Can J Diabetes 43 (2019) 594–599

Contents lists available at ScienceDirect

Canadian Journal of Diabetes

journal homepage: www.canadianjournalofdiabetes.com

Original Research

Incidence and Outcomes of Gestational Diabetes Mellitus Using the New International Association of Diabetes in Pregnancy Study Group Criteria in Hôpital Maisonneuve-Rosemont

Alexandra Pouliot MD; Riham Elmahboubi MD; Catherine Adam MD, FRCPC *

Hôpital Maisonneuve-Rosemont, Université de Montréal, Montréal, Québec, Canada

Key Messages

- The International Association of Diabetes in Pregnancy Study Group (IADPSG) approach to diagnose gestational diabetes is debated and outcomes reported are inconsistent.
- This study compared pregnancy outcomes of women delivering before and after the adoption of the IADPSG criteria.
- The IADPSG criteria showed lower rates of pre-eclampsia, labour induction and neonatal intensive care unit admission.

ARTICLE INFO

Article history:
Received 14 March 2019
Received in revised form
6 October 2019
Accepted 7 October 2019

Keywords:
gestational diabetes mellitus
glucose intolerance
new diagnostic criteria

Mots clés:
diabète sucré gestationnel
intolérance au glucose
nouveaux critères diagnostiques

ABSTRACT

Objectives: At 1 Canadian university hospital, pregnant women were routinely screened for gestational diabetes mellitus (GDM) with a 75-g oral glucose tolerance test (OGTT). Diagnostic plasma glucose thresholds were as follows: fasting: ≥5.3 mmol/L, 1 h: ≥10.6 mmol/L and 2 h: ≥9.0 mmol/L. In 2015, diagnostic thresholds were reduced to those recommended by the International Association of Diabetes in Pregnancy Study Group (IADPSG) as follows: fasting: ≥5.1 mmol/L, 1 h: ≥10.0 mmol/L and 2 h: ≥8.5 mmol/L. However, subsequent Diabetes Canada guidelines state that further evidence is required before recommending those thresholds. Our objectives were to compare pregnancy outcomes of all pregnant women who underwent a 75-g OGTT before and after the adoption of the IADPSG criteria.
Methods: Pregnancy outcomes of all women (N=2,830) that had a pregnancy OGTT at the Hôpital Maisonneuve-Rosemont between July 1, 2014 and March 1, 2015 (pre-IADPSG group) were compared with women who were screened between March 1, 2015 and January 1, 2016 (post-IADPSG group). Medical files were reviewed to compare outcomes.
Results: Women in the post-IADPSG group had a higher early body mass index (26.3 vs 25.5 kg/m^2, p=0.01) and more chronic hypertension (3.7% vs 1.2%, p<0.0001), respectively. OGTT results were similar, but rates of GDM were 10.8% (141 of 1,295) in the pre-IADPSG group and 17.6% (271 of 1,535) in the post-IADPSG group. In the post-IADPSG group, pre-eclampsia rates were lower (1.0% vs 2.2%, p=0.021), as was labour induction (25.6% vs 32.8%, p<0.0001) and neonatal intensive care unit admission (4.8% vs 8.5%, p<0.001), respectively.
Conclusions: Adopting IADPSG criteria for GDM improved pregnancy outcomes in our obstetric population.

RÉSUMÉ

Objectifs : Dans un centre hospitalier universitaire, les femmes enceintes sont dépistées pour le diabète gestationnel (DG) avec une hyperglycémie orale provoquée (HGOP) de 75 g. Les valeurs pour un diagnostic étaient: á jeûn ≥5.3 mmol/L, 1-hr: ≥10.6 mmol/L, 2-hr: ≥9.0 mmol/L. En mars 2015, les valeurs diagnostiques ont été réduites á celles recommandées par le International Association of Diabetes in Pregnancy Study Group (IADPSG): á jeûn ≥5.1 mmol/l, 1-hr ≥10.0 mmol/l, 2-hr ≥8.5 mmol/l. Les lignes

* Address for correspondence: Catherine Adam MD, FRCPC, Endocrinology Department, Hôpital Maisonneuve-Rosemont, 5415 Boulevard de l'Assomption, Montréal, Québec H1T 2M4, Canada.
E-mail address: adam.catherine@gmail.com

