Cesarean section and diabetes during pregnancy: A NSW population study using the Robson classification

Short running title: Robson classification for diabetes

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Abstract

Aims

To identify the main contributors to cesarean section (CS) among women with and without diabetes during pregnancy using the Robson classification and to compare CS rates within Robson groups.

Methods

A population-based cohort study was conducted of all women who gave birth in New South Wales, Australia, between 2002 and 2012. Women with pre-gestational diabetes (Types 1 and 2) and gestational diabetes mellitus (GDM) were grouped using the Robson classification. Adjusted odd ratios (AOR) and 95% Confidence Interval (CI) were calculated using multivariable logistic regression.

Results

The total CS rate was 53.6% for women with pre-gestational diabetes, 36.8% for women with GDM, and 28.5% for women without diabetes. Previous CS contributed the most to the total number of cesarean sections in all populations. For preterm birth, the contribution to the total was 20.5% for women with pre-gestational diabetes and 5.7% for women without diabetes. Compared to women without diabetes, for nulliparous with pre-gestational diabetes, the odds of CS was 1.4 (95% CI, 1.1-1.8) for spontaneous labor and 2.0 (95% CI, 1.7-2.3) for induction of labor.

Conclusion

A history of CS was the main contributor to the total cesarean section. Reducing primary CS is the first step to lowering the high rate of CS among women with diabetes. Nulliparous women were more likely to have cesarean sections if they had pre-gestational

diabetes. This increase was also evident in all multiparous women giving birth. The high rate of preterm births and CSs reflects the clinical issues for women diabetes during pregnancy.

Keywords

Cesarean section, Gestational diabetes, Pregnancy, Pregnancy in Diabetics, Robson classification.

Introduction

Diabetes during pregnancy is an increasing problem worldwide.[1] In Australia, 0.5% of women have pre-gestational diabetes (Type 1 and type 2 diabetes) and up to 13.0% of women develop gestational diabetes mellitus (GDM).[2, 3] Pre-gestational diabetes occurs before pregnancy and continues after pregnancy.[4] GDM is defined as pregnancy-induced hyperglycemia or glucose abnormality that existed previously but was undiagnosed prior to pregnancy.[5]

The rate of cesarean section (CS) is positively associated with an increase in plasma glucose level during pregnancy.[6] The Hyperglycemia and Adverse Pregnancy Outcomes study showed an increase of 8 to 11% in the odds of CS with one standard deviation increase in plasma glucose level.[6] The 2005–2007 Australian data show that 59.2% of women with pre-gestational diabetes and 40.1% of women with GDM gave birth by CS, compared with 30.0% for women without diabetes.[2]

In order to better understand current clinical practice around the method of birth for women with and without a diagnosis of diabetes during pregnancy, a clinically relevant classification system of CS is required. In 2015, the World Health Organization (WHO) recommended that the Robson classification be used as a global standard for evaluating, monitoring and comparing CS rates.[7] The Robson classification is 'mutually exclusive and totally inclusive' and is based on women's parity, plurality, presentation, gestational age, history of previous CS and onset of labor.[8] To date, three hospital-based studies have applied the Robson classification to women with diabetes during pregnancy.[9-11] However, there have not been any population-based studies applying the Robson classification to pre-gestational diabetes and GDM, despite suggestions by the classification users.[9, 12]

Our study, using New South Wales (NSW) population data, had two aims. Firstly, to use the Robson classification to identify the main contributors to CS among women with pre-gestational diabetes, women with GDM and women without diabetes during pregnancy. The second part of the study aimed to compare CS rates between women with diabetes during pregnancy and those without, within each Robson classification group.

Method

Study design and outcome

A population-based retrospective cohort study was conducted. The main outcome of the study was CS.

Data source

This study used data and definitions from the NSW Perinatal Data Collection (PDC). The PDC is a population-based surveillance system of all births in NSW, Australia. It contains information about NSW public and private hospital births and home births, and about all women who have had live births and stillbirths of at least 20 weeks' gestational age or at least 400 grams birthweight.[13] NSW is the most populous state, with a third of the total Australian population and more than 95 000 women giving birth every year.[14]

PDC information is collected from the electronic notification form that is completed by the attending midwife or doctor at birth. It includes information on maternal demographics, health, pregnancy, labor and birth, as well as perinatal outcomes. The completed forms are sent to NSW Ministry of Health, where the information is validated and compiled into the PDC.[13]

Study population

This study included all women (n=1 007 843) who gave birth in NSW between 1 January 2002 and 31 December 2012. Of these, 6030 (0.6%) women had pre-gestational

diabetes (Type 1 and type 2 diabetes), 51 135 (5.1%) had GDM, and 950 678 (94.3%) did not have diabetes during pregnancy.

Diagnosis of GDM

During the study period, there was only one guideline used in NSW for the diagnosis of GDM. This was the Australasian Diabetes In Pregnancy Society (ADIPS) guideline that recommended screening for GDM at 26 to 28 weeks' gestation using the glucose challenge test (GCT). If the non-fasting GCT measured at one-hour post-load plasma glucose level was ≥7.8 mmol/L after 50g glucose load or ≥ 8.0 mmol/L after 75g glucose load, a 75g two-hour oral glucose tolerance test (OGTT) was recommended.[15] GDM was then diagnosed if the fasting venous plasma glucose level was ≥ 5.5 mmol/L and/or at two hours following the 75g glucose load was ≥8.0 mmol/L.[15]

Pre-gestational diabetes and GDM are different in their effect on pregnancy outcomes, with pre-gestational diabetes being associated with more complicated outcomes.[2, 4, 16] In addition, pre-gestational diabetes poses considerable challenges in clinical management.[17] For this reason statistical analysis was done separately for pre-gestational diabetes and GDM.

