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# Early screening for gestational diabetes mellitus: a meta-analysis of randomized controlled trials

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## Abstract

**OBJECTIVE:** Current evidence is conflicting on whether early screening and treatment for gestational diabetes mellitus improve pregnancy outcomes. Thus, this systematic review and meta-analysis of randomized controlled trials aimed to assess the rate of adverse pregnancy outcomes among participants with early screening and treatment for gestational diabetes mellitus vs those with routine care.

**DATA SOURCES:** A systematic review of the literature was conducted using MEDLINE, Scopus, ClinicalTrials.gov, EMBASE, ScienceDirect, the Cochrane Library at the Central Register of Controlled Trials, and SciELO from inception to November 2021.

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Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.ajogmf.2022.100737.

The authors report no conflict of interest.

**STUDY ELIGIBILITY CRITERIA:** Studies were eligible for inclusion if they described randomized controlled trials comparing early screening with routine care for gestational diabetes mellitus to assess the effects of early screening and treatment on pregnancy outcomes.

**METHODS:** All randomized controlled trials comparing early vs standard screening of gestational diabetes mellitus assessing the effect of early screening (defined as a screening at <20 weeks of gestation) vs routine screening (defined as a screening at ≥20 weeks of gestation) on pregnancy outcomes were included. The primary outcome was defined as large for gestational age, as defined by the trial. The secondary maternal and neonatal outcomes were also evaluated. Subgroup analyses were performed on the basis of screening strategy and methods.

**RESULTS:** After exclusion, 8 randomized clinical trials (1920 participants) of early screening and treatment vs standard care were included. There were a total of 746 participants with early gestational diabetes mellitus. The risk of large for gestational age at birth did not differ between early screening and treatment for gestational diabetes mellitus and routine care among all included trials (8.1 vs 9.0%; relative risk, 0.94; 95% confidence interval, 0.73–1.22). Trials with a protocol of universal screening of participants at their first prenatal visit (>80% screened with HbA1c) and receiving early treatment if the screening test returned positive had a lower risk of large for gestational age (2.3 vs 9.1%; relative risk, 0.29; 95% confidence interval, 0.09–0.90) than those who had routine screening and care.

**CONCLUSION:** Overall, early screening and treatment of gestational diabetes mellitus did not reduce the risk of large for gestational age at birth. However, trials that screened all participants at their first visit and treated early, most for an HbA1c of 5.7% to 6.4%, had a reduced risk of large for gestational age at birth compared with routine care, suggesting a possible benefit of screening all pregnant patients. However, future well-designed trials are needed to confirm these findings.

### Keywords

diabetes mellitus; early screening; gestational diabetes mellitus; large for gestational age; macrosomia

## Introduction

Gestational diabetes mellitus (GDM) is associated with multiple adverse maternal and fetal outcomes.[1–5] The reported prevalence of GDM in the United States is 7.6%.[6] However, with the rising obesity epidemic in the United States[7] and its association with GDM,[8] disease prevalence will inevitably increase. In 2015, worldwide, approximately 1 in 7 births was complicated by some form of hyperglycemia during pregnancy.[9]

Hyperglycemia in early pregnancy is associated with adverse pregnancy outcomes.[10–15] Large for gestational age (LGA) is one of the strongest indicators of poor glycemic control.[4] Thus, early screening and diagnosis of GDM provide an opportunity to lower this risk and other risks of adverse outcomes. Several organizations recommend selective early screening,[9,16] including the American College of Obstetricians and Gynecologists (ACOG), which recommends early screening in participants with certain risk factors for diabetes mellitus.[1] Screening and treatment for GDM starting at 24 weeks of gestation have been shown to reduce maternal and perinatal morbidity[17,18] and are currently the standard of care

in the United States and many parts of the world. In 2021, the US Preventative Task Forces reaffirmed their 2014 recommendation of screening for GDM after 24 weeks of gestation but stated that the evidence is insufficient for screening before 24 weeks of gestation.[19] The current evidence on whether early screening for GDM and early treatment if diagnosed early improve outcomes is conflicting.[11,15,20–29]

### Objective

Thus, this systematic review and meta-analysis of randomized controlled trials (RCTs) aimed to evaluate the incidence of LGA at birth and additional maternal and neonatal outcomes with early screening and treatment vs routine care of GDM.

## Methods

### Search strategy

This review was conducted according to a protocol designed a priori and recommended for systematic review.[30,31] Electronic databases (ie, MEDLINE, Scopus, ClinicalTrials.gov, ScienceDirect, the Cochrane Library at the Central Register of Controlled Trials, and SciELO) were searched from their inception to November 2021. This study's protocol was registered in the International Prospective Register of Systematic Reviews before the review (registration number CRD42021290052).

Search terms used were the following text words: "early," "screening," "hyperglycemia," "gestational diabetes," "trial," "randomized," and "clinical trial." No restriction for language or geographic location was applied. In addition, the reference lists of all identified articles were examined to identify studies not captured by electronic searches. The electronic search and the eligibility of the studies were independently assessed by 2 authors (R.A.M. and K.R.R.). Differences were discussed with a third reviewer (V.B.).

### Study selection

We included all RCTs comparing early vs standard screening of GDM assessing the effect of early intervention (defined as screening at <20 weeks of gestation) vs routine care (defined as screening at ≥20 weeks of gestation) on pregnancy outcomes. The inclusion criteria were pregnant participants with evidence of hyperglycemia (as defined by the RCT) at <20 weeks of gestation. These participants were randomized to either intervention at <20 weeks of gestation (diet, exercise, and medications as needed) or routine care. Quasi RCTs (ie, trials in which allocation was done on the basis of a pseudorandom sequence, eg, odd or even hospital number or date of birth, alternation) were excluded.

### Risk of bias assessment

The risk of bias in each included study was assessed by using the criteria outlined in the Cochrane Handbook for Systematic Reviews of Interventions. Of note, 5 domains related to the risk of bias were assessed in each included trial using the Cochrane risk of bias tool as there is evidence that these issues are associated with biased estimates of treatment effect: (1) randomization process, (2) deviations from the intended interventions, (3) missing outcome data, (4) measurement of the outcome, and (5) selection of the reported result.

Review authors' judgments were categorized as "low risk," "some concerns," or "high risk" of bias.[32]

In addition, 2 authors (R.A.M. and K. R.R.) independently assessed the inclusion criteria, risk of bias, and data extraction. Disagreements were resolved by discussion with a third reviewer (V. B.).

## Primary and secondary outcomes

All analyses were done using an intention-to-treat approach, evaluating women according to the treatment group to which they were randomly allocated in the original trials. Primary and secondary outcomes were defined before data extraction. All authors of the original trials were contacted for missing data. Sensitivity analyses were performed on published data and unpublished data.

The primary outcome was the incidence of LGA, defined by the original trial (or a birthweight [BW] of >90th percentile or a BW of >4000 g). The maternal secondary outcomes included gestational weight gain from randomization to delivery (in kilograms), hypertensive complications (gestational hypertension and preeclampsia (PE) as defined by the original trial), preterm birth (PTB) at <37 weeks of gestation, induction of labor, and cesarean delivery. The neonatal secondary outcomes were BW, stillbirth (ie, fetal death at >23 weeks of gestation), small for gestational age (ie, a BW of <10th percentile), birth trauma, shoulder dystocia (as defined by the original trial), neonatal hypoglycemia (ie, a glucose level of <40 mg/dL or as defined by the original trial), umbilical cord C-peptide ≥90th percentile, neonatal hyperbilirubinemia (ie, total serum bilirubin level of >5 mg/dL), admission to the neonatal intensive care unit, and neonatal death (ie, death of a live-born baby within the first 28 days of life).

Subgroup analyses were planned a priori. Of note, 1 subgroup analysis aimed to compare the rate of the primary and secondary outcomes between participants who were screened and treated at <14 weeks of gestation and those who were screened and treated at 15 to 20 weeks of gestation. Additional subgroup analyses aimed to compare outcomes among trials that had the following inclusion criteria: universal screening of participants at their first prenatal visit, screening only in participants with obesity, and screening in participants with other high-risk factors for GDM. In addition, subgroup analyses were planned among trials with different screening methods (eg, HbA1c test and glucose tolerance test [GTT]). Finally, the outcomes of trials performed in the United States and outside the United States were compared.

## Data synthesis

The data analysis was completed independently by 2 authors (R.A.M. and K. R.R.) using Review Manager (RevMan; version 5.4.1; Cochrane Collaboration, 2020, London, United Kingdom). The completed analyses were compared, and any difference was resolved by discussion with a third reviewer (V.B.). Data from each eligible study were extracted without modification of original data onto custom-made data collection forms. For continuous outcomes, means±standard deviations were extracted and imported into RevMan (version 5.4.1).

A meta-analysis was performed using the fixed-effects model of Mantel and Haenszel, to produce summary treatment effects in terms of mean differences or relative risks (RRs) with 95% confidence intervals (CIs). Heterogeneity was measured using the I-squared (Higgins $I^2$) test. Multiple planned subgroup analyses for the primary and secondary outcomes were performed, comparing early screening with routine screening by the subgroups defined above. Potential publication biases were assessed statistically by using Begg and Egger tests. The meta-analysis was reported following the Preferred Reporting Item for Systematic Reviews and Meta-Analyses statement.[30] The Grading of Recommendations Assessment, Development, and Evaluation (GRADE) approach was performed to interpret findings.

## Results

### Study selection and study characteristics

Of note, 8 RCTs[33–40] (1920 participants) were identified as relevant and included in the meta-analysis (Figure 1). Publication bias, assessed statistically by using Begg and Egger tests, showed significant bias ($P$=.019 and $P$=.019, respectively). Corresponding authors from Roeder et al,[37] Osmundson et al,[33] and Harper et al[38] trials kindly provided additional unpublished data from their trials.

The characteristics and procedures of the studies are summarized in Supplementary Tables 1 to 5. Of the 8 trials, 5 randomized patients who were diagnosed with early GDM to early treatment or routine screening, whereas 3 randomized patients to early screening (and treatment if screen test returned positive) or routine screening (Supplementary Table 2). All trials treated the participants who had early treatment with diet and glucose checks 4 to 6 times a day,[33–35,37–40] except in the Vinter et al[36] trial, where participants only had a diet and exercise program protocol (Supplementary Table 3).

### Risk of bias of included studies

The overall risk of bias was low. All studies had a low risk of bias in “random sequence generation” and used opaque randomized envelopes. The randomization sequence was computer-generated and adequate methods for allocation of women were used in all trials, except for 1 trial[39] where it was not clear. All but one of the trials were unblinded. Simmons et al[35] included decoy participants, thus blinding providers to which arm the participants were in (Supplementary Table 2). Of the 8 trials, 2 were pilot studies,[34,35] 2 were conference abstracts,[39,40] and 1 was a secondary analysis of a randomized study.[41] Of note, the 2 included abstracts were oral presentations at the annual Society for Maternal-Fetal Medicine meeting. Data were extracted from both the abstract and the oral presentation of the abstract. There was no difference between the data presented during their oral presentations and the data in this systematic review. The risk of bias assessment is summarized in Figure 2. The statistical heterogeneity within the study ranged from low to high with no inconsistency ($I^2$=0%) for the primary outcome.