1499-2671/
https://doi.org/10.1016/j.jcjd.2019.10.003

directrices canadiennes mentionnent que davantage d'évidences sont nécessaires avant de recommander ces critères. L'objectif de cette étude était de comparer les taux de complications obstétricales avant et après l'adoption des critères IADPSG.
Méthodes : Étude de cohorte rétrospective incluant 2830 femmes. Les complications obstétricales des femmes ayant eu une HGOP avant l'adoption des critères IADPSG ont été comparées à celles des femmes ayant été dépistées par IADPSG.
Résultats : Les femmes ayant été dépistées par IADPSG, ont un IMC pré-gestationnel plus important (26.3 kg/m^2 vs 25.5 kg/m^2, p=0.01) et davantage d'hypertension chronique (3.7% vs 1.2%, p < 0.0001). L'incidence de DG était de 10.8% (141 femmes de 1295) dans le groupe avant l'adoption de l'IADPSG, alors qu'elle est de 17.6% (271 patientes de 1535) après leur adoption. Dans le groupe utilisant les critères IADPSG, le taux de prééclampsie est moindre (1.0% vs 2.2%, p=0.021), tout comme le taux d'induction (25.6% vs 32.8%, p< 0.0001) ainsi que les admissions en néonatalogie (4.8% vs 8.5%, p< 0.001).
Conclusions : Grâce à l'adoption des critères IADPSG, les taux de complications liées à la grossesse sont significativement réduits.

Introduction

Gestational diabetes mellitus (GDM) is defined as "any degree of glucose intolerance with onset or first recognition during pregnancy" (1). Various methods have been used worldwide over the years to diagnose GDM. These include a 50-g glucose challenge test with a 75- or 100-g oral glucose tolerance test (OGTT) and 1-step OGTT with different cutoff values (2). In 2008, the Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study was conducted to establish universal GDM diagnostic criteria (3). In 2010, the International Diabetes in Pregnancy Study Group (IADPSG) committee recommended universal screening using a 1-step 75-g OGTT between 24 and 28 weeks of gestation with cutoff values of 5.1 mmol/L fasting, and 10.0 and 8.5 mmol/L at 1 and 2 h, respectively. GDM was defined by 1 abnormal value (4). The use of IADPSG criteria is debated and elicits discussion. Most studies have observed an increase in GDM incidence when using these criteria, but the reported maternal and neonatal outcomes have been inconsistent (5–7). Two large randomized controlled studies have shown that treatment of GDM reduces adverse obstetric and fetal outcomes, such as gestational hypertension, pre-eclampsia, caesarean section, large-for-gestational-age (LGA) newborns, fetal trauma, neonatal hypoglycemia, hyperbilirubinemia and respiratory distress (8,9). In 2018, Diabetes Canada stated that there were insufficient evidence to support the use of the IADPSG approach (2). The Canadian guidelines still recommend a 2-step strategy with a 50-g glucose challenge test (GCT) followed by a 75-g OGTT if the result of the GCT is ≥7.8 mmol/L. Cutoff values for GDM diagnosis remain 5.3, 10.6 and 9.0 mmol/L, with 1 abnormal value establishing GDM diagnosis. In the Hôpital Maisonneuve-Rosemont, Montreal, Quebec, Canada, the decision had been made to change to IADPSG recommendations in 2015 before the publication of the most recent Diabetes Canada guidelines (2). This study was conducted to evaluate the impact of the IADPSG approach on the incidence of GDM and perinatal outcomes of women who had a 75-g OGTT during their pregnancy.

Methods

Study design

This is a retrospective cohort study. The study protocol received approval from the institutional research ethics board. The medical files of 3,117 pregnant women, who underwent routine GDM screening with a 75-g OGTT between July 1, 2014 and January 1, 2016, were reviewed. Before March 1, 2015, pregnant women underwent GDM screening with a 1-step approach using a 75-g OGTT and were diagnosed with GDM when 1 blood glucose value was ≥5.3 mmol/L fasting, 10.6 mm/L after 1 h and 9.0 mmol/L after 2 h (pre-IADPSG group). From March 1 to December 31, 2016, women were diagnosed according to IADPSG recommendations (post-IASPSG group). All women with singleton pregnancy who were screened with an OGTT during the study period were included. Patients with abortion before 28 weeks' gestation, multiple gestation pregnancies, pre-GDM, no GDM screening test results and delivery at other centres were excluded.

