold levels of 140 mg/dL at 1 hour postprandial or 120 mg/dL at 2 hours postprandial are recommended.[16] Insulin, which does not cross the placenta, is the standard pharmacologic treatment for gestational diabetes. Although oral hypoglycemic medications have demonstrated effective glycemic control in women with gestational diabetes, they are not approved by the U.S. Food and Drug Administration (FDA) for this purpose.

Update of Evidence

USPSTF Systematic Review

A systematic review to update the USPSTF's recommendation on screening for gestational diabetes in 2021[3] included 76 studies (18 randomized clinical trials [RCTs] [n=31,241], 2 nonrandomized intervention studies [n=190], and 56 observational studies [n=261,678]).[17]

Benefits and harms of screening at 24 or more weeks' gestation: Four observational studies of the effectiveness of screening versus no screening had inconsistent findings and important methodological limitations. Screening was not significantly associated with serious or long-term harms.

Accuracy of testing at 24 or more weeks' gestation: In five RCTs (n=25,772), 1-step (IADPSG) versus 2-step (Carpenter and Coustan) screening was significantly associated with increased likelihood of gestational diabetes (11.5% vs. 4.9%), but not improved health outcomes. Oral glucose challenge tests had 82% sensitivity and 82% specificity with 140-mg/dL cutoffs, and 93% sensitivity and 79% specificity at 135-mg/dL cutoffs against Carpenter and Coustan criteria. Testing with a 140-mg/dL cutoff had 85% sensitivity and 81% specificity against the IADPSG criteria. Fasting plasma glucose tests had 88% sensitivity and 73% specificity with 85 mg/dL cutoffs, and 81% sensitivity and 82% specificity with 90 mg/dL cutoffs against Carpenter and Coustan criteria.

Benefits and harms of treatment at 24 or more weeks' gestation: Based on eight RCTs and one nonrandomized study (n=3,982), treatment initiated at 24 or more weeks' gestation was significantly associated with decreased risk of primary cesarean deliveries, shoulder dystocia, macrosomia, birth injuries, and neonatal intensive care unit admissions, but not decreased preterm deliveries.

Screening in early pregnancy: One RCT (n=922) comparing early versus usual timing of screening using Carpenter and Coustan criteria included obese pregnant women from mostly Black and Hispanic populations in the United States.[18] Results indicated no statistically significant differences in pregnancy outcomes (preeclampsia, gestational hypertension, hypertensive disorders in pregnancy, primary cesarean delivery, induction of labor) or fetal/neonatal outcomes (shoulder dystocia, macrosomia, hypoglycemia, hyperbilirubinemia); and provided no data on long-term outcomes.

Benefits and harms of treatment in early pregnancy: Three RCTs and one nonrandomized intervention study (n=253) of the benefits of diabetes treatment initiated early in pregnancy were inconclusive; and three trials (n=123) were inadequately designed to determine harms of early treatment.

WPSI Update

The evidence review for the WPSI included two approaches:

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 through September 2022 were reviewed to determine whether studies relevant to screening for gestational diabetes have been published since the 2021 USPSTF review.[17] No new studies were identified from the surveillance searches.

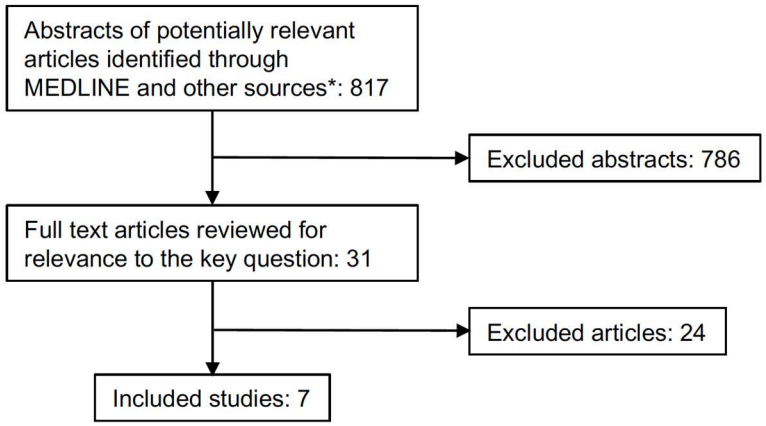
Targeted search: Targeted literature searches of the Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, and MEDLINE electronic databases (inception to August 29, 2022) were conducted that addressed gaps in current evidence reviews (**Appendix**). The searches addressed the question,

What is the accuracy of methods to estimate risk for diabetes during pregnancy that can be used to guide screening in early pregnancy?