The inclusion and exclusion criteria and the screening and diagnostic criteria for GDM for each trial are summarized in Tables 1 and 2. Of note, 3 trials screened all participants at their first prenatal visit, 3 trials screened only participants with obesity, and 2 trials

screened participants with risk factors for GDM (one based on the Australasian Diabetes in Pregnancy Society[42] and the other on the ACOG Practice Bulletin[1]). All trials excluded participants with pregestational diabetes mellitus. Of the 4 trials that did not screen all participants (ie, included because of risk factors), 3 adequately screened for preexisting abnormal glucose tolerance. Harper et al[38] screened all participants with obesity with an HbA1c and excluded those who had an HbA1c of ≥6.5%. Vinter et al[36] excluded participants who had a 2-hour GTT of ≥9 mmol. Enakpene et al[39] screened all participants with obesity with an HbA1c and excluded those with an HbA1c of ≥6.5% and/or a 1-hour glucose challenge test (GCT) of ≥200 mg/dL. It was unclear whether Rodriguez et al[40] excluded or screened included participants for preexisting diabetes mellitus. All but one of the trials[38] excluded participants younger than 18 years old.[33–37,39,40] All but one of the trials[40] excluded multifetal pregnancies.[33–39] Of note, 3 trials excluded participants using chronic corticosteroids.[33,38,40]

## Synthesis of results

Tables 3 and 4 show the primary and secondary outcomes in all included trials. There was no difference in the primary outcome, LGA, among participants who were randomized to early screening and treatment if the screening test returned positive compared with those who were randomized to routine care with second-trimester GDM screening (8.1% vs 9.0%; RR, 0.94; 95% CI, 0.73–1.22) (Figure 3). The overall quality of evidence for the primary outcome was assessed using the GRADE approach and graded at “moderate” because of the publication bias of the included RCTs. Among secondary maternal outcomes, participants who were randomized to early screening had a higher risk of GDM diagnosis than those randomized to routine care (29.0% vs 25.3%; RR, 1.13; 95% CI, 1.04–1.24). There was no difference in other maternal secondary or neonatal outcomes in both analyses using published and unpublished data (Tables 3 and 4).

## Subgroup analyses

*Who were screened?* Planned subgroup analysis was performed for primary and secondary outcomes in trials that universally screened (and randomized if the screen test returned positive) all participants at the first prenatal visit. Of the 8 trials, 3 screened all participants at the first visit using an HbA1c, with 1 trial using both an HbA1c and a fasting plasma glucose (FPG).[33,34,37] The primary and secondary outcomes of this subgroup are presented in Tables 5 and 6. Among trials that screened all participants at the first visit, early diagnosis and treatment of GDM were associated with a significantly decreased risk of LGA compared with those with routine GDM screening and treatment (2.3% vs 9.1%; RR, 0.29; 95% CI, 0.09–0.90) (Figure 4). In addition, participants screened and treated early for GDM had a lower rate of PE than those with routine GDM screening and treatment, although this difference was not statistically significant (published data: 0% vs 14% [RR, 0.13; 95% CI, 0.01–2.39]; unpublished data: 2.9% vs 8.5% [RR, 0.37; 95% CI, 0.11–1.25]).

Of the 8 included trials, 3 trials randomized only participants with obesity to early vs routine screening and treatment of GDM.[36,38,39] The primary and secondary outcomes of this subgroup analysis are presented in Tables 7 and 8. There was no difference in the risk of LGA among participants with obesity screened and treated early for GDM compared

with those who had routine screening and treatment (8.1% vs 8.1%; RR, 1.10; 95% CI, 0.74–1.65) (Supplementary Figure 1). However, there was a higher rate of GDM diagnosis in those screened early vs those who had routine screening (23.6% vs 19.3%; RR, 1.30; 95% CI, 1.10–1.55). In addition, participants with obesity who were screened and treated early for GDM had a higher risk of PE (13.4% vs 9.8%; RR, 1.35; 95% CI, 1.03–1.78) (Supplementary Figure 2). Higher risk of PTB was seen in those screened and treated early when unpublished data was added (published data: 5.6% vs 3.7% [RR, 1.50; 95% CI, 0.22–10.17]; unpublished data: 16.5% vs 10.0% [RR, 1.62; 95% CI, 1.17–2.25]) (Supplementary Figure 2). These results remained when we compared those who screened positive and were treated early among the trials that randomized participants to early screening vs those who had routine screening (PE: 16.2% vs 9.1% [RR, 2.06; 95% CI, 1.24–3.42]; PTB: 23.8% vs 10.0% [RR, 2.94; 95% CI, 1.93–4.46]) (Supplementary Figure 3).

Of note, 2 of 8 included trials screened participants based on GDM risk factors.[35,40] The primary and secondary outcomes of the 2 trials are presented in Tables 9 and 10. There was no difference in the rate of LGA between the group that was screened and treated early compared with those who had routine screening and treatment of GDM (20.3% vs 20.2%; RR, 1.01; 95% CI, 0.68–1.50).

*How were they screened?* Of the 8 trials, 3 screened participants using the 2-step method (50-g, 1-hour GCT followed by a 100-g, 3-hour GTT), 3 screened participants using an HbA1c, and 2 used the 1-step method (75-g, 2-hour GTT). Moreover, 1 trial used both an HbA1c and a FPG.[37] The primary and secondary outcomes of the analysis of trials that used the 2-step method are presented in Tables 11 and 12. Participants screened early for GDM using the 2-step method did not differ in the rate of LGA compared with participants who had routine screening (7.9% vs 7.7%; RR, 1.03; 95% CI, 0.76–1.39) (Supplementary Figure 4). Those screened early with the 2-step method were more likely to be diagnosed with GDM (16.9% vs 13.0%; RR, 1.07; 95% CI, 1.07–1.58) and, when unpublished data was added, were more likely to have a PTB than those with routine screening (published data: 17.3% vs 16.9% [RR, 1.02; 95% CI, 0.77–1.35]; unpublished data: 17.3% vs 13.9% [RR, 1.25; 95% CI, 1.01–1.55]) (Supplementary Figure 5). In addition, when removing trials that included multifetal pregnancy, the difference in the PTB rate remained (17.4% vs 10.7%; RR, 1.62; 95% CI, 1.16–2.26). The difference in PTB also remained when comparing participants who were screened and treated early with participants who had routine screening based solely on the Harper et al trial[38] (unpublished data: 33.3% vs 10.7%; RR, 3.12; 95% CI, 2.04–4.77) (Supplementary Figure 6).

The primary and secondary outcomes of trials that screened participants with an HbA1c are presented in Tables 13 and 14. Only participants who were included on the basis of an HbA1c were included in this analysis from the trial[37] that screened all participants with both an HbA1c and a FPG (ie, participants who were included only based on a FPG were excluded). Participants who were screened with HbA1c and treated early for an HbA1c of >5.7% had a trend toward lower risk of LGA compared with those who had routine care, but this did not meet statistical significance (published data: 4.2% vs 17.4%; RR, 0.28; 95% CI, 0.07–1.06; unpublished data: 1.9% vs 8.2%; RR, 0.28; 95% CI, 0.07–1.06) (Supplementary Figure 7).

Tables 15 and 16 present the primary and secondary outcomes of the trials that screened participants with a 1-step method. The risk of LGA for participants who were screened by a 1-step method early and treated for GDM did not differ from those who were screened and treated as routine (23.3% vs 24.7%; RR, 1.05; 95% CI, 0.59–1.85).

*When they were screened.* Of the 8 included trials, 4 trials screened and treated participants for GDM at ≤15 weeks of gestation. The primary and secondary outcomes of these 4 trials are presented in Tables 17 and 18. There was no difference in the risk of LGA between participants screened and treated early for GDM and those with routine care (9.6% vs 15.4%; RR, 0.77; 95% CI, 0.46–1.29).

## Comment

### Principal findings

This meta-analysis from 8 RCTs showed that early screening and treatment of early GDM were not associated with a reduced risk of LGA. However, among trials that universally screened all participants at their first prenatal visit, participants diagnosed and treated early for GDM had a lower risk of LGA than participants with early GDM who were randomized to routine care. Among these trials, most participants were screened with an HbA1c and randomized if the HbA1c was >5.7%.

### Comparison with existing literature

National organizations and societies have differing recommendations and guidelines for early screening of GDM (Supplementary Table 10). Most guidelines acknowledged that more research is needed on whether early screening and treatment lead to better outcomes. Through our systematic review, we found only 8 RCTs that evaluated pregnancy outcomes in participants screened and treated early compared with those treated with routine care. Most of the trials demonstrated that early screening and treatment for GDM did not improve maternal or neonatal outcomes. In this meta-analysis of these trials, we found no difference in the risk of LGA or other pregnancy outcomes between women who were screened and treated early for GDM.

In the United States, many practices use the 2-step method for early screening of GDM.[1] In the subgroup analysis of our meta-analysis, participants screened for GDM early using the 2-step method did not differ in the risk of LGA or other perinatal outcomes. However, there were increased risks of PTB in participants randomized to early screening compared with those screened at the routine time. It is unclear why those screened early had a higher risk of PTB; however, indicated and spontaneous PTBs were not differentiated. Thus, it is possible that labeling participants early in pregnancy, and associated enhanced surveillance, may have led to more indicated PTBs. To test this hypothesis, we compared the outcomes of those who screened positive early and were treated with that of those who had routine screening and treatment. We found that the increased risk of PTB remained despite early treatment in these trials.

A few trials found some improvements with early screening and treatment. Osmundson et al[33] found in a subgroup analysis that women without obesity with early hyperglycemia had

a 50% reduction in GDM diagnosis in the third trimester of pregnancy if they were treated early. In addition, in a pilot trial, Simmons et al[35] found a reduction in macrosomia. Our subgroup meta-analysis also found that among trials where all participants were screened, those screened and treated early for GDM had a reduced risk of LGA than those who had routine care. Of the included trials that screened all participants on the first prenatal visit, most performed universal screening using HbA1c and randomized those who had an HbA1c between 5.7% and 6.4%, but 1 study also randomized participants with an elevated FPG. The subgroup analysis, excluding participants with elevated FPG, failed to show a statistically significant difference in LGA compared with those with routine care.

There are 3 ongoing randomized controlled trials, which are summarized in Table 19. Many are evaluating outcomes with the use of oral glucose tolerance testing for early screening following ACOG recommendations. These trials will be informative as currently published trials show no difference in pregnancy outcomes when participants were screened on the basis of risk factors.

## Strengths and limitations

The main strength of this meta-analysis was the inclusion of randomized controlled trials evaluating early screening and treatment vs routine care for GDM. Overall, there was low heterogeneity between all trials included. In addition, the interventions were consistent and included diet, exercise, and blood glucose monitoring with or without medical treatment.

The main limitation was that included trials differed concerning screening strategies (eg, all participants vs risk based) and different methods and diagnostic criteria for early GDM diagnosis (eg, HbA1c and 1-step vs 2-step oral GTT) were used. However, we performed subgroup analyses to help control for these differences. There were also differences when participants were randomized among the included trials (eg, randomized to early screening vs randomized to early treatment or routine care after diagnosis of early GDM). LGA as a primary outcome may not necessarily be influenced by maternal glucose alone. A prospective study found that prepregnancy obesity was associated with macrosomia.[43] However, the Hyperglycemia and Adverse Pregnancy Outcome study demonstrated in a large cohort that only increasing BW and increasing umbilical cord blood serum C-peptides were associated with increased glucose levels. Another limitation was the small sample sizes of the RCTs. Overall, the sample size was not powered to assess differences in several secondary neonatal outcomes, such as shoulder dystocia and birth trauma.

## Conclusions and implications

We found that there was no difference in LGA and other pregnancy outcomes among all trials comparing early screening and treatment to routine care. In addition, early screening using the 2-step glucose testing method, and among participants with obesity, was associated with an increased risk of PE and PTB without a reduction in LGA or other neonatal outcomes. However, we found that a subgroup analysis of trials that universally screened participants, as opposed to only including participants with obesity or those with high-risk factors for the development of GDM, demonstrated a lower rate of LGA with early screening and treatment for GDM. Universal early GDM screening among the trials was

based on different screening approaches; thus, a specific screening method followed by treatment cannot be recommended. Our findings highlighted potential harms (eg, preterm delivery) associated with early GDM screening but also supported the possibility that certain subpopulations of women with glucose intolerance (eg, women with abnormal HbA1c) could benefit from early screening and treatment. However, future well-designed clinical trials comparing specific strategies are needed to confirm these findings.

## Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

## Acknowledgments

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This study has been registered in the International Prospective Register of Systematic Reviews (registration number CRD42021290052) on December 18, 2021.

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## AJOG MFM at a Glance

**Why was this study conducted?**

Although some national guidelines recommend early screening for gestational diabetes mellitus (GDM), current evidence on the benefit is conflicting.

**Key findings**

Overall meta-analysis of all included randomized controlled trials that evaluated pregnancy outcomes between participants who were screened and treated early for GDM and those who had routine care demonstrated no improvement in the incidence of large-for-gestational-age (LGA) neonates and other pregnancy outcomes. Among trials that screened all participants early in pregnancy, those screened and treated early had a reduced risk of LGA.

**What does this add to what is known?**

Data from this meta-analysis suggested that all pregnant participants should be universally screened early for GDM at the first prenatal visit.

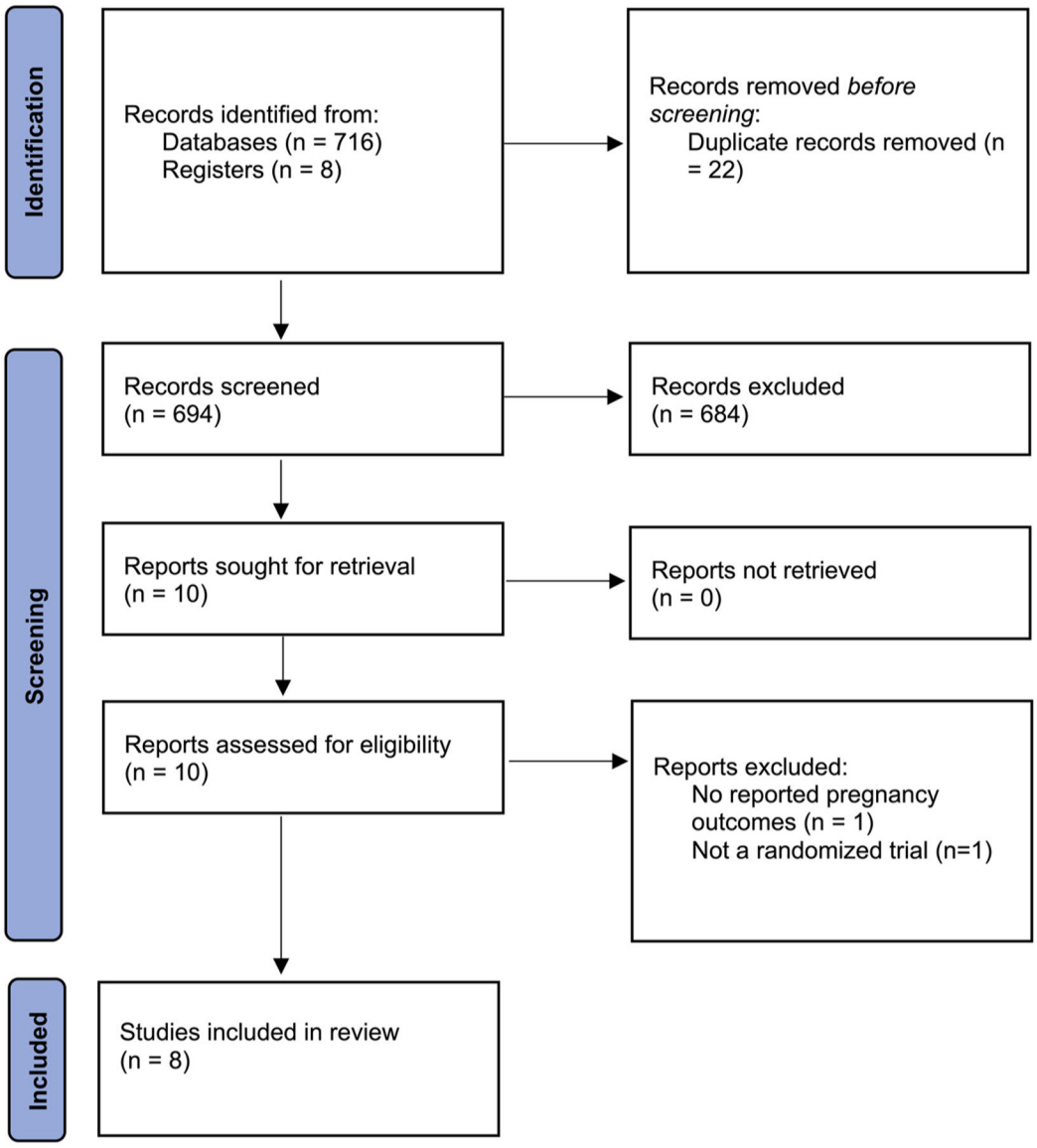


**FIGURE 1. PRISMA 2020 flow diagram of identified studies**

PRISMA, Preferred Reporting Item for Systematic Reviews and Meta-analyses.

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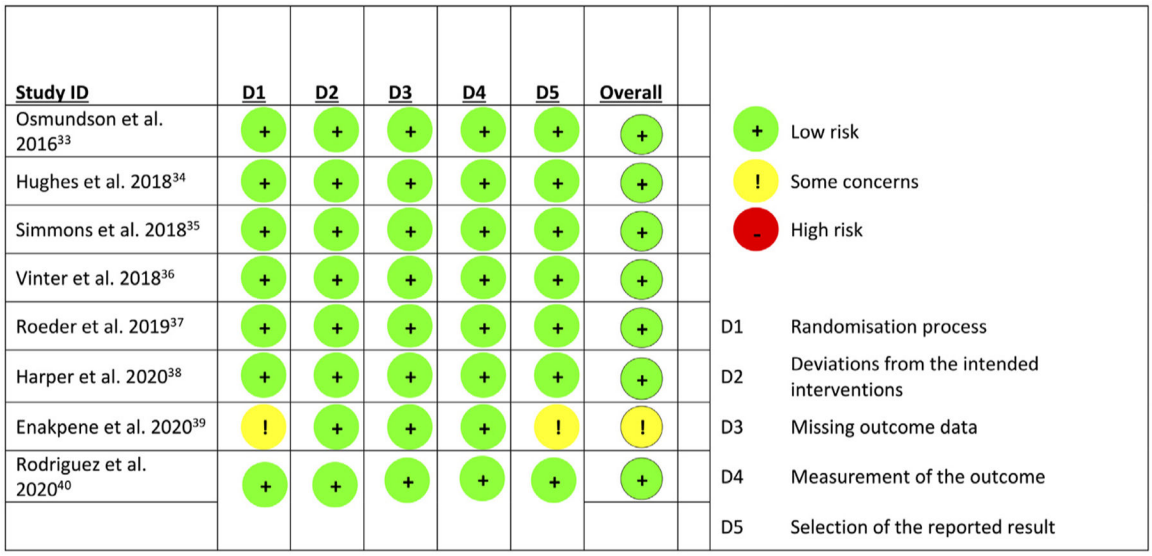


**FIGURE 2. Risk of bias 2 diagram**

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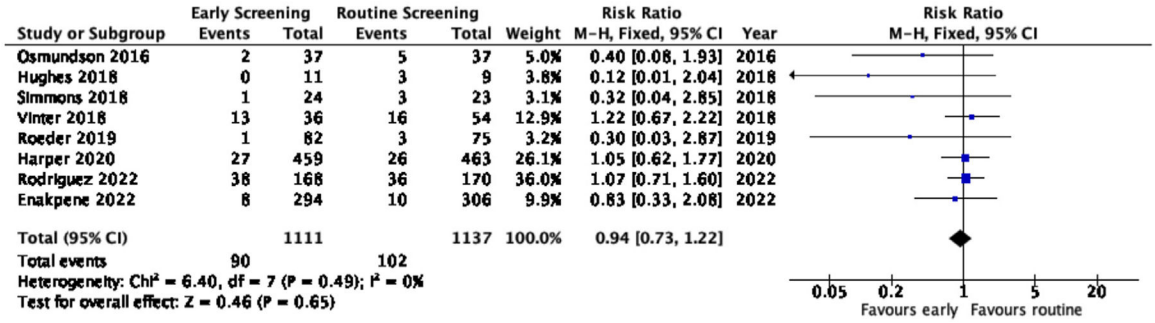


**FIGURE 3. LGA between early and routine screening among all trials**

The forest plot shows the incidence of LGA among all trials

CI, confidence interval; LGA, large for gestational age; OR, odds ratio.

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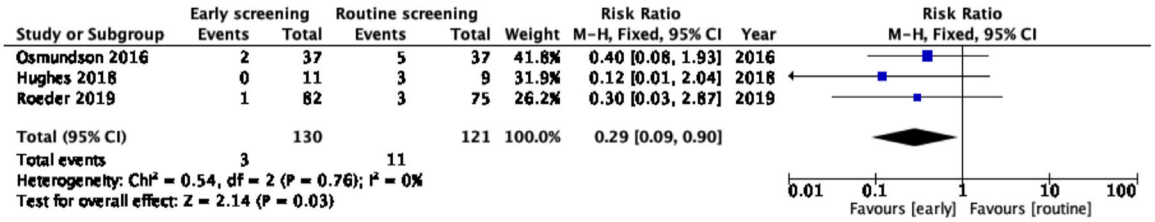


**FIGURE 4. LGA between early and routine screening and treatment among trials that screened all participants**

The forest plot shows the incidence of large for gestational age among trials screening all participants at first prenatal visit.

CI, confidence interval; LGA, large for gestational age; OR, odds ratio.

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## TABLE 1

Inclusion criteria of the trials

| Author, y | Screening criteria | Pregnancy plurality | Exclusion |
|---|---|---|---|
| Osmundson et al,[33] 2016 | All participants | Singleton | Pregestational diabetes mellitus<br>Chronic corticosteroid use<br>Multifetal pregnancy<br>Age<18 y<br>Previous pregnancy complicated by shoulder dystocia or birth injury or macrosomia |
| Hughes et al,[34] 2018 | All participants | Singleton | Age<18 y<br>Preexisting overt diabetes mellitus<br>Fetus with lethal congenital anomaly<br>Multiple pregnancy |
| Simmons et al,[35] 2018 | Based on GDM risk factors by the Australasian Diabetes in Pregnancy Society[42] | Singleton | Inability to understand English<br>Major active medical disorder<br>Age<18 y |
| Vinter et al,36,[a] 2018 | Participants with obesity (30–45 kg/m$^2$) | Singleton | Age<18 y; age>40 y<br>Previous serious obstetrical complications<br>Major medical disorders including pregestational diabetes mellitus, alcohol abuse<br>Non-Danish speaking |
| Roeder et al,[37] 2019 | All participants | Singleton | Age<18 y<br>Preexisting diabetes mellitus (including Hba1c>6.5% or FPG>126 mg/dL<br>Multiple pregnancy |
| Harper et al,[38] 2020 | Participants with obesity (≥30 kg/m$^2$) | Singleton | Previous cesarean delivery<br>Preexisting diagnosis of diabetes mellitus<br>History of bariatric surgery<br>Major medical illness (eg, cardiac disease or sickle cell disease)<br>Known fetal anomalies<br>Chronic steroid use |
| Enakpene et al,39,[b] 2022 | Participants with obesity (≥30 kg/m$^2$) | Singleton | Preexisting diabetes mellitus<br>1-h GCT≥200 mg/dL or A1c≥6.5%<br>History of GDM in past pregnancy<br>Known impaired glucose tolerance<br>Multifetal pregnancy<br>Gestational age of >20 wk<br>Present of lethal abnormalities or chromosomal anomaly in index pregnancy |
| Rodriguez et al,40,[b] 2022 | Based on risk factors of the 2013 ACOG 2013 Practice Bulletin | Singleton or multiple pregnancy | Gestational age of >18 wk at first prenatal visit<br>Fetal congenital malformations<br>Pregestational diabetes mellitus or overt diabetes mellitus<br>Early diabetes mellitus screen performed before enrollment<br>Medical contraindications to glucose tolerance testing<br>Chronic use of steroids |

*ACOG*, American College of Obstetricians and Gynecologists; *FPG*, fasting plasma glucose; *GCT*, glucose challenge test; *GDM*, gestational diabetes mellitus.