Patients

Each patient file was reviewed to include maternal demographics and personal medical history, such as age, ethnicity, prepregnancy weight, prepregnancy body mass index (BMI), chronic hypertension and prior history of macrosomia, caesarean section and GDM. Familial history of type 2 diabetes was also obtained. During pregnancy, OGTT results, GDM treatment when required and total weight gain were recorded, as were delivery and fetal outcomes including pre-eclampsia, preterm delivery, labour induction, caesarean section, LGA infant, macrosomia and neonatal intensive care unit (NICU) admission.

Endpoints were defined as follows: 1) total weight gain during pregnancy (based on the last recorded weight before delivery); 2) gestational hypertension (defined as the onset of hypertension after the 20th week of pregnancy in the absence of accompanying proteinuria); 3) pre-eclampsia (defined as systolic blood pressure of at least 140 mmHg and diastolic blood pressure of at least 90 mmHg based on the average of at least 2 measurements after the 20th week of pregnancy in previously normotensive women with new-onset proteinuria, or one or more adverse conditions, or one or more severe complications as defined by Society of Obstetricians and Gynaecologists of Canada (SOGC) guidelines and assessed by the obstetric team) (10); 4) primary caesarean section; 5) prematurity (defined as a delivery before the 37th week of pregnancy); 6) LGA infant (defined as a birth weight of >90th percentile according to Canadian charts) (11); 7) small-for-gestational-age infant (defined as a birth weight of <10th percentile according to Canadian charts) (11); 8) macrosomia (defined as a birth weight of ≥4,000 g) (12); 9) admission to NICU and 10) presence of respiratory distress (defined as a need for positive pressure assisted-ventilation for >5 min).

Follow-up period

Women in both groups received obstetric care by the same physicians before and after the adoption of the IADPSG recommendations. For those diagnosed with GDM, diabetes care was consistent during the study period. Women diagnosed with GDM received individualized diet counselling by a registered dietitian and were asked to monitor their blood sugars fasting and 1 h after each meal during 2 weeks. If >50% of blood glucose values exceeded 5.2 mmol/L fasting and/or 7.7 mmol/L 1 h postmeal, insulin therapy was added to diet. From 2014 to 2016, recommendations for diet treatment and blood glucose thresholds for adding insulin therapy remained exactly the same in our centre. Therefore, patients in both groups received the same treatment and medical follow up during their pregnancy and postpartum period. As for child assessment, the neonatology team remained the same during the study period.

Statistical analysis

Results are presented as means and SDs for continuous variables with normal distribution, and as numbers and percentages for categorical variables. Student *t* test for continuous variables and chi-square test or Fisher exact test for categorical variables were used for the comparison between the 2 groups. A linear regression model was used for adjustment for continuous variables, and a logistic regression model was used for categorical variables. A value of $p<0.05$ was considered statistically significant. Analyses were made using SAS version 9.4 (SAS Institute, Cary, North Carolina, United States).

Results

A total of 3,117 women underwent routine GDM screening between 24 and 28 weeks of gestation with a 75-g OGTT during the study period. Among these, 287 were excluded because of overt or pre-GDM (n=1), abortion before 28 gestational weeks (n=4), multiple pregnancy (n=39) or delivery at another centre (n=242) as shown in Figure 1. A total of 1,295 pregnancies were included in the pre-IADPSG group, and 1,535 pregnancies were in the post-IADPSG group. Before adopting the IADPSG diagnostic approach, 10.8% of pregnant patients (n=141) were diagnosed with GDM. The incidence of GDM increased to 17.6% (n=271) when using the IADPSG thresholds ($p<0.0001$). This represents an absolute increase of 6.8% and a relative increase of 62%. In the pre-IADPSG group, 108 additional women would have received a GDM diagnosis with IADPSG criteria and, therefore, were not treated as GDM before the adoption of the guidelines. A subgroup analysis was conducted between women with treated GDM in the pre-IADPSG group (n=141) to which we added the 108 patients with untreated GDM (pre-IADPSG-GDM subgroup, n=249) and women treated for GDM in the post-IADPSG group (post-IADPSG-GDM subgroup, n=271).

