OBSTETRICS

The prevalence of gestational diabetes mellitus recurrence—effect of ethnicity and parity: a metaanalysis

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Reports on the gestational diabetes mellitus (GDM) recurrence rate have been highly variable. Our objectives were to examine the possible causes of GDM recurrence rate variability and to obtain pooled estimates in subgroups. We have carried out a systematic review and metaanalysis based on the Metaanalysis Of Observational Studies in Epidemiology statement. We identified papers published from 1973 to September 2014. We identified papers using Medline (PubMed and Ovid), ClinicalTrials.gov and Google Scholar databases, and published references. We included only English-language, population-based studies that reported specified GDM criteria and GDM recurrence rate. A total of 18 eligible studies with 19,053 participants were identified. We used the Cochrane's Q test of heterogeneity to choose the model for estimating the pooled GDM recurrence rate. Metaregression was also used to explore the possible causes of variability between studies. The pooled GDM recurrence rate was 48% (95% confidence interval, 41—54%). A significant association between ethnicity and GDM recurrence rate was found ($P = .02$). Non-Hispanic whites had lower recurrence rate compared with other ethnicities (39% and 56%, respectively). Primiparous women had a lower recurrence rate compared with multiparous women (40% and 73%, respectively; $P < .0001$) No evidence for association between family history of diabetes and GDM recurrence was found. The overall GDM recurrence rate is high. Non-Hispanic whites and primiparous women have substantially lower GDM recurrence rates, which contributes to the variability between studies. Because no association between family history of diabetes and GDM recurrence was found, the large differences between ethnic groups may have also resulted from nongenetic factors. Thus, intervention programs could reduce the GDM recurrence rates.

Key words: ethnicity, gestational diabetes mellitus, parity, recurrence

Gestational diabetes mellitus (GDM), a common medical complication of pregnancy, is defined as any degree of glucose intolerance with onset or first recognition during pregnancy.[1,2] GDM is associated with increased risk of perinatal morbidity, maternal trauma, preeclampsia and eclampsia, and operative deliveries.[3] Poor control of glycemic levels increases the rates of delivery by cesarean delivery and shoulder dystocia.[4] Adverse outcomes may include macrosomia, neonatal intensive care unit admission, and perinatal death.[5-7] As for the mothers' long-term complications, GDM is a significant predictor of type 2 diabetes.[8]

Prevalence of gestational diabetes mellitus varies widely. It may range from 1% to 14% of all pregnancies, depending on the population studied and the diagnostic tests used.[9] In the past, 3 review articles discussed the prevalence of GDM recurrence.[10-12] However, an updated systematic review is needed because new population-based studies, reporting the GDM recurrence rate, with large sample sizes, have been published since then. Although these reviews reported that the GDM recurrence rate vary from 30% to 84%, the prevalence of overall (pooled) GDM recurrence is unknown. Past reviews pointed out that the GDM recurrence rate may vary by non-Hispanic whites (NHW) vs minority ethnicities, but the role of ethnicity as a potential cause for the GDM recurrence rate variability remains unknown.

Materials and methods

Objectives

In this systematic review and meta-analysis, we aimed to explore studies on GDM recurrence and to quantify the variability of GDM recurrence rates. We intended to obtain pooled estimates overall and by subgroups. Additionally, we aimed to explore the possible causes of the variability in the prevalence of GDM recurrence using meta-regression analysis.

Methods for review

Sources. We searched Medline (PubMed and Ovid) and Google Scholar for studies published from 1973 to September 2014 using the following key words: gestational diabetes and recurrence or gestational diabetes and previous and subsequent pregnancy. The search was

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restricted to English-language journals. All reference lists from the main reports and relevant reviews were hand searched for additional eligible studies.