[a] Secondary analysis of a primary randomized clinical trial[41]

[b] Conference abstract.

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## TABLE 2

GDM screening methods

| Author, y | Timing | Method for <20 wk | Method for >20 wk | GDM<20 wk diagnostic criteria | GDM>20 wk diagnostic criteria |
|---|---|---|---|---|---|
| Osmundson et al,[33] 2016 | <14 wk | HbA1c initial prenatal laboratory tests | 2-h, 75-g OGTT | HbA1c of 5.7%–6.4% | FBG level≥92 mg/dL, 1-h FBG level≥180 mg/dL, or 2-h FBG level≥153 mg/dL (IADPSG criteria) |
| Hughes et al,[34] 2018 | <14 wk | HbA1c initial prenatal laboratory tests | 2-h, 75-g OGTT | HbA1c of 5.9%–6.4% | FBG level≥5.5 mmol/L (99 mg/dL) or 2-h FBG≥9.0 mmol/L (162 mg/dL) |
| Simmons et al,[35] 2018 | 4 0/7 to 19 6/7 wk | 2-h, 75-g OGTT | 2-h, 75-g OGTT | FBG level≥7.0 and/or 2-h FBG level≥11.1 mmol/L | FBG level≥7.0 and/or 2-h FBG level≥11.1 mmol/L |
| Vinter et al,36,[a] 2018 | 12–15 wk | 2-h, 75-g OGTT | 2-h, 75-g OGTT | FBG level >5.1 mmol/L and/or >8.5 mmol/L at 2 h (2013 WHO GDM criteria) | FBG level>5.1 mmol/L and/or >8.5 mmol/L at 2 h (WHO 2013 GDM criteria) |
| Roeder et al,[37] 2019 | ≤15 wk | HbA1c and FBG | 2-h, 75-g OGTT | Hba1c 5.7%–6.4% and/or FBG level of 92–125 mg/dL | FBG level≥92 mg/dL, 1-h FBG level≥180 mg/dL, or 2-h FBG level≥153 mg/dL (IADPSG criteria) |
| Harper et al,[38] 2020 | <20 wk | 2-step method (1-h GCT and 3-h GTT) | 2-step method (1-h GCT and 3-h GTT) | Carpenter-Coustan criteria | Carpenter-Coustan criteria |
| Enakpene et al,39,[b] 2022 | <20 wk | 2-step method (1-h GCT and 3-h GTT) | 2-step method (1-h GCT and 3-h GTT) | Carpenter-Coustan criteria | Carpenter-Coustan criteria |
| Rodriguez et al,40,[b] 2022 | 12–18 wk | 2-step method (1-h GCT and 3-h GTT) | 2-step method (1-h GCT and 3-h GTT) | Carpenter-Coustan criteria | Carpenter-Coustan criteria |

*FBG*, fasting blood glucose; *GCT*, glucose challenge test; *GDM*, gestational diabetes; *GTT*, glucose tolerance test; *IADPSG*, International Association of the Diabetes and Pregnancy Study Groups; *OGTT*, oral glucose tolerance test; *WHO*, World Health Organization.

[a] Secondary analysis of a primary randomized clinical trial[41]

[b] Conference abstracts.

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**TABLE 3**

Perinatal outcomes among all trials

| Author, y | BW (g) | LGA | SGA | Shoulder dystocia | Neonatal hypoglycemia | NICU admission | Cord blood C-peptide |
|---|---|---|---|---|---|---|---|
| Osmundson et al,[33] 2016 | 3218±611 vs 3322±473 | 2/37 (5.4) vs 5/37 (13.5) | 4/34 (11.8) vs 2/33 (6.1)[a] | Not stated | Not stated | Not stated | 3/23 (13.0) vs 1/17 (5.9) |
| Hughes et al,[34] 2018 | 3209±613 vs 3344±522 | 0/11 (0.0) vs 3/9 (33.0) | 3/11 (27.0) vs 0/9 (0.0) | 0/23 (0.0) vs 0/21 (0.0) | 1/9 (11.0) vs 1/8 (13.0) | 1/23 (4.0) vs 2/21 (10.0) | Not stated |
| Simmons et al,[35] 2018 | 3055±758 vs 3552±743 | 1/24 (4.3) vs 3/23 (13.0) | 3/24 (12.5) vs 3/23 (13.0) | Not stated | 0/24 (0.0) vs 0/23 (0.0) | 4/11 (36.0) vs 0/9 (0.0) | Not stated |
| Vinter et al,36,[b] 2018 | 3865 (3508–4136) vs 3575 (3300–4178)[c] | 13/36 (36.1) vs 16/54 (29.6) | Not stated | 0/36 (0.0) vs 1/54 (1.9) | Not stated | 5/36 (13.9) vs 10/54 (18.5) | 7/36 (19.4) vs 3/54 (5.6) |
| Roeder et al,[37] 2019 | 3165±445 vs 3408±1130 | 1/82 (1.5) vs 3/75 (5.0) | Not stated | 0/82 (0) vs 2/73 (2.7) | 13/82 (15.9) vs 15/73 (20.5)[a] | 26/82 (31.7) vs 19/73 (26.0)[a] | 1/82 (1.5) vs 4/75 (7.1) |
| Harper et al,[38] 2020 | 3095±723 vs 3136±678[a] | 27/459 (5.9) vs 26/463 (5.6) | Not stated | 30/459 (6.6) vs 32/463 (6.9) | 22/459 (4.8) vs 19/463 (4.1) | 87/446 (19.5) vs 72/450 (16.0)[a] | Not stated |
| Enakpene et al,39,[d] 2022 | 3148±726 vs 3160±687 | 8/294 (2.8) vs 10/306 (3.4) | Not stated | 5/294 (1.7) vs 5/306 (1.6) | Not stated | 23/294 (7.8) vs 28/306 (9.1) | Not stated |
| Rodriguez et al,40,[d] 2022 | 3221±713 vs 3278±611 | 38/168 (22.6) vs 36/170 (21.2) | Not stated | Not stated | 17/85 (20.0) vs 16/88 (18.1) | 26/166 (15.7) vs 36/146 (24.7) | Not stated |
| Published data, total | 616 vs 620 | 90/111 (8.1) vs 102/1137 (9.0) | 6/35 (17.1) vs 3/32 (9.3) | 35/894 (3.9) vs 40/917 (4.4) | 40/577 (6.9) vs 30/582 (5.2) | 59/530 (11.1) vs 76/536 (14.2) | 11/141 (7.8) vs 8/146 (5.5) |
| Published data, RR or MD (95% CI) | −71.62 (−149.03 to 5.78) | 0.94 (0.73–1.22) | 1.70 (0.49–5.87) | 0.89 (0.58–1.38) | 1.13 (0.74–1.73) | 0.77 (0.56–1.06) | 1.54 (0.66–3.59) |
| Published data, $I^2$ | 23% | 0% | 23% | 0% | 0% | 0% | 57% |
| With unpublished data, total | 1075 vs 1083 | 90/1111 (8.1) vs 102/1137 (9.0) | 10/69 (14.5) vs 5/65 (7.7) | 35/894 (3.9) vs 40/917 (4.4) | 53/659 (8.0) vs 51/655 (7.8) | 172/1058 (16.3) vs 167/1059 (15.8) | 11/141 (7.8) vs 8/146 (5.5) |
| With unpublished data (in grams), RR or MD (95% CI) | −58.68 (−117.51 to 0.14) | 0.94 (0.73–1.22) | 1.78 (0.66–4.79) | 0.89 (0.58–1.38) | 1.02 (0.71–1.46) | 1.02 (0.84–1.23) | 1.54 (0.66–3.59) |
| With unpublished data, $I^2$ | 11% | 0% | 0% | 0% | 0% | 36% | 57% |

Data are presented as mean±standard deviation or number/total number (percentage), intervention vs control groups.

*BW*, birthweight; *CI*, confidence interval; *LGA*, large for gestational age; *MD*, mean difference; *NICU*, neonatal intensive care unit; *RR*, relative risk; *SGA*, small for gestational age.

[a] Unpublished data kindly obtained by the original authors

[b] Secondary analysis of a primary randomized clinical trial[41]

[c] Presented as median (interquartile range) as per original trial

[d] Conference abstract.

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*Am J Obstet Gynecol MFM*. Author manuscript; available in PMC 2024 October 20.

**TABLE 4**

Maternal outcomes among all trials

| Author, y | Intervention vs control | GDM | GDM diagnosed at <20 wk | GDM diagnosed at >20 wk | Gestational hypertension | PE | PTB | Induction | Cesarean delivery |
|---|---|---|---|---|---|---|---|---|---|
| Osmundson et al,[33] 2016 | 42 vs 41 | 42/42 (100.0) vs 41/41 (100.0)[a] | 42/42 (100.0) vs 41/41 (100.0)[a] | 19/42 (45.2) vs 23/41 (56.1)[a] | 3/38 (7.9) vs 3/36 (8.3) | Not stated | 4/35 (11.4) vs 5/36 (13.9)[c] | 16/37 (43.2) vs 13/37 (35.4) | 11/37 (29.7) vs 17/37 (46) |
| Hughes et al,[34] 2018 | 24 vs 23 | 24/24 (100.0) vs 23/23 (100.0) | 24/24 (100.0) vs 23/23 (100.0) | Not clear | Not stated | 0/23 (0.0) vs 3/21 (14.0) | 1/23 (4.0) vs 1/21 (5.0) | 10/23 (43.0) vs 11/21 (52.0) | 6/23 (26.0) vs 9/21 (43.0) |
| Simmons et al,[35] 2018 | 11 vs 10 | 11/11 (100.0) vs 10/10 (100.0) | 11/11 (100.0) vs 10/10 (100.0) | Not applicable | Not stated | 3/11 (27.2) vs 0/9 (0.0) | Not stated | 7/11 (64.0) vs 3/10 (33.0) | 5/11 (45.5) vs 3/10 (33.0) |
| Vinter et al,36,[b] 2018 | 36 vs 54 | 36/36 (100.0) vs 54/54 (100.0) | 36/36 (100.0) vs 54/54 (100.0) | Not applicable | 4/36 (11.1) vs 9/54 (16.7) | 2/36 (5.6) vs 3/54 (5.6) | 2/36 (5.6) vs 2/54 (3.7) | Not stated | 12/36 (33.3) vs 12/54 (22.2) |
| Roeder et al,[37] 2019 | 82 vs 75 | 82/82 (100.0) vs 75/75 (100.0) | 82/82 (100.0) vs 75/75 (100.0) | Not applicable | Not stated | 3/82 (3.7) vs 5/73 (6.8)[c] | 6/81 (7.4) vs 9/73 (12.3) | 3/82 (3.7) vs 1/73 (1.4) | 26/82 (31.0) vs 20/75 (27.0) |
| Harper et al,[38] 2020 | 459 vs 463 | 69/387 (17.8) vs 56/443 (12.6) | 29/387 (7.5) vs 1/443 (0.2) | 40/387 (10.3) vs 55/443 (12.4) | 74/459 (16.2) vs 58/463 (12.6) | 62/459 (13.6) vs 44/463 (9.5) | 79/455 (17.4) vs 49/458 (10.7)[c] | 212/455 (46.6) vs 229/458 (50.0)[c] | 79/459 (17.2) vs 93/463 (20.1) |
| Enakpene et al,39,[d] 2022 | 294 vs 306 | 64/294 (21.8) vs 45/306 (14.7) | Not clear | Not clear | Not stated | 42/294 (14.3) vs 34/306 (11.1) | Not stated | Not stated | 106/294 (37.6) vs 118/306 (40.1) |
| Rodriguez et al,40,[d] 2022 | 462 vs 477 | 60/462 (13.0) vs 58/477 (12.2) | Not stated | Not stated | 29/462 (6.3) vs 37/461 (8.1) | 30/462 (6.5) vs 37/477 (7.7) | 80/462 (17.3) vs 81/477 (16.9) | Not stated | Not stated |
| Published data, total | 1410 vs 1449 | 388/1338 (29.0) vs 361/1429 (25.3) | 224/582 (38.5) vs 204/646 (31.6) | 59/429 (13.8) vs 78/484 (16.1) | 110/995 (11.1) vs 107/1014 (10.6) | 139/1285 (10.8) vs 121/1330 (9.1) | 87/556 (15.6) vs 89/588 (15.1) | 36/153 (23.5) vs 28/141 (19.9) | 245/942 (26.0) vs 272/966 (28.2) |
| Published data, RR or MD | | 1.13 (1.04–1.24) | 1.15 (1.09–1.21) | 0.82 (0.61–1.11) | 1.06 (0.82–1.36) | 1.15 (0.92–1.44) | 1.02 (0.78–1.33) | 1.22 (0.83–1.79) | 0.93 (0.80–1.07) |
| Published data, $I^2$ | | 96% | 98% | 0% | 20% | 25% | 0% | 1% | 4% |
| With unpublished data, total | 1410 vs 1449 | 388/1338 (29.0) vs 361/1429 (25.3) | 224/582 (38.5) vs 204/646 (31.6) | 59/429 (13.8) vs 78/484 (16.1) | 110/995 (11.1) vs 107/1014 (10.6) | 142/1367 (10.4) vs 126/1403 (9.0) | 172/1096 (15.7) vs 147/1124 (13.1) | 248/612 (40.5) vs 257/604 (42.5) | 245/942 (26.0) vs 272/966 (28.2) |