Eligible studies evaluated how well clinical risk factors obtained early in pregnancy predicted gestational diabetes diagnosed later in pregnancy, typically at the time of routine screening at 24 or more weeks' gestation. Studies of risk factors obtained later in pregnancy to guide selective versus universal screening at 24 or more weeks' gestation were not included. Also excluded were studies of risk prediction methods that included laboratory measures, studies conducted in settings that may not be applicable to patient populations or medical practice in the United States, and studies that did not report performance characteristics of the risk method.

Seven prediction models of risk factors for gestational diabetes that were validated in clinical populations of pregnant patients with and without gestational diabetes addressed this question (**Figure 1**).[19-25]

Figure 1. Literature Flow Diagram



*Identified from LitWatch searching, reference lists, hand searching, and other sources.

Descriptions of the models and their performance characteristics are included in **Tables 3-5**. Models varied by the risk factors included and how they were scored within the model, although most models included age, BMI, family history of diabetes mellitus, and previous gestational diabetes. Models using race and ethnicity as risk factors assigned higher risk scores for East, Northeast, or South Asian origin; one model also assigned higher risk score for Black racial origin.[23] Despite these variations, discriminatory accuracy was moderate to high across the models with area under the receiver operating characteristic (AUROC) curve values ranging from 0.70 (95% confidence interval [CI], 0.68–0.73) to 0.82 (95% CI, 0.82-0.83).

The most accurate recently developed model demonstrated an AUROC curve value of 0.82 (95% CI, 0.82-0.83).[23] The model was derived from a prospective population of 75,161 women with singleton pregnancies attending their routine first pregnancy visit at two hospitals in England at 11 to 13 weeks' gestation. Women with preexisting diabetes or pregnancies ending before 30 weeks were not included. Patient characteristics, medical and obstetric history, and examination findings were collected at the first pregnancy visit. Of women included, 1,827 (2.4%) were diagnosed with gestational diabetes based on a routine 75-g OGTT given at 24 to 28 weeks' gestation. Risk factors in the final logistic regression model included:

- Previous history of gestational diabetes (strongest predictor in the model)
- Family history of first or second-degree relatives with type 2 diabetes
- Maternal age (>35 years)
- Weight (>69 kg)
- Height (<164 cm)
- Racial origin (risk higher in East and South Asian and Black racial origins)
- Use of ovulation drugs with the current pregnancy
- Birth weight of neonate in the last pregnancy (z-score)

Subsequent validation studies of the models generally confirm the original performance estimates (**Table 5**).[23,26,27] Validation studies included prospective cohorts of pregnant patients in England (N=75,161),[23] the Netherlands (N= 3,723),[26] and Canada (N=7,9,29).[27]

Table 3. Characteristics of Studies of Risk Prediction Models for Gestational Diabetes

Study	Population	Screening	Diagnostic	Clinical risk factors in the model	Method (points when used by model)
Gabbay-Benziv et al, 2015[20]	924 women in Baltimore (63 with GDM)	GCT	100 g OGTT	Age; Northeast Asian ethnicity; prior GDM; first trimester BMI and systolic blood pressure	Logistic regression model
Syngelaki et al, 2015[23]	75,161 women in the United Kingdom (1,827 with GDM)	RPG	75 g OGTT	History of GDM; family history of diabetes (1st or 2nd degree); maternal age; weight; height; race and ethnicity; method of conception; previous birth weight	Logistic regression model
Nanda et al, 2011[21]	11,464 women in the United Kingdom (297 with GDM)	RPG	75 g OGTT	Age in years; BMI; race and ethnicity; previous GDM; previous birth weight >90th %	Logistic regression model
Teede et al, 2011[24]	4,276 women in Australia (356 with GDM)	GCT	75 g OGTT	Maternal age; BMI at first visit; race and ethnicity; family history of diabetes (1st degree); history of GDM	Points based on age: <25 (0); 25–34 (1); ≥35 (2); BMI: <20.0 (0); 20.0–34.9 (1); ≥35.0 (2); race and ethnicity: Caucasian (0); African (1); Asian (0–1–2)*; Polynesian (1); Other (0); family history of diabetes: No (0); Yes (1); previous GDM: No (0); Yes (2)
van Leeuwen et al, 2010[25]	995 women in the Netherlands (24 with GDM)	GCT	75 g OGTT	BMI; race and ethnicity; family history of diabetes (1st or 2nd degree); previous GDM	Logistic regression model
Caliskan et al, 2004[19]	4,612 women in Turkey (143 with GDM)	GCT	100 g OGTT	Age ≥25 years; BMI ≥25 kg/m^2; prior adverse obstetric outcome†; family history of diabetes (1st degree); prior macrosomic infant (>4000 g)	1 point for each risk factor
Naylor et al, 1997[22]	3,131 women in Canada (113 with GDM)	GCT	100 g OGTT	Maternal age; BMI before pregnancy; race and ethnicity	Points based on age: <30 (0); 31–34 (1); ≥35 (2); BMI: <22.0 (0); 22.1–25.0 (2); ≥25.1 (3); race and ethnicity: White (0); Black (0); Asian (5); Other (2)

Abbreviations: BMI, body mass index; GCT, glucose challenge test; GDM, gestational diabetes mellitus; OGTT, oral glucose tolerance test; RPG, random plasma glucose.