Maternal baseline characteristics are shown in Table 1. The 2 main groups were similar in terms of age, history of previous GDM, previous caesarean section and macrosomia. The post-IADPSG group presented a higher prepregnancy BMI (26.3 vs 25.5 kg/m^2, p=0.01), but prepregnancy weight was similar between both groups (68.2±15.0 vs 69.4±15.4 kg, p=0.055). Data for prepregnancy BMI was available for only 60% of the entire cohort (1,652 of 2,830), mostly because of missing heights; therefore, a reliable prepregnancy weight was available for most of the cohort (2,511 of 2,830). At baseline, there was a higher prevalence of chronic hypertension (3.7% vs 1.2%, $p<0.0001$) in the post-IADPSG group. Nearly one-half of the cohort was of white ethnicity, but other ethnic backgrounds were different between the pre-IADPSG and post-IADPSG groups as shown in Table 1. The same trends were seen in the 2 GDM subgroups.

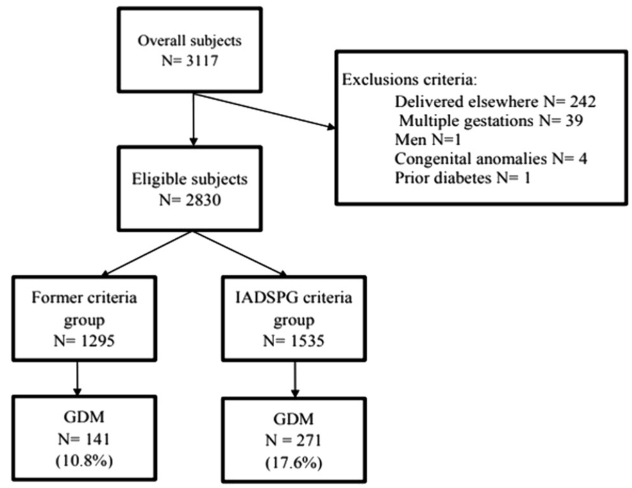

Figure 1. Flowchart describing study population. *GDM,* gestational diabetes mellitus; *IADPSG,* International Association of the Diabetes in Pregnancy Study Group.

Pregnancy outcomes are presented in Table 2. After adopting IADPSG diagnostic criteria, there were a significant decrease in the rate of pre-eclampsia (2.2% pre-IADPSG vs 1.0% post-IADPSG group; p=0.0184), labour induction (32.8% pre-IADPSG group vs 25.6% post-IADPSG group; $p<0.001$) and NICU admission (8.5% pre-IADPSG group vs 4.8% post-IADPSG group, $p<0.001$). Women also tended to gain less weight during their pregnancy in the post-IADPSG group (14.2±6.3 vs 13.3±6.2 kg, p=0.0011). Adjusted models showed that pre-eclampsia, induction rate and NICU admission remained significant after adjusting for gestational weight gain, ethnicity and prepregnancy hypertension (p=0.0029 for pre-eclampsia, and $p<0.0001$ for induction rate and NICU admission). Another model including prepregnancy BMI, gestational weight gain, ethnicity and prepregnancy hypertension yielded similar results (p=0.0004 for pre-eclampsia, $p<0.0001$ for induction rate and p=0.0029 for NICU admission). Trends were similar in the 2 GDM subgroups. Rates of pre-eclampsia decreased from 2.4% to 0.4% (p=0.059) after adopting IADPSG guidelines, and NICU admission was reduced from 8.4% to 4.4% (p=0.072). Both results failed to reach statistical significance because of a smaller sample size. However, labour induction rate remained significant between the 2 GDM subgroups (40.6% pre-IADPSG-GDM subgroup vs 30.9% post-IADPSG-GDM subgroup; p=0.028). The rates of primary caesarean section, preterm delivery, macrosomia and shoulder dystocia were similar in both groups.