| Author, y | Intervention vs control | GDM | GDM diagnosed at <20 wk | GDM diagnosed at >20 wk | Gestational hypertension | PE | PTB | Induction | Cesarean delivery |
|---|---|---|---|---|---|---|---|---|---|
| With unpublished data, RR or MD (95% CI) | | 1.13 (1.04–1.24) | 1.15 (1.09–1.21) | 0.82 (0.61–1.11) | 1.06 (0.82–1.36) | 1.15 (0.92–1.44) | 1.19 (0.97–1.46) | 0.97 (0.85–1.10) | 0.93 (0.80–1.07) |
| With unpublished data, $I^2$ | | 96% | 98% | 0% | 20 | 24% | 27% | 3% | 4% |

Data are presented as mean±standard deviation or number/total number (percentage), intervention vs control groups.

*CI*, confidence interval; *GDM*, gestational diabetes mellitus; *MD*, mean difference; *PE*, preeclampsia; *PTB*, preterm birth; *RR*, relative risk.

[a] Different diagnostic criteria between early screening and late second-trimester screening (Table 2)

[b] Secondary analysis of a primary randomized clinical trial[41]

[c] Unpublished data kindly obtained by the original authors

[d] Conference abstract.

McLaren. Early screening for gestational diabetes. Am J Obstet Gynecol MFM 2022.

## TABLE 5

Perinatal outcomes among trials that screened all participants on first visit

| Author, y | BW (g) | LGA | SGA | Shoulder dystocia | Neonatal hypoglycemia | NICU admission | Cord blood C-peptide |
|---|---|---|---|---|---|---|---|
| Osmundson et al,[33] 2016 | 3218±611 vs 3322±473 | 2/37 (5.4) vs 5/37 (13.5) | 4/34 (11.8) vs 2/33 (6.1)[a] | Not stated | Not stated | Not stated | 3/23 (13.0) vs 1/17 (5.9) |
| Hughes et al,[34] 2018 | 3209±613 vs 3344±522 | 0/11 (0.0) vs 3/9 (33.0) | 3/11 (27.0) vs 0/9 (0.0) | 0/23 (0.0) vs 0/21 (0.0) | 1/9 (11 vs 1/8 (13) | 1/23 (4.0) vs 2/21 (10.0) | Not stated |
| Roeder et al,[37] 2019 | 3165±445 vs 3408±1130 | 1/82 (1.5) vs 3/75 (5.0) | Not stated | 0/82 (0.0) vs 2/73 (2.7) | 13/82 (15.9) vs 15/73 (20.5)[a] | 26/82 (31.7) vs 19/73 (26.0)[a] | 1/82 (1.5) vs 4/75 (7.1) |
| Published data, total | 130 vs 121 | 3/130 (2.3) vs 11/121 (9.1) | 3/11 (27.0) vs 0/9 (0.0) | 0/105 (0.0) vs 2/94 (2.1) | 1/9 (11.0) vs 1/8 (13.0) | 1/23 (4.0) vs 2/21 (10.0) | 4/105 (3.8) vs 5/92 (5.4) |
| Published data, RR or MD (95 CI) | −163.19 (−335.80 to 9.42) | 0.29 (0.09–0.90) | 5.83 (0.34–100.03) | 0.18 (0.01–3.65) | 0.89 (0.07–12.00) | 0.46 (0.04–4.68) | 0.66 (0.18–2.47) |
| Published data, $I^2$ | 0% | 0% | — | — | — | — | 53% |
| With unpublished data, total | | | 7/45 (15.6) vs 2/42 (4.8) | | 14/92 (15.4) vs 16/81 (19.8) | 27/105 (25.7) vs 21/94 (22.3) | |
| With unpublished data, RR or MD (95% CI) | | | 2.77 (0.69–11.06) | | 0.78 (0.41–1.49) | 1.15 (0.70–1.87) | |
| With unpublished data, $I^2$ | | | 0% | | 0% | 0% | |

Data are presented as mean±standard deviation or number/total number (percentage), intervention vs control groups.

*BW*, birthweight; *CI*, confidence interval; *LGA*, large for gestational age; *MD*, mean difference; *NICU*, neonatal intensive care unit; *RR*, relative risk; *SGA*, small for gestational age.

[a] Unpublished data kindly obtained by the original authors.

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**TABLE 6**

Maternal outcomes among trials that screened all participants on first visit

| Author, y | Intervention vs control | GDM | GDM diagnosed at <20 wk | GDM diagnosed at >20 wk | Gestational hypertension | PE | PTB | Induction | Cesarean delivery |
|---|---|---|---|---|---|---|---|---|---|
| Osmundson et al,[33] 2016 | 42 vs 41 | 42/42 (100.0) vs 41/41 (100.0)[a] | 42/42 (100.0) vs 41/41 (100.0)[a] | 19/42 (45.2) vs 23/41 (56.1) | 3/38 (7.9) vs 3/36 (8.3) | Not stated | 4/35 (11.4) vs 5/36 (13.9)[b] | 16/37 (43.2) vs 13/37 (35.4) | 11/37 (29.7) vs 17/37 (46.0) |
| Hughes et al,[34] 2018 | 24 vs 23 | 24/24 (100.0) vs 23/23 (100.0) | 24/24 (100.0) vs 23/23 (100.0) | Not clear | Not stated | 0/23 (0.0) vs 3/21 (14.0) | 1/23 (4.0) vs 1/21 (5.0) | 10/23 (43.0) vs 11/21 (52.0) | 6/23 (26.0) vs 9/21 (43.0) |
| Roeder et al,[37] 2019 | 82 vs 75 | 82/82 (100.0) vs 75/75 (100.0) | 82/82 (100.0) vs 75/75 (100.0) | Not applicable | Not stated | 3/82 (3.7) vs 5/73 (6.8)[b] | 6/81 (7.4) vs 9/73 (12.3)[b] | 3/82 (3.7) vs 1/73 (1.4) | 26/82 (31.0) vs 20/75 (27.0) |
| Published data, total | 148 vs 139 | 148/148 (100.0) vs 139/139 (100.0) | 148/148 (100.0) vs 139/139 (100.0) | 19/42 (45.2) vs 23/41 (56.1) | 3/38 (7.9) vs 3/36 (8.3) | 0/23 (0.0) vs 3/21 (14.0) | 1/23 (4.0) vs 1/21 (5.0) | 29/142 (20.4) vs 25/131 (19.1) | 43/142 (30.3) vs 46/133 (34.6) |
| Published data, RR or MD (95% CI) | | 1.00 (0.98–1.02) | 1.00 (0.98–1.02) | 0.81 (0.53–1.24) | 0.95 (0.20–4.39) | 0.13 (0.01–2.39) | 0.91 (0.06–13.69) | 1.11 (0.73–1.68) | 0.88 (0.62–1.24) |
| Published data, $I^2$ | | 0% | 0% | — | — | — | — | 0% | 37% |
| With unpublished data, total | | | | | | 3/105 (2.9) vs 8/94 (8.5) | 11/139 (7.9) vs 15/130 (11.5) | | |
| With unpublished data, RR or MD (95% CI) | | | | | | 0.37 (0.11–1.25) | 0.69 (0.33–1.45) | | |
| With unpublished data, $I^2$ | | | | | | 0% | 0% | | |

Data are presented as mean±standard deviation or number/total number (percentage), intervention vs control groups.

*CI*, confidence interval; *GDM*, gestational diabetes mellitus; *MD*, mean difference; *PE*, preeclampsia; *PTB*, preterm birth; *RR*, relative risk.

[a]Different diagnostic criteria

[b]Unpublished data kindly obtained by original authors.

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## TABLE 7

Perinatal outcomes among trials that screened all participants with obesity

| Author, y | BW (g) | LGA | SGA | Shoulder dystocia | Neonatal hypoglycemia | NICU admission | Cord blood C-peptide |
|---|---|---|---|---|---|---|---|
| Vinter et al,36,[a] 2018 | 3865 (3508–4136) vs 3575 (3300–4178)[b] | 13/36 (36.1) vs 16/54 (29.6) | Not stated | 0/36 (0.0) vs 1/54 (1.9) | Not stated | 5/36 (13.9) vs 10/54 (18.5) | 7/36 (19.4) vs 3/54 (5.6) |
| Harper et al,[38] 2020 | 3095±723 vs 3136±678[d] | 27/459 (5.9) vs 26/463 (5.6) | Not stated | 30/459 (6.6) vs 32/463 (6.9) | 22/459 (4.8) vs 19/463 (4.1) | 87/446 (19.5) vs 72/450 (16.0)[d] | Not stated |
| Enakpene et al,39,[c] 2022 | 3148±726 vs 3160±687 | 8/294 (2.8) vs 10/306 (3.4) | Not stated | 5/294 (1.7) vs 5/306 (1.6) | Not stated | 23/294 (7.8) vs 28/306 (9.1) | Not stated |
| Published data, total | 294 vs 306 | 48/789 (6.1) vs 52/823 (6.3) | — | 35/789 (4.4) vs 38/823 (4.6) | 22/459 (4.8) vs 19/463 (4.1) | 28/330 (8.5) vs 38/360 (10.6) | 7/36 (19.4) vs 3/54 (5.6) |
| Published data, RR or MD (95% CI) | −12.00 (−125.19–101.19) | 1.05 (0.73–1.51) | — | 0.94 (0.61–1.47) | 1.17 (0.64–2.13) | 0.83 (0.52–1.32) | 3.50 (0.97–12.65) |
| Published data, $I^2$ | — | 0% | — | 0% | — | 0% | — |
| With unpublished data, total | 753 vs 769 | | | | | 115/776 (14.8) vs 110/810 (13.6) | |
| With unpublished data, RR or MD (95% CI) | −29.69 (−100.37–40.99) | | | | | 1.09 (0.86–1.39) | |
| With unpublished data, $I^2$ | 0% | | | | | 0% | |

Data are presented as mean±standard deviation or number/total number (percentage), intervention vs control groups.