*Score varies by region: Central Asia (0); Chinese, Southern, Maritime Southeast (1); Mainland Southeast (2).

†Includes recurrent spontaneous abortion (>2), fetal anomaly despite a normal karyotype, or prior unexplained in utero fetal death at a gestational age ≥20 weeks.

Table 4. Risk Prediction Models for Gestational Diabetes

Model	Risk Factors in the Models							
	Age	BMI	Family history DM*	Previous GDM	Race and ethnicity†	Previous macrosomia	Previous adverse outcome	Other
Gabbay-Benziv, 2015[20]	X	X		X	X			X
Syngelaki et al, 2015[23]	X	X	X	X	X	X		X
Nanda et al, 2011[21]	X	X		X	X	X		
Teede et al, 2011[24]	X	X	X	X	X			
van Leeuwen et al, 2010[25]		X	X	X	X			
Caliskan et al, 2004[19]	X	X	X			X	X	
Naylor et al, 1997[22]	X	X			X			

Abbreviations: BMI, body mass index; diabetes mellitus; GDM, gestational diabetes mellitus.

*The Caliskan and Teede models use first-degree relatives only, the van Leeuwen and Syngelaki models use first and second-degree relatives.

†Models using race and ethnicity as a risk factor assign higher risk score for East, Northeast, or South Asian; the Syngelaki model also assigns higher risk score for Black racial origin.

‡Other: use of ovulation drugs in Syngelaki, 2015; high systolic blood pressure in Gabbay-Benziv, 2015.

Table 5. Performance of Risk Prediction Models

Model	AUROC values (95% CI)			
	Original development study	External validation studies		
		Lamain-de Ruiter et al., 2016[26]	Syngelaki et al., 2015[23]	Theriault et al., 2014[27]
Gabbay-Benziv, 2015[20]	0.82 (0.77 to 0.87)	0.75 (0.71 to 0.79)	NR	NR
Syngelaki et al, 2015[23]	0.82 (0.82 to 0.83)	NR	NA	NR
Nanda et al, 2011[21]	0.79 (0.76 to 0.82)	0.78 (0.74 to 0.82)	0.79 (0.78 to 0.79)	NR
Teede et al, 2011[24]	0.70 (0.68 to 0.73)	0.77 (0.73 to 0.81)	0.77 (0.76 to 0.77)	0.74 (0.70 to 0.78)
van Leeuwen et al, 2010[25]	0.77 (0.69 to 0.85)	0.74 (0.71 to 0.78)	0.77 (0.77 to 0.78)	0.76 (0.73 to 0.79)
Caliskan et al, 2004[19]	0.83 (0.79 to 0.87)	0.73 (0.69 to 0.76)	0.70 (0.70 to 0.70)	0.68 (0.65 to 0.71)
Naylor et al, 1997[22]	0.73 (0.71 to 0.76)	0.72 (0.68 to 0.76)	0.69 (0.68 to 0.69)	0.67 (0.64 to 0.70)

Abbreviations: AUROC, area under the receiver operating characteristic curve; CI, confidence interval; NA, not applicable; NR, not reported.

CONCLUSIONS

Screening for gestational diabetes after 24 weeks' gestation is recommended by the USPSTF, the WPSI, and other guideline groups, and has become a standard of prenatal care. New studies identified in a recent evidence review for the USPSTF provide no direct evidence of the benefits and harms of screening after 24 weeks' gestation. New studies provide additional evidence for the accuracy of screening tests, and strategies and benefits of treating gestational diabetes once detected. The USPSTF recommendation for screening after 24 weeks' gestation is based on this indirect evidence.

The USPSTF also evaluated evidence for screening for diabetes in early pregnancy and determined that evidence was insufficient to support screening recommendations, in contrast with the WPSI. The current WPSI recommendation for screening in early pregnancy uses the presence of risk factors to identify higher risk patients for screening that were identified by the Institutes of Medicine (now National Academies of Science, Engineering, and Medicine) initial recommendation in 2011. These were described in the report as a history of gestational diabetes in a previous pregnancy, obesity, family history of gestational diabetes or type 2 diabetes, having a large for gestational age infant, and a history of unexplained fetal death.[2]

More recent studies of clinical risk prediction models in large patient populations demonstrate the accuracy of risk models to identify patients in early pregnancy who are likely to develop gestational diabetes later in pregnancy. These prediction models include many of the risk factors cited in the current WPSI recommendation except for age and race and ethnicity, which are commonly included in the models.