Discussion

This retrospective study showed a statistically significant reduction in the rate of pre-eclampsia, labour induction and NICU admission after adopting the IADPSG approach at our institution. The 2 GDM subgroups showed similar trends in those 3 outcomes. In total, there was an associated increase in rates of GDM from 10.8% to 17.6%.

Our study showed a decrease in the rate of pre-eclampsia (2.2% pre-IADPSG vs 1.0% post-IADPSG; p=0.0184). There are multiple risk factors for pre-eclampsia including obesity, diabetes, prior history of pre-eclampsia and chronic hypertension (13). Our post-IADPSG group had a higher BMI (26.3 vs 25.5 kg/m^2) and a higher prevalence of chronic hypertension (3.7% vs 1.2%). An adjusted model to account for those differences showed that the change in pre-eclampsia between both groups remained significant

Table 1
Baseline clinical characteristics

Baseline characteristics	Pre-IADPSG criteria entire cohort (n=1,295)	Pre-IADPSG criteria GDM subgroup (n=249)	Post-IADPSG criteria entire cohort (n=1,535)	Post-IADPSG criteria GDM subgroup (n=271)	p value (entire cohort)
Age, years	30.9±5.3	32.6±5.6	31.0±5.2	32.2±5.1	0.40*
Ethnicity					<0.0001†
White	644 (49.7)	104 (41.8)	816 (53.2)	116 (42.8)	
Asian	30 (2.3)	9 (3.6)	41 (2.7)	16 (5.9)	
Middle East	334 (25.8)	94 (37.7)	302 (19.7)	70 (25.8)	
African-Caribbean	210 (16.2)	31(12.4)	303 (19.7)	47 (17.3)	
Hispanic	71 (5.5)	8 (3.2)	56 (3.6)	12 (4.4)	
Other	6 (0.5)	0 (0)	17 (1.1)	1 (0.4)	
Baseline BMI, kg/m^2	25.5±5.6	26.2±5.6	26.3±5.9	27.4±7.1	0.011*
Prepregnancy weight, kg	68.2±15.0	70.0±16.5	69.4±15.6	71.5±17.5	0.055*
Primiparity	433 (33.4)	63 (25.3)	484 (31.5)	66 (24.4)	0.29‡
Pre-existing hypertension	15 (1.2)	2 (0.8)	56 (3.7)	13 (4.8)	<0.0001‡
History of GDM	52 (5.8)	28 (11.2)	49 (4.4)	22 (8.1)	0.15‡
History of previous c/s	125 (14.2)	34 (12.5)	184 (16.2)	42 (15.5)	0.21‡
History of macrosomia	81 (9.2)	22 (8.8)	93 (8.4)	24 (8.9)	0.58‡

BMI, body mass index; *c/s,* caesarean section; *GDM,* gestational diabetes mellitus; *IADPSG,* International Association of the Diabetes in Pregnancy Study Group.
Note: Values are mean ± SD, n (%), or as otherwise indicated.
* Student *t* test.
† Chi-square test.
‡ Fisher exact test.

(p=0.0004 when adjusted for ethnicity, prepregnancy hypertension, prepregnancy BMI and gestational weight gain). A reduction in the rate of gestational hypertension was seen in the Duran et al study (5) (4.1% vs 3.5%, p<0.02), where they prospectively studied maternal and fetal outcomes in the entire obstetric population after changing GDM diagnostic criteria from the 2-step Carpenter-Coustan diagnostic method (n=1,750) to the IADPSG criteria (n=1,526). There were no pre-eclampsia data in the study. Other retrospective studies exploring perinatal outcomes in pregnant women who had a GDM screening test before and after adopting the IADPSG approach showed conflicting results on pre-eclampsia. Wu et al (14) showed no change in the pre-eclampsia rate (1.1% vs 1.4%, p=0.92), whereas Feldman et al (15) showed an increased rate of pre-eclampsia (3% vs 4%, p=0.006). The discrepancy between studies could partially be explained by other factors, including the difference in study population and GDM treatment protocols.