*BW*, birthweight; *CI*, confidence interval; *LGA*, large for gestational age; *MD*, mean difference; *NICU*, neonatal intensive care unit; *RR*, relative risk; *SGA*, small for gestational age.

[a] Secondary analysis of a primary randomized clinical trial[41]

[b] Presented as median (interquartile range) as per original trial

[c] Conference abstract

[d] Unpublished data kindly obtained by original authors.

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**TABLE 8**

Maternal outcomes among trials that screened all participants with obesity

| Author, y | Intervention vs control | GDM | GDM diagnosed at <20 wk | GDM diagnosed at >20 wk | Gestational hypertension | PE | PTB | Induction | Cesarean delivery |
|---|---|---|---|---|---|---|---|---|---|
| Vinter et al,36,[a] 2018 | 36 vs 54 | 36/36 (100.0) vs 54/54 (100.0) | 36/36 (100.0) vs 54/54 (100.0) | Not applicable | 4/36 (11.1) vs 9/54 (16.7) | 2/36 (5.6) vs 3/54 (5.6) | 2/36 (5.6) vs 2/54 (3.7) | Not stated | 12/36 (33.3) vs 12/54 (22.2) |
| Harper et al,[38] 2020 | 459 vs 463 | 69/387 (17.8) vs 56/443 (12.6) | 29/387 (7.5) vs 1/443 (0.2) | 40/387 (10.3) vs 55/443 (12.4) | 74/459 (16.2) vs 58/463 (12.6) | 62/459 (13.6) vs 44/463 (9.5) | 79/455 (17.4) vs 49/458 (10.7)[b] | Not stated | 79/459 (17.2) vs 93/463 (20.1) |
| Enakpene et al,39,[c] 2022 | 294 vs 306 | 64/294 (21.8) vs 45/306 (14.7) | Not stated | Not stated | Not stated | 42/294 (14.3) vs 34/306 (11.1) | Not stated | Not stated | 106/294 (37.6) vs 118/306 (40.1) |
| Published data, total | 789 vs 823 | 169/717 (23.6) vs 155/803 (19.3) | — | 40/387 (10.3) vs 55/443 (12.4) | 78/495 (15.8) vs 67/517 (13.0) | 106/789 (13.4) vs 81/823 (9.8) | 2/36 (5.6) vs 2/54 (3.7) | — | 197/789 (25.0) vs 223/823 (27.1) |
| Published data, RR or MD (95% CI) | | 1.30 (1.10–1.55) | — | 0.83 (0.57–1.22) | 1.22 (0.90–1.65) | 1.35 (1.03–1.78) | 1.50 (0.22–10.17) | — | 0.93 (0.79–1.09) |
| Published data, $I^2$ | | 98% | — | — | 21% | 0% | — | — | 11% |
| With unpublished data, total | | | | | | | 81/491 (16.5) vs 51/512 (10.0) | | |
| With unpublished data, RR or MD (95% CI) | | | | | | | 1.62 (1.17–2.25) | | |
| With unpublished data, $I^2$ | | | | | | | 0% | | |

Data are presented as mean±standard deviation or number/total number (percentage), intervention vs control groups.

*CI*, confidence interval; *GDM*, gestational diabetes mellitus; *MD*, mean difference; *PE*, preeclampsia; *PTB*, preterm birth; *RR*, relative risk.

[a] Secondary analysis of a primary randomized clinical trial[41]

[b] Unpublished data

[c] Conference abstract.

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## TABLE 9

Perinatal outcomes among trials that screened participants based on risk factors

| Author, y | BW (g) | LGA | SGA | Shoulder dystocia | Neonatal hypoglycemia | NICU admission | Cord blood C-peptide |
|---|---|---|---|---|---|---|---|
| Simmons et al,35,[a] 2018 | 3055±758 vs 3552±743 | 1/24 (4.3) vs 3/23 (13.0) | 3/24 (12.5) vs 3/23 (13.0) | Not stated | 0/24 (0.0) vs 0/23 (0.0) | 4/11 (36.0) vs 0/9 (0.0) | Not stated |
| Rodriguez et al,40,[b] 2022 | 3221±713 vs 3278±611 | 38/168 (22.6) vs 36/170 (21.2) | Not stated | Not stated | 17/85 (20.0) vs 16/88 (18.1) | 26/166 (15.7) vs 36/146 (24.7) | Not stated |
| Published data, total | 192 vs 193 | 39/192 (20.3) vs 39/193 (20.2) | 3/24 (12.5) vs 3/23 (13.0) | — | 17/109 (15.6) vs 16/111 (14.4) | 30/177 (16.9) vs 36/155 (23.2) | — |
| Published data, RR or MD (95% CI) | −100.22 (−234.72 to 34.28) | 1.01 (0.68–1.50) | 0.96 (0.21–4.27) | — | 1.10 (0.60–2.03) | 0.73 (0.47–1.13) | — |
| Published data, $I^2$ | 73% | 12% | — | — | — | 0% | — |

Data are presented as mean±standard deviation or number/total number (percentage), intervention vs control groups.

*BW*, birthweight; *CI*, confidence interval; *LGA*, large for gestational age; *MD*, mean difference; *NICU*, neonatal intensive care unit; *RR*, relative risk; *SGA*, small for gestational age.

[a] Specific risk factors: previous hyperglycemia in pregnancy, previously elevated blood glucose level, maternal age of ≥40 years, ethnicity, first-degree relative with diabetes mellitus or a sister with hyperglycemia in pregnancy, prepregnancy body mass index of >30 kg/m$^2$, previous macrosomia, polycystic ovarian syndrome, and use of corticosteroids or antipsychotics[42]

[b] Conference abstract; specific risk factors: obesity, history of previous pregnancy complicated by gestational diabetes mellitus, history of previous pregnancy complicated by macrosomia, first-degree relative with diabetes mellitus, and multiple pregnancy.

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## TABLE 10

Maternal outcomes among trials that screened participants based on risk factors

| Author, y | Intervention vs control | GDM | GDM diagnosed at <20 wk | GDM diagnosed at >20 wk | Gestational hypertension | PE | PTB | Induction | Cesarean delivery |
|---|---|---|---|---|---|---|---|---|---|
| Simmons et al,35,[a] 2018 | 11 vs 10 | 11/11 (100.0) vs 10/10 (100.0) | 11/11 (100.0) vs 10/10 (100.0) | Not applicable | Not stated | 3/11 (27.2) vs 0/9 (0.0) | Not stated | Not stated | 7/11 (64.0) vs 3/10 (33.0) |
| Rodriguez et al,40,[b] 2022 | 462 vs 477 | 60/462 (13.0) vs 58/477 (12.2) | Not stated | Not stated | 29/462 (6.3) vs 37/477 (8.1) | 30/462 (6.5) vs 37/477 (7.7) | 80/462 (17.3) vs 81/477 (16.9) | Not stated | Not stated |
| Published data, total | 473 vs 487 | 71/473 (15.0) vs 68/487 (14.0) | 11/11 (100.0) vs 10/10 (100.0) | — | 29/462 (6.3) vs 38/477 (8.1) | 33/473 (7.0) vs 37/486 (7.6) | 80/462 (17.3) vs 81/477 (16.9) | — | 7/11 (64.0) vs 3/10 (33.0) |
| Published data, RR (95% CI) | | 1.06 (0.79–1.41) | 1.00 (0.84–1.19) | — | 0.78 (0.49–1.25) | 0.91 (0.58–1.43) | 1.02 (0.77–1.35) | — | 2.12 (0.74–6.04) |
| Published data, $I^2$ | | 0% | — | — | — | 43% | — | — | — |

Data are presented as mean±standard deviation or number/total number (percentage), intervention vs control groups.

*CI*, confidence interval; *GDM*, gestational diabetes mellitus; *PE*, preeclampsia; *PTB*, preterm birth; *RR*, relative risk.

[a] Specific risk factors: previous hyperglycemia in pregnancy, previously elevated blood glucose level, maternal age of ≥40 years, ethnicity, first-degree relative with diabetes mellitus or a sister with hyperglycemia in pregnancy, prepregnancy body mass index of >30 kg/$m^2$, previous macrosomia, polycystic ovarian syndrome, and use of corticosteroids or antipsychotics.[42]

[b] Conference abstract; specific risk factors: obesity, history of previous pregnancy complicated by gestational diabetes mellitus, history of previous pregnancy complicated by macrosomia, first-degree relative with diabetes mellitus, and multiple pregnancy.

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## TABLE 11

Perinatal outcomes among trials that screened participants based on the 2-step method (1-hour GCT and 3-hour GTT)

| Author, y | BW (g) | LGA | SGA | Shoulder dystocia | Neonatal hypoglycemia | NICU admission | Cord blood C-peptide |
|---|---|---|---|---|---|---|---|
| Harper et al,[38] 2020 | 3095±723 vs 3136±678[a] | 27/459 (5.9) vs 26/463 (5.6) | Not stated | 30/459 (6.6) vs 32/463 (6.9) | 22/459 (4.8) vs 19/463 (4.1) | 87/446 (19.5) vs 72/450 (16.0)[a] | Not stated |
| Enakpene et al,39,[b] 2022 | 3148±726 vs 3160±687 | 8/294 (2.8) vs 10/306 (3.4) | Not stated | 5/294 (1.7) vs 5/306 (1.6) | Not stated | 23/294 (7.8) vs 28/306 (9.1) | Not stated |
| Rodriguez et al,40,[b] 2022 | 3221±713 vs 3278±611 | 38/168 (22.6) vs 36/170 (21.2) | Not stated | Not stated | 17/85 (20.0) vs 16/88 (18.1) | 26/166 15.7) vs 36/146 (24.7) | Not stated |
| Published data, total | 462 vs 476 | 73/921 (7.9) vs 72/939 (7.7) | — | 35/753 (4.6) vs 37/769 (4.8) | 39/544 (7.2) vs 35/551 (6.4) | 49/460 (10.7) vs 64/452 (14.2) | — |
| Published data, RR or MD (95% CI) | −29.54 (−117.96 to 58.88) | 1.03 (0.76–1.39) | — | 0.96 (0.61–1.50) | 1.14 (0.74–1.75) | 0.73 (0.52–1.02) | — |
| Published data, $I^2$ | 0% | 0% | — | 0% | 0% | 0% | — |
| With unpublished data, total | 921 vs 939 | | | | | 136/906 (15.0) vs 136/902 (15.1) | |
| With unpublished data, RR or MD (95% CI) | −35.14 (−98.38 to 28.11) | | | | | 0.98 (0.79–1.22) | |
| With unpublished data, $I^2$ | 0% | | | | | 67% | |

Data are presented as mean±standard deviation or number/total number (percentage), intervention vs control groups.

*BW*, birthweight; *CI*, confidence interval; *GCT*, glucose challenge test; *GTT*, glucose tolerance test; *LGA*, large for gestational age; *MD*, mean difference; *NICU*, neonatal intensive care unit; *RR*, relative risk; *SGA*, small for gestational age.

[a] Unpublished data kindly obtained by original authors

[b] Conference abstract.