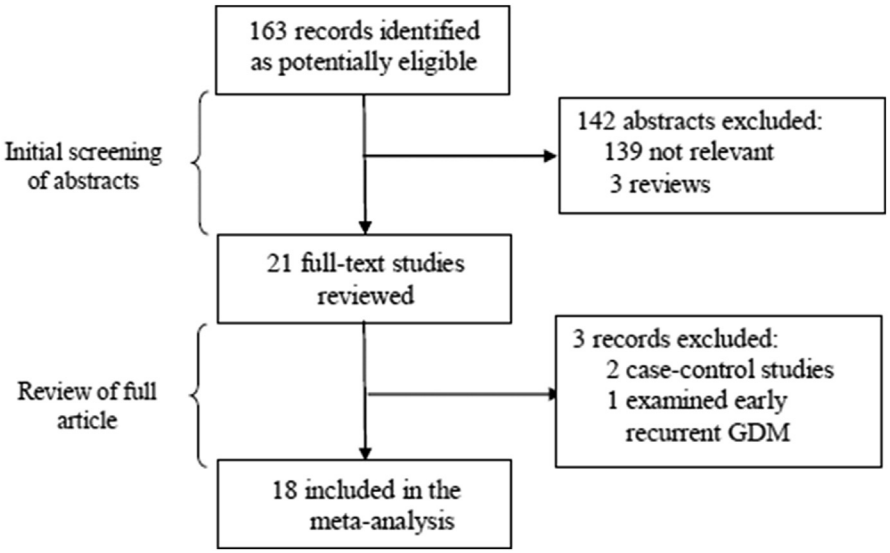
Study selection. Studies were included if they met the following criteria: they reported a specified GDM criteria and GDM recurrence rate. For the purpose of estimating the pooled GDM recurrence rates, we included only population-based studies. The study population consisted of women with GDM who had a consecutive birth afterward. The GDM recurrence rate was the percentage of women who had a recurrence of GDM in their subsequent pregnancy.

The credentials of the investigators are indicated in the author list. Two independent reviewers (N.S. and Z.N.) checked each full-text report for eligibility and extracted and tabulated all relevant data. Disagreements were settled by consensus between the reviewers. All procedures conformed to the guidelines for systematic review and metaanalysis of observational studies in epidemiology: the Meta-analysis Of Observational Studies in Epidemiology checklist.[13] Methodological quality of studies was assessed by the 22-item Strengthening the Reporting of Observational Studies in Epidemiology score.[14] The possible score ranged between 0 and 22 points (partial points were given for partial reporting).

Statistical analysis. The statistical analysis and graphical presentation were performed using Stata software, version 12.1 (StataCorp, College Station, TX). Heterogeneity of the studies was tested using Cochrane's Q test of heterogeneity ($P < .05$ was considered statistically significant) and measured by the I^2 statistic. Based on the Cochrane's Q test results, we chose the random-effects model (DerSimonian and Laird method). The pooled GDM recurrence rate was estimated and a separate estimation was also made for subsamples of studies.

We evaluated the role of several potential sources of heterogeneity by fitting metaregression models to the individual study GDM recurrence prevalence rates. Evaluated variables included maternal age, study length (years), ethnicity (NHW vs other), GDM criteria (national diabetes data group 1979 vs other criteria), obstetric history (primiparous cohort vs multiparous or a mix of primiparous and multiparous), publication period (1970–1999 vs 2000–2013), and the quality score. Funnel plot was presented to examine publication bias and the Egger test was used to test for asymmetry.

FIGURE 1
Inclusion and exclusion studies for review



GDM, gestational diabetes mellitus.

Schwartz. Prevalence of gestational diabetes recurrence. Am J Obstet Gynecol 2015.

Results

The study selection process is presented in Figure 1. One hundred forty-two studies of 163 abstracts (87%) were excluded because of irrelevance. After a full review, 18 studies with 19,053 women were deemed eligible and were included in the metaanalysis.[15-32]

The GDM diagnosis criteria varied across studies, in which 10 studies used the National Diabetes Data Group 1979 (NDDG) criteria (United States, Canada, and Korea), 3 used the Australasian Diabetes in Pregnancy Society (ADIPS) criteria, 2 used the Carpenter and Coustan (C&C) criteria (United States), 1 used the Japan Diabetes Society (JDS) criteria, and 2 others used a combination of specified criteria (The Netherlands and Australia). Eleven studies had time periods of more than 8 years (range, 9–22 years) and 7 studies included more than 80% NHW women and 3 studies included greater than 80% Hispanic/Latino women. For additional information regarding the studies' characteristics, see Table 1.

Before executing the pooled analysis, heterogeneity was found (Cochran Q = 1223.4 [df = 17]; $P < .0001$; I^2 = 98.6%), and as a result, the random-effects model was selected. The pooled GDM recurrence rate was 48% (95% confidence interval [CI], 41–54%). The pooled GDM recurrence rate of women after pregnancy that was complicated by GDM is presented in Figure 2. The funnel plot (Figure 3) suggests a tendency toward publication bias in which more studies reported a high recurrence rate (compared with the pooled GDM recurrence rate). According to the Egger test, no asymmetry was found ($P = .64$), but the statistical power is limited.

Metaregression analysis showed no significant association between the average maternal age and the GDM recurrence rate ($P = .71$). In addition, we witnessed a decline in the GDM recurrence rate as the studies length (in years)