Our study also demonstrated a reduction in gestational weight gain in the post-IADPSG group (14.2±6.3 vs 13.3±6.2 kg, p=0.0011). This might be explained by the increase in GDM diagnosis because this cohort benefited from a closer weight monitoring and nutrition

Table 2
Maternal and fetal outcomes

Outcomes	Pre-IADPSG criteria entire cohort (n=1,295)	Pre-IADPSG criteria GDM subgroup (n=249)	Post-IADPSG criteria entire cohort (n=1,535)	Post-IADPSG criteria GDM subgroup (n=271)	p value (entire cohort)
GDM	141 (10.8)	141 (56.6)	271 (17.6)	271 (100)	<0.001
Insulin treated	58 (41)		73 (26.9)		0.0038
Weight gain during pregnancy, kg	14.2±6.3	13.1±7.1	13.3±6.2	12.1±6.3	0.0011*
Gestational HTN	24 (1.9)	4 (1.6)	27 (1.8)	3 (1.1)	0.89†
Preeclampsia	28 (2.2)	6 (2.4)	16 (1.0)	1 (0.4)	0.021† 0.0029‡ 0.0004§
GA at delivery >37 weeks	1,203 (93.8)	231 (92.8)	1,444 (94.9)	252 (92.9)	0.19†
Induction of labour	422 (32.8)	101 (40.6)	391 (25.6)	84 (30.9)	<0.0001† <0.0001‡,§
Mode of delivery					
OVD	87 (6.8)	24 (9.6)	91 (6.0)	14 (5.2)	0.39†
Primary CD	182 (14.2)	41 (16.4)	203 (13.3)	31 (11.4)	0.51†
Total CD	269 (20.9)	62 (24.9)	336 (21.0)	60 (22.1)	0.49†
Shoulder dystocia	30 (0.02)	2 (0.8)	31 (0.02)	4 (1.5)	0.60†
Fetal weight					
Macrosomia (>4,000 g)	112 (8.9)	27 (10.8)	127 (8.6)	21 (7.7)	0.79†
LGA (>90th percentile)	115 (9.2)	19 (7.6)	114 (8.0)	22 (8.1)	0.27†
SGA (<10th percentile)	108 (8.7)	25 (10.0)	151 (10.6)	22 (8.1)	0.10†
Infant outcomes					
Stillbirth	5 (0.4)	1 (0.4)	2 (0.1)	0 (0)	0.26†
Respiratory distress	94 (7.5)	15 (6.0)	108 (7.2)	24 (8.9)	0.83†
NICU admission	107 (8.5)	21 (8.4)	71 (4.8)	12 (4.4)	<0.0001† <0.0001‡ 0.0029§

CD, caesarean delivery; *GA,* gestational age; *GDM,* gestational diabetes mellitus; *HTN,* hypertension; *IADPSG,* International Association of the Diabetes in Pregnancy Study Group; *LGA,* large for gestational age; *NICU,* neonatal intensive care unit; *OVD,* operative vaginal delivery; *SGA,* small for gestational age.
Note: Values are mean ± SD, n (%), or as otherwise indicated.
* Student *t* test.
† Fisher exact test.
‡ Adjusted for ethnicity and prepregnancy hypertension and gestational weight gain.
§ Adjusted for ethnicity, prepregnancy hypertension, gestational weight gain and prepregnancy body mass index.

counselling by a registered dietitian. It has been demonstrated that patients with a higher BMI tend to gain less weight during pregnancy (16). The IADPSG cohort had a slightly higher BMI that could have contributed to the reduction in weight gain. The Wu et al study (14) showed similar results. A reduction in gestational weight gain is likely to lead to long-term positive outcomes because excessive gestational weight gain is associated with adverse pregnancy outcomes, postpartum weight retention and childhood obesity (17).