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**TABLE 12**

Maternal outcomes among trials that screened participants based on the 2-step method (1-hour GCT and 3-hour GTT)

| Author, y | Intervention vs control | GDM | GDM diagnosed at <20 wk | GDM diagnosed at >20 wk | Gestational hypertension | PE | PTB | Induction | Cesarean delivery |
|---|---|---|---|---|---|---|---|---|---|
| Harper et al,[38] 2020 | 459 vs 463 | 69/387 (17.8) vs 56/443 (12.6) | 29/387 (7.5) vs 1/443 (0.2) | 40/387 (10.3) vs 55/443 (12.4) | 74/459 (16.2) vs 58/463 (12.6) | 62/459 (13.6) vs 44/463 (9.5) | 79/455 (17.4) vs 49/458 (10.7)[a] | 212/455 (46.6) vs 229/458 (50.0)[a] | 79/459 (17.2) vs 93/463 (20.1) |
| Enakpene et al,39,[b] 2022 | 294 vs 306 | 64/294 (21.8) vs 45/306 (14.7) | Not stated | Not stated | Not stated | 42/294 (14.3) vs 34/306 (11.1) | Not stated | Not stated | 106/294 (37.6) vs 118/306 (40.1) |
| Rodriguez et al,40,[b] 2022 | 462 vs 477 | 60/462 (13.0) vs 58/477 (12.2) | Not stated | Not stated | 29/462 (6.3) vs 39/477 (8.1) | 30/462 (6.5) vs 37/477 (7.7) | 80/462 (17.3) vs 81/477 (16.9) | Not stated | Not stated |
| Published data, total | 1215 vs 1246 | 193/1143 (16.9) vs 159/1226 (13.0) | 29/387 (7.5) vs 1/443 (0.2) | 40/387 (10.3) vs 55/443 (12.4) | 103/921 (11.2) vs 97/940 (10.3) | 104/753 (13.8) vs 78/769 (10.1) | 80/462 (17.3) vs 81/477 (16.9) | — | 185/753 (24.6) vs 211/769 (27.4) |
| Published data RR (95% CI) | | 1.30 (1.07–1.58) | — | 0.83 (0.57–1.22) | 1.08 (0.83–1.40) | 1.19 (0.94–1.51) | 1.02 (0.77–1.35) | — | 0.90 (0.76–1.06) |
| Published data, $I^2$ | | 4% | — | — | 69% | 38% | — | — | 0% |
| With unpublished data, total | | | | | | | 159/917 (17.3) vs 130/935 (13.9) | 212/455 (46.6) vs 229/458 (50.0) | |
| With unpublished data, RR (95% CI) | | | | | | | 1.25 (1.01–1.55) | 0.93 (0.81–1.07) | |
| With unpublished data, $I^2$ | | | | | | | 77% | — | |

Data are presented as mean±standard deviation or number/total number (percentage), intervention vs control groups.

*CI*, confidence interval; *GCT*, glucose challenge test; *GDM*, gestational diabetes mellitus; *GTT*, glucose tolerance test; *MD*, mean difference; *PE*, preeclampsia; *PTB*, preterm birth; *RR*, relative risk.

[a] Unpublished data

[b] Conference abstract.

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**TABLE 13**

Perinatal outcomes among trials that screened participants based on HbA1c

| Author, y | BW (g) | LGA | SGA | Shoulder dystocia | Neonatal hypoglycemia | NICU admission | Cord blood C-peptide |
|---|---|---|---|---|---|---|---|
| Osmundson et al,[33] 2016 | 3218±611 vs 3322±473 | 2/37 (5.4) vs 5/37 (13.5) | 4/34 (11.8) vs 2/33 (6.1)[a] | Not stated | Not stated | Not stated | 3/23 (13.0) vs 1/17 (5.9) |
| Hughes et al,[34] 2018 | 3209±613 vs 3344±522 | 0/11 (0.0) vs 3/9 (33.0) | 3/11 (27.0) vs 0/9 (0.0) | 0/23 (0.0) vs 0/21 (0.0) | 1/9 (11.0) vs 1/8 (13.0) | 1/23 (4.0) vs 2/21 (10.0) | Not stated |
| Roeder et al,[37] 2019 | 3243±684 vs 3399±441[a] | 0/59 (0.0) vs 0/52 (0.0)[a] | Not stated | 0/59 (0.0) vs 1/52 (1.9)[a] | 8/59 (13.6) vs 10/52 (19.2)[a] | 16/59 (27.1) vs 11/52 (21.2)[a] | 0/50 (0.0) vs 2/42 (4.8)[a] |
| Published data, total | 48 vs 46 | 2/48 (4.2) vs 8/46 (17.4) | 3/11 (27.0) vs 0/9 (0.0) | 0/23 (0.0) vs 0/21 (0.0) | 1/9 (11.0) vs 1/8 (13.0) | 1/23 (4.0) vs 2/21 (10.0) | 3/23 (13.0) vs 1/17 (5.9) |
| Published data, RR or MD (95% CI) | −110.21 (−332.86 to 112.44) | 0.28 (0.07–1.06) | 5.83 (0.34–100.03) | — | 0.89 (0.07–12.00) | 0.46 (0.04–4.68) | 2.22 (0.25–19.51) |
| Published data, $I^2$ | 0% | 0% | — | — | — | — | — |
| With unpublished data, total | 107 vs 98 | 2/107 (1.9) vs 8/98 (8.2) | 7/45 (15.6) vs 2/42 (4.8) | 0/82 (0) vs 1/73 (1.4) | 9/68 (13.2) vs 11/60 (19.2) | 17/82 (20.7) vs 13/73 (17.8) | 3/73 (4.1) vs 3/59 (5.1) |
| With unpublished data, RR or MD (95% CI) | −134.25 (−287.69 to 19.18) | 0.28 (0.07–1.06) | 2.77 (0.69–11.06) | 0.29 (0.01–7.07) | 0.72 (0.32–1.62) | 1.16 (0.61–2.19) | 0.78 (0.18–3.39) |
| With unpublished data, $I^2$ | 0% | 0% | 0% | — | 0% | 0% | 47% |

Data are presented as mean±standard deviation or number/total number (percentage), intervention vs control groups.

*BW*, birthweight; *CI*, confidence interval; *LGA*, large for gestational age; *MD*, mean difference; *NICU*, neonatal intensive care unit; *RR*, relative risk; *SGA*, small for gestational age.

[a]Unpublished data kindly obtained by original authors.

McLaren. Early screening for gestational diabetes. Am J Obstet Gynecol MFM 2022.

**TABLE 14**

Maternal outcomes among trials that screened participants based on HbA1c alone

| Author, y | Intervention vs control | GDM | GDM diagnosed at <20 wk | GDM diagnosed at >20 wk | Gestational hypertension | PE | PTB | Induction | Cesarean delivery |
|---|---|---|---|---|---|---|---|---|---|
| Osmundson et al,[33] 2016 | 42 vs 41 | 42/42 (100.0) vs 41/41 (100.0) | 42/42 (100.0) vs 41/41 (100.0) | 19/42 (45.2) vs23/41 (56.1) | 3/38 (7.9) vs 3/36 (8.3) | Not stated | 4/35 (11.4) vs 5/36 (13.9)[a] | 16/37 (43.2) vs 13/37 (35.4) | 11/37 (29.7) vs 17/37 (46) |
| Hughes et al,[34] 2018 | 24 vs 23 | 24/24 (100.0) vs 23/23 (100.0) | 24/24 (100.0) vs 23/23 (100.0) | Not applicable | Not stated | 0/23 (0.0) vs 3/21 (14.0) | 1/23 (4.0) vs 1/21 (5.0) | 10/23 (43.0) vs 11/21 (52.0) | 6/23 (26.0) vs 9/21 (43.0) |
| Roeder et al,[37] 2019 | 59 vs 52[a] | 59/59 (100.0) vs 52/52 (100.0)[a] | 59/59 (100.0) vs 52/52 (100.0)[a] | Not applicable | Not stated | 1/59 (1.7) vs 3/52 (5.8)[a] | 4/59 (6.8) vs 3/52 (5.8)[a] | 1/59 (1.7) vs 1/52 (1.9)[a] | 19/59 (32.2) vs 13/52 (25.0)[a] |
| Published data, total | 66 vs 64 | 66/66 (100.0) vs 64/64 (100.0) | 66/66 (100.0) vs 64/64 (100.0) | 19/42 (45.2) vs 23/41 (56.1) | 3/38 (7.9) vs 3/36 (8.3) | 0/23 (0.0) vs 3/21 (14.0) | 1/23 (4.0) vs 1/21 (5.0) | 26/60 (43.3) vs 24/58 (41.4) | 17/60 (28.3) vs 26/58 (44.8) |
| Published data, RR (95% CI) | | 1.00 (0.97–1.03) | 1.00 (0.97–1.03) | 0.81 (0.53–1.24) | 0.95 (0.20–4.39) | 0.13 (0.01–2.39) | 0.91 (0.06–13.69) | 1.04 (0.69–1.59) | 0.63 (0.39–1.04) |
| Published data, $I^2$ | | 0% | 0% | — | — | — | — | 0% | 0% |
| With unpublished data, total | 119 vs 110 | 119/119 (100.0) vs 110/110 (100.0) | 119/119 (100.0) vs 110/110 (100.0) | | | 1/82 (1.2) vs 6/73 (8.2) | 5/82 (6.1) vs 4/73 (5.5) | 27/119 (22.7) vs 25/110 (22.7) | 36/119 (30.3) vs 39/110 (35.5) |
| With unpublished data, RR (95% CI) | | 1.00 (0.97–1.03) | 1.00 (0.97–1.03) | | | 0.21 (0.04–1.19) | 1.11 (0.31–3.98) | 1.04 (0.68–1.57) | 0.86 (0.59–1.25) |
| With unpublished data, $I^2$ | | 0% | 0% | | | 0% | 0% | 0% | 38% |

Data are presented as mean±standard deviation or number/total number (percentage), intervention vs control groups.

*CI*, confidence interval; *GDM*, gestational diabetes mellitus; *MD*, mean difference; *PE*, preeclampsia; *PTB*, preterm birth; *RR*, relative risk.

[a]Unpublished data kindly obtained from original authors.

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## TABLE 15

Perinatal outcomes among trials that screened participants with 2-hour GTT

| Author, y | BW (g) | LGA | SGA | Shoulder dystocia | Neonatal hypoglycemia | NICU admission | Cord blood C-Peptide |
|---|---|---|---|---|---|---|---|
| Simmons et al,[35] 2018 | 3055±758 vs 3552±743 | 1/24 (4.3) vs 3/23 (13.0) | 3/24 (12.5) vs 3/23 (13.0) | Not stated | 0/24 (0.0) vs 0/23 (0.0) | 4/11 (36.0) vs 0/9 (0.0) | Not stated |
| Vinter et al,36,[a] 2018 | 3865 (3508–4136) vs 3575 (3300–4178)[b] | 13/36 (36.1) vs 16/54 (29.6) | Not stated | 0/36 (0.0) vs 1/54 (1.9) | Not stated | 5/36 (13.9) vs 10/54 (18.5) | 7/36 (19.4) vs 3/54 (5.6) |
| Published data, total | 24 vs 23 | 14/60 (23.3) vs 19/77 (24.7) | 3/24 (12.5) vs 3/23 (13.0) | 0/36 (0.0) vs 1/54 (1.9) | 0/24 (0.0) vs 0/23 (0.0) | 9/47 (19.1) vs 10/63 (15.9) | 7/36 (19.4) vs 3/54 (5.6) |
| Published data, RR or MD (95% CI) | −497.00 (−926.15 to −67.85) | 1.05 (0.59–1.85) | 0.96 (0.21–4.27) | 0.50 (0.02–11.84) | — | 1.18 (0.50–2.80) | 3.50 (0.97–12.65) |
| Published data, $I^2$ | — | 28% | — | — | — | 60% | — |

Data are presented as mean±standard deviation or number/total number (percentage), intervention vs control groups.