While effectiveness trials of diabetes screening in early or later in pregnancy have not been conducted, applying risk models to clinical care provides a more evidence-based approach to selective screening in early pregnancy. Future research should validate existing risk models in additional clinical populations in the United States to assure their applicability; and directly evaluate the benefits and adverse effects of universal screening after 24 weeks' gestation and risk-based screening in early pregnancy.

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APPENDIX. SEARCH STRATEGIES

Database: Ovid MEDLINE(R) ALL <1946 to August 29, 2022>
Search Strategy:
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1 exp Diabetes, Gestational/ (16145)
2 ((gestat* or (pregnan* adj2 (induc* or caus* or link* or associat* or result*))) adj5 diabet*).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (22937)
3 1 or 2 (24710)
4 exp pregnancy trimester, first/ (17971)
5 exp pregnancy trimester, second/ (15850)
6 (((first or 1st or second or 2nd) adj2 trimester*) or ((early or earlier or earliest or initial*) adj3 pregnan*) or (("4" or four or "5" or five or "6" or six or "7" or seven or "8" or eight or "9" or nine or "10" or ten or "11" or eleven or "12" or twelve or "13" or thirteen or "14" or fourteen or "15" or fifteen or "16" or sixteen or "17" or seventeen or "18" or eighteen or "19" or nineteen or "20" or twenty or "21" or twenty one or "22" or twenty two or "23" or twenty three) adj3 gestat* adj3 week*)).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (102993)
7 4 or 6 (102993)
8 3 and 7 (3746)
9 ((gestat* or (pregnan* adj2 (induc* or caus* or link* or associat* or result*))) adj5 diabet* adj10 (((first or 1st or second or 2nd) adj2 trimester*) or ((early or earlier or earliest or initial*) adj3 pregnan*) or (("4" or four or "5" or five or "6" or six or "7" or seven or "8" or eight or "9" or nine or "10" or ten or "11" or eleven or "12" or twelve or "13" or thirteen or "14" or fourteen or "15" or fifteen or "16" or sixteen or "17" or seventeen or "18" or eighteen or "19" or nineteen or "20" or twenty or "21" or twenty one or "22" or twenty two or "23" or twenty three) adj3 gestat* adj3 week*))).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (898)
10 8 or 9 (3746)
11 exp Mass Screening/ (141513)
12 exp Diagnostic Tests, Routine/ (14896)
13 exp Glucose Tolerance Test/ (36671)
14 ((fasting adj2 glucos*) or (glucos* adj2 tolera*) or (hgb a1c or hgba1c or hb a1c or hba1c or ((glycosyl* or glycat*) adj2 (hgb or hemoglobin*)))).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (159296)

15 (((fasting adj2 glucos*) or (glucos* adj2 tolera*) or (hgb a1c or hgba1c or hb a1c or hba1c or ((glycosyl* or glycat*) adj2 (hgb or hemoglobin*)))) adj10 (test or test or testing or tested or screen* or detect* or diagnos* or assay* or monitor* or measur* or assess* or level or levels)).mp. [mp=title, book title, abstract, original title, name of substance word, subject heading word, floating sub-heading word, keyword heading word, organism supplementary concept word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] (93332)
16 exp "Diagnostic Techniques and Procedures"/ (7736003)
17 14 and 16 (76914)
18 15 or 17 (115751)
19 10 and 11 (133)
20 10 and 12 (4)
21 10 and 13 (625)
22 10 and 15 (1213)
23 10 and 18 (1315)
24 19 or 20 or 21 or 22 or 23 (1355)
25 exp "Sensitivity and Specificity"/ (639318)
26 exp Models, Theoretical/ (1925605)
27 exp Biomarkers/ (856607)
28 exp Risk Factors/ (934793)
29 (predict* or foretell* or forecast* or forsee* or prognostic*).mp. (2306651)
30 ((correct* or reliab* or consisten* or dependab* or quick* or early or earlie* or swift* or rapid*) adj5 (identi* or recogni* or result* or associat* or link* or correlat*)).mp. (620863)
31 (auroc or auc-roc or (area* adj2 under* adj2 curv*)).mp. (122814)
32 accura*.mp. (978021)
33 (statistic* adj5 (valid* or verif* or proof* or prove or proves or proving or proved or proven or confirm* or affirm* or substantiat* or corroborat* or support* or model*)).mp. (163924)
34 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 (6479769)
35 24 and 34 (820)