To date, no other study has shown a difference in induction rate after adopting IADPSG criteria. Our data might be explained by an increased maternal and fetal monitoring for patients with GDM, but further studies are needed to draw conclusions. NICU admissions were also reduced in the post-IADPSG group (8.5% pre-IADPSG group vs 4.8% post-IADPSG group, $p<0.001$). Because the same trend was seen in the GDM subgroups (8.4% vs 4.4%, $p=0.072$), we are confident that treating additional patients contributed to those results. Because of the retrospective nature of our study, reasons for NICU admission could not be further explored. However, other studies reported a similar decrease in neonatal adverse outcome. The Duran et al study (5) demonstrated a reduction in admission to NICU when comparing the 2-step Carpenter-Coustan approach with the IADPSG approach (8.2% vs 6.2%, $p<0.001$). The Wu et al study (14) did not show an isolated reduction in NICU admission, but showed an overall reduction in adverse fetal outcomes, including NICU admission, hypoglycemia, jaundice, LGA and birth trauma.

Primary caesarean section, LGA, preterm delivery, shoulder dystocia and macrosomia rates were similar between both cohorts. Results have been conflicting for those outcomes in other studies. Some studies showed a reduction in total caesarean section rate (5,14), but others showed an increased rate after adopting IADPSG criteria (15,18,20). These conflicting results might be explained by the level of medical delivery intervention normally used in GDM settings in each of those countries. LGA rates was showed to be lower in only 1 study, where there was a relative reduction of 20% (5).

In this retrospective study, GDM incidence increased significantly after adopting the IADPSG recommendations (17.6% vs 10.8%, $p<0.001$) when compared with our former approach also using a 1-step 75-g OGTT with higher cutoff values. Our respective pre-IADPSG (10.8%) and post-IADPSG (17.8%) GDM incidences are very close to the HAPO study results (19). Other studies have shown a much higher incidence increase when IADPSG recommendations were adopted. For instance, in Duran et al (5), the incidence of GDM increased to 35.5% with the IADPSG approach, but other studies showed lower incidence ranging from 9.4% to 27% (14,15,20).

Our study has multiple strengths. This is a unique study comparing the same diagnostic approach (1-step 75-g OGTT) for GDM screening but with different cutoff values, corresponding to the HAPO odds ratios of 2.0 and 1.75, respectively (4). Throughout the study, pregnant women and offspring were followed by the same obstetric physicians and, when needed, the same neonatology team. GDM treatment also remained similar, making GDM diagnosis the major change during the study period. We also included a significant number of patients in our study. Our observations are also subject to some limitations. The main limitation is the retrospective nature of the study. Reports were sometimes incomplete and data were lacking on confounders, such as maternal prepregnancy BMI. Some outcomes, such as reasons for induction and NICU admissions, were also limited by file review. Finally, this study did not evaluate the cost-effectiveness of the increased incidence of GDM when compared with a possible improvement in perinatal outcomes. Duran et al (5) showed an absolute incidence increase in GDM diagnosis of 24.9% (from 10.6% to 35.5%) after adopting IADPSG recommendations, and they still found their intervention cost-effective because of the reduction in caesarean section (25.9% vs 19.7%, $p=0.002$) and NICU admission (8.2% vs 6.2%, $p=0.001$). We showed a much lesser increase in GDM diagnosis and a similar reduction rate in NICU admissions.

Conclusions

The use of IADPSG criteria increased the incidence of GDM by 62%. For all pregnant women who had a 75-g OGTT during the study period, our observations showed a reduction in the rate of pre-eclampsia, labour induction, NICU admissions and pregnancy total weight gain after adopting IADPSG recommendations in our entire obstetric population. These results support the use of IADPSG criteria in our hospital settings. Further randomized studies are needed to evaluate the economic impact of the IADPSG approach.

Acknowledgments

We thank Gabrielle Jutras MD, Lauranne Pouliot and Alexandre Chênevert, who contributed substantially to the data collection. We also thank Louis Coupal for statistical analysis. All inferences, opinions and conclusions exposed in this paper are those of the authors.

Author Disclosures

Conflicts of interest: None.

Author Contributions

C.A., A.P. and R.E. researched the data and wrote the manuscript.