*BW*, birthweight; *CI*, confidence interval; *GTT*, glucose tolerance test; *LGA*, large for gestational age; *MD*, mean difference; *NICU*, neonatal intensive care unit; *RR*, relative risk; *SGA*, small for gestational age.

[a] Secondary analysis of a primary randomized clinical trial[41]

[b] Presented as median (interquartile range) as per original trial.

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## TABLE 16

Maternal outcomes among trials that screened participants based on 2-hour OGTT

| Author, y | Intervention vs control | GDM | GDM diagnosed at <20 wk | GDM diagnosed at >20 wk | Gestational hypertension | PE | PTB | Shoulder dystocia | Induction | Cesarean delivery |
|---|---|---|---|---|---|---|---|---|---|---|
| Simmons et al,[35] 2018 | 11 vs 10 | 11/11 (100.0) vs 10/10 (100.0) | 11/11 (100.0) vs 10/10 (100.0) | Not applicable | Not stated | 3/11 (27.2) vs 0/9 (0.0) | Not stated | Not stated | 7/11 (64.0) vs 3/10 (33.0) | 5/11 (45.5) vs 3/10 (33.0) |
| Vinter et al,36,[a] 2018 | 36 vs 54 | 36/36 (100.0) vs 54/54 (100.0) | 36/36 (100.0) vs 54/54 (100.0) | Not applicable | 4/36 (11.1) vs 9/54 (16.7) | 2/36 (5.6) vs 3/54 (5.6) | 2/36 (5.6) vs 2/54 (3.7) | 0/36 (0.0) vs 1/54 (1.9) | Not stated | 12/36 (33.3) vs 12/54 (22.2) |
| Published data, total | 47 vs 64 | 47/47 (100.0) vs 64/64 (100.0) | 47/47 (100.0) vs 64/64 (100.0) | — | 4/36 (11.1) vs 9/54 (16.7) | 5/47 (10.6) vs 3/63 (4.8) | 2/36 (5.6) vs 2/54 (3.7) | 0/36 (0.0) vs 1/54 (1.9) | 7/11 (64.0) vs 3/10 (33.0) | 17/47 (36.2) vs 15/64 (23.4) |
| Published data, RR (95% CI) | | 1.00 (0.95–1.05) | 1.00 (0.95–1.05) | — | 0.67 (0.22–2.00) | 1.90 (0.48–1.55) | 1.50 (0.22–10.17) | 0.50 (0.02–11.84) | 2.12 (0.74–6.04) | 1.50 (0.84–2.70) |
| Published data, $I^2$ | | 0% | 0% | — | — | 11% | — | — | — | 0% |

Data are presented as mean±standard deviation or number/total number (percentage), intervention vs control groups.

*CI*, confidence interval; *GDM*, gestational diabetes mellitus; *MD*, mean difference; *OGTT*, oral glucose tolerance test; *PE*, preeclampsia; *PTB*, preterm birth; *RR*, relative risk.

[a] Secondary analysis of a primary randomized clinical trial.[41]

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**TABLE 17**

Perinatal outcomes among trials that screened participants at ≤15 weeks of gestation

| Author, y | BW (g) | LGA | SGA | Shoulder dystocia | Neonatal hypoglycemia | NICU admission | Cord blood C-peptide |
|---|---|---|---|---|---|---|---|
| Osmundson et al,[33] 2016 | 3218±611 vs 3322±473 | 2/37 (5.4) vs 5/37 (13.5) | 4/34 (11.8) vs 2/33 (6.1)[a] | Not stated | Not stated | Not stated | 3/23 (13.0) vs 1/17 (5.9) |
| Hughes et al,[34] 2018 | 3209±613 vs 3344±522 | 0/11 (0.0) vs 3/9 (33.0) | 3/11 (27.0) vs 0/9 (0.0) | 0/23 (0.0) vs 0/21 (0.0) | 1/9 (11.0) vs 1/8 (13.0) | 1/23 (4.0) vs 2/21 (10.0) | Not stated |
| Vinter et al,36,[b] 2018 | 3865 (3508–4136) vs 3575 (3300–4178)[c] | 13/36 (36.1) vs 16/54 (29.6) | Not stated | 0/36 (0.0) vs 1/54 (1.9) | Not stated | 5/36 (13.9) vs 10/54 (18.5) | 7/36 (19.4) vs 3/54 (5.6) |
| Roeder et al,[37] 2019 | 3243±684 vs 3399±441[a] | 1/82 (1.5) vs 3/75 (5.0) | Not stated | 0/82 (0.0) vs 2/73 (2.7) | 13/82 (15.9) vs 15/73 (20.5)[a] | 26/82 (31.7) vs 19/73 (26.0)[a] | 1/82 (1.5) vs 4/75 (7.1) |
| Published data, total | 48 vs 46 | 16/166 (9.6) vs 27/175 (15.4) | 3/11 (27.0) vs 0/9 (0.0) | 0/141 (0.0) vs 3/148 (2.0) | 1/9 (11.0) vs 1/8 (13.0) | 6/59 (10.2) vs 12/75 (16.0) | 11/141 (7.8) vs 8/146 (5.5) |
| Published data, RR or MD (95% CI) | −110.21 (−332.86 to 112.44) | 0.77 (0.46–1.29) | 5.83 (0.34–100.03) | 0.28 (0.03–2.33) | 0.89 (0.07–12.00) | 0.69 (0.28–1.71) | 1.54 (0.66–3.59) |
| Published data, $I^2$ | 0% | 43% | — | 0% | — | 0% | 57% |
| With unpublished data, total | 130 vs 121 | | 7/45 (15.6) vs 2/42 (4.8) | | 14/91 (15.4) vs 16/81 (19.8) | 32/141 (22.7) vs 31/148 (20.9) | |
| With unpublished data, RR or MD (95% CI) | −138.08 (−277.37 to 1.21) | | 2.77 (0.69–11.06) | | 0.78 (0.41–1.49) | 1.04 (0.67–1.61) | |
| With unpublished data, $I^2$ | 0% | | 0% | | 0% | 0% | |

Data are presented as mean±standard deviation or number/total number (percentage), intervention vs control groups.

[a] Unpublished data kindly obtained by original authors

[b] Secondary analysis of a primary randomized clinical trial.[41]

[c] Presented as median (interquartile range) as per original trial.

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**TABLE 18**

Maternal outcomes among trials that screened participants at ≤15 weeks of gestation

| Author, y | Intervention vs control | GDM | GDM diagnosed at <20 wk | GDM diagnosed at >20 wk | Gestational hypertension | PE | PTB | Induction | Cesarean delivery |
|---|---|---|---|---|---|---|---|---|---|
| Osmundson et al,[33] 2016 | 42 vs 41 | 42/42 (100.0) vs 41/41 (100.0) | 42/42 (100.0) vs 41/41 (100.0) | 19/42 (45.2) vs 23/41 (56.1) | 3/38 (7.9) vs 3/36 (8.3) | Not stated | 4/35 (11.4) vs 5/36 (13.9)[a] | 16/37 (43.2) vs 13/37 (35.4) | 11/37 (29.7) vs 17/37 (46.0) |
| Hughes et al,[34] 2018 | 24 vs 23 | 24/24 (100.0) vs 23/23 (100.0) | 24/24 (100.0) vs 23/23 (100.0) | Not clear | Not stated | 0/23 (0.0) vs 3/21 (14.0) | 1/23 (4.0) vs 1/21 (5.0) | 10/23 (43.0) vs 11/21 (52.0) | 6/23 (26.0) vs 9/21 (43.0) |
| Vinter et al,35,[b] 2018 | 36 vs 54 | 36/36 (100.0) vs 54/54 (100.0) | 36/36 (100.0) vs 54/54 (100.0) | Not applicable | 4/36 (11.1) vs 9/54 (16.7) | 2/36 (5.6) vs 3/54 (5.6) | 2/36 (5.6) vs 2/54 (3.7) | Not stated | 12/36 (33.3) vs 12/54 (22.2) |
| Roeder et al,[37] 2019 | 82 vs 75 | 82/82 (100.0) vs 75/75 (100.0) | 82/82 (100.0) vs 75/75 (100.0) | Not applicable | Not stated | 3/82 (3.7) vs 5/73 (6.8) | 6/81 (7.4) vs 9/73 (12.3) | 3/82 (3.7) vs 1/73 (1.4) | 26/82 (31.0) vs 20/75 (27.0) |
| Published data, total | 184 vs 193 | 184/184 (100.0) vs 193/193 (100.0) | 184/184 (100.0) vs 193/193 (100.0) | 19/42 (45.2) vs 23/41 (56.1) | 7/74 (9.5) vs 12/90 (13.3) | 5/141 (3.5) vs 11/148 (7.4) | 9/140 (6.4) vs 13/148 (8.8) | 29/142 (20.4) vs 25/131 (19.1) | 55/178 (30.9) vs 58/187 (31.0) |
| Published data, RR (95% CI) | | 1.00 (0.98–1.02) | 1.00 (0.98–1.02) | 0.81 (0.53–1.24) | 0.75 (0.31–1.83) | 0.50 (0.19–1.33) | 0.70 (0.31–1.58) | 1.11 (0.73–1.68) | 0.98 (0.72–1.33) |
| Published data, $I^2$ | | 0% | 0% | — | 0% | 0% | 0% | 0% | 41% |
| With unpublished data, total | | | | | | | 13/175 (7.4) vs 18/184 (9.8) | | |
| With unpublished data, RR (95% CI) | | | | | | | 0.73 (0.37–1.44) | | |
| With unpublished data, $I^2$ | | | | | | | 0% | | |

Data are presented as mean±standard deviation or number/total number (percentage), intervention vs control groups.

*CI*, confidence interval; *GDM*, gestational diabetes mellitus; *MD*, mean difference; *PE*, preeclampsia; *PTB*, preterm birth; *RR*, relative risk.

[a]Unpublished data kindly obtained from original authors

[b]Secondary analysis of a primary randomized clinical trial.[41]

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## TABLE 19

Ongoing trials on early screening and treatment for gestational diabetes mellitus

| Listed contact; trial identifier | Location | Title | Study arm | Control arm | Testing | Primary outcome | Anticipated number |
|---|---|---|---|---|---|---|---|
| David Simmons, MD; ACTRN12616000924459 | New Zealand | Hyperglycemia in early pregnancy: the Treatment of Booking Gestational diabetes Mellitus (TOBOGM) study. A randomised controlled trial | GDM based on IADPSG criteria at <20 wk | GDM based on IADPSG criteria at routine timing | Based on IADPSG criteria | Pregnancy induced hypertension; neonatal composite | 800 |
| Anne Vambergue, MD, PhD; NCT04451915 | France | Late vs early management of gestational diabetes mellitus: a non-inferiority randomized multicenter trial | Early management | Late management | Fasting plasma glucose, 5.1–6.1 mmol/L plus 1 GDM risk factor | Composite: LGA, neonatal hypoglycemia, shoulder dystocia, birth trauma | 2010 |
| Hung-Yuan Li, PhD; NCT03523143 | Taiwan | The Effect of Early Screening and Intervention for Gestational Diabetes Mellitus on Pregnancy Outcomes (TESGO) | Early screen and treatment, 18–20 weeks gestation | Standard screen and treatment, gestational age of 24–28 wk | 2-h, 75-g GTT, IADPSG criteria | Composite: primary cesarean delivery, LGA, neonatal hypoglycemia, cord serum C-peptide >90th percentile, pregnancy-induced hypertension, preeclampsia, birth trauma | 2068 |

*GDM*, gestational diabetes mellitus; *GTT*, glucose tolerance test; *IADPSG*, International Association of the Diabetes and Pregnancy Study Groups; *LGA*, large for gestational age.

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