References

1. Oats JJ. Fourth International Workshop-conference on gestational diabetes mellitus: Overview and commentary on first session. Diabetes Care 1998;21:B58.
2. Diabetes Canada Clinical Practice Guidelines Expert Committee. Diabetes Canada 2018 clinical practice guidelines for the prevention and management of diabetes in Canada. Can J Diabetes 2018;42(Suppl 1):S1–325.
3. Metzger BE, Lowe LP, Dyer AR, et al. Hyperglycemia and adverse pregnancy outcomes. HAPO Study Cooperative Research Group. N Engl J Med 2008;358:1991–2002.
4. International Association of Diabetes and Pregnancy Study Groups Consensus Panel. International Association of Diabetes and Pregnancy Study Groups recommendations on the diagnosis and classification of hyperglycemia in pregnancy. Diabetes Care 2010;33:676–82.
5. Duran A, Sáenz S, Torrejón MJ, et al. Introduction of IADPSG criteria for the screening and diagnosis of gestational diabetes mellitus results in improved pregnancy outcomes at a lower cost in a large cohort of pregnant women: The St. Carlos Gestational Diabetes Study. Diabetes Care 2014;37:2442–50.
6. Mayo K, Melamed N, Vandenberghe H, Berger H. The impact of adoption of the international association of diabetes in pregnancy study group criteria for the screening and diagnosis of gestational diabetes. Am J Obstet Gynecol 2015;212:224-e1.
7. Cundy T, Ackermann E, Ryan EA. Gestational diabetes: New criteria may triple the prevalence but effect on outcomes is unclear. BMJ 2014;348:g1567.
8. Landon MB, Spong CY, Thom E, et al. A multicenter, randomized trial of treatment for mild gestational diabetes. N Engl J Med 2009;361:1339–48.
9. Crowther CA, Hiller JE, Moss JR, McPhee AJ, Jeffries WS, Robinson JS. Effect of treatment of gestational diabetes mellitus on pregnancy outcomes. N Engl J Med 2005;352:2477–86.
10. Hypertension Guideline Committee. SOGC clinical practice 2014. J Obstet Gynaecol Can 2014;36:416–38.
11. Kramer MS, Platt RW, Wen SW, et al. A new and improved population based Canadian reference for birth weight for gestational age. Pediatrics 2001;108:E35.
12. Wassimi S, Wilkins R, Mchugh NG, Xiao L, Simonet F, Luo ZC. Association of macrosomia with perinatal and postneonatal mortality among First Nations people in Quebec. CMAJ 2011;183:322–6.
13. Duckitt K, Harrington D. Risk factors for pre-eclampsia at antenatal booking: Systematic review of controlled studies. BMJ 2005;330:565.

14. Wu ET, Nien FJ, Kuo CH, et al. Diagnosis of more gestational diabetes lead to better pregnancy outcomes: Comparing the International Association of the Diabetes and Pregnancy Study Group criteria, and the Carpenter and Coustan criteria. J Diabetes Invest 2016;7:121−6.
15. Feldman RK, Tieu RS, Yasumura L. Gestational diabetes screening: The International Association of the Diabetes and Pregnancy Study Groups compared with Carpenter-Coustan screening. Obstet Gynecol 2016;127:10−7.
16. Barisic T, Mandic V, Barac I. Associations of body mass index and gestational weight gain with term pregnancy outcomes. Mater Sociomed 2017;29:52.
17. Farpour-Lambert NJ, Ells LJ, Martinez de Tejada B, Scott C. Obesity and weight gain in pregnancy and postpartum: An evidence review of lifestyle interventions to inform maternal and child health policies. Front Endocrinol 2018;9:546.
18. Basri NI, Mahdy ZA, Ahmad S, et al. The World Health Organization (WHO) versus The International Association of Diabetes and Pregnancy Study Group (IADPSG) diagnostic criteria of gestational diabetes mellitus (GDM) and their associated maternal and neonatal outcomes. Horm Mol Biol Clin Investig 2018;34:20170077.
19. Sacks DA, Hadden DR, Maresh M, et al. Frequency of gestational diabetesmellitus at collaborating centers based on IADPSG consensus panel−recommendedcriteria: The Hyperglycemia and Adverse Pregnancy Outcome (HAPO) study. Diabetes Care 2012;35:526−8.
20. Kong J, Lim K, Thompson D. Evaluation of the International Association of the Diabetes in Pregnancy Study Group new criteria: Gestational diabetes project. Can J Diabetes 2015;39:128−32.