Statistical analysis

The socio-demographic factors of women with pre-gestational diabetes and women with GDM were compared with women without diabetes using a Chi square test for categorical variables and an Independent Samples T-Test for continuous variables. Women were classified according to Robson criteria into 10 groups correlating with their obstetric history (Table 1).

Six variables inform the classification: parity, plurality, presentation, gestational age, history of previous CS, and type of labor. Women in groups 2 and 4 were further grouped according to their onset of labor into those who had an induction of labor and those who had a CS with no labor.

Summary statistics were produced using the extended Robson classification 10 groups stratified by diabetes status. These include:

a. the proportion of the obstetric population of each group

b. the rate of CS within each group

c. the relative contribution of each group to the total CS rate (the proportion of CSs in each Robson group according to the total number of CSs)

d. the absolute contribution of each group to the total CS rate (rate of CS in each Robson group in relation to the total population).

Multivariable logistic regression was used to investigate the likelihood of CSs for women with diabetes compared with women without diabetes. Adjusted odds ratios (AOR) and 95% confidence intervals (95% CI) were calculated. Adjustment was made for maternal age, maternal country of birth (Australian born – Yes/No), smoking status, birthweight (< 2500g, 2500–3999g and ≥ 4000g) and pre-gestational and maternal hypertension.

The analysis was performed by using the Statistical Package for the Social Sciences (SPSS) software Version 22.0 (Armonk, NY: IBM Corporation). A P value < 0.05 was considered statistically significant.

Details of ethics approval

The use of de-identified data was approved by the Executive Director, Centre for Epidemiology and Evidence, NSW Ministry of Health. Ethics approval was granted by University of Technology Sydney Human Research Ethics Committee (UTS HREC ETH16-0219).

Results

There were significant differences in maternal socio-demographic factors between women with diabetes during pregnancy and women without diabetes (Table 2). A higher proportion of women aged ≥ 35 years was observed among women with diabetes during pregnancy – 32.5% of women with pre-gestational diabetes and 34.9% of women with GDM – compared to 21.3% among women without diabetes. Multiparous women represented 63.0% of women with pre-gestational diabetes and 59.7% of women with GDM, compared with 57.4% of women without diabetes (Table 2).

Table 3 presents the extended Robson classifications for women with pre-gestational diabetes, women with GDM and women without diabetes. Nulliparous women who had an induction of labor or a CS with no labor (Robson group 2) represented the largest percentages of women in both pre-gestational diabetes and GDM categories – 20.8% and 21.4%, respectively compared to only 14.4% of women without diabetes. Group 3 (multiparous who went into spontaneous labor) was the largest group of women without diabetes contributed to 27.3% of the total population. The second largest group of women with diabetes during pregnancy was multiparous women who had induction of labor. Although the percentages of women with diabetes during pregnancy in groups 4 and 2 were relatively similar to each other, the contribution of group 4 to the total number of CS was significantly lower than the contribution of group 2. Among women with and without

diabetes during pregnancy, the highest contribution to the total number of CSs was among multiparous women who had a history of previous CS (group 5). This group contributed to 30.9% of all CSs performed among women with pre-gestational diabetes, 34.8% among women with GDM and 34.8% among women without diabetes (Table 3). The main indication for CS in this group was elective repeat CS. The rate of the elective repeat CS was 69.5% among women with pre-gestational diabetes, 61.3% among women with GDM, and 74.1% among women without diabetes.

The rates of vaginal birth after CS (VBAC) among women in group 5 was 8.6% among women with pre-gestational diabetes, 14.1% among women with GDM and 19.5% among women without diabetes.

Women who had experienced preterm births (Robson group 10) represented 16.8% of the total number of women with pre-gestational diabetes. This percentage was significantly larger than the percentage of group 10 women without diabetes (4.9%). Group 10 women contributed to 20.5% of the total number of CSs among women with pre-gestational diabetes, 7.4% among women with GDM and 5.7% of the total number of CS among women without diabetes (Table 3). Forty six percent of women with pre-gestational diabetes in group 10 had a no labor CS and 21.6% had induction of labor respectively contributed to 14.5% and 2.5% of the total number of CSs among women with pre-gestational diabetes.

Table 4 shows that the total CS rate was significantly higher among women with pre-gestational diabetes than among women without diabetes (AOR 2.4, 95% CI, 2.3-2.6). With the exception of women in Robson groups 6, 7 and 9 (women who had non-cephalic pregnancies), the rate of CS was significantly higher among women with pre-gestational diabetes compared to women without diabetes across all other Robson groups.

For women with pre-gestational diabetes, the highest rate of CS was among women with a history of previous CS (group 5). This rate was significantly higher among women with pre-gestational diabetes than women without diabetes (91.4% and 80.5%) (AOR 2.5, 95% CI, 2.0-3.1). Half (49.6%) of nulliparous women who had induction of labor (group *2(a)*) had a CS compared to 31.7% of women without diabetes in the same group (AOR 2.0, 95% CI, 1.7-2.3) (Table 4).

Table 5 shows that 36.8% of women with GDM gave birth by CS compared to 28.5% of women without diabetes (AOR 1.3, 95% CI, 1.2-1.3). The highest rate of CS was for women with GDM (97.5%) and women without diabetes (92.1%) among group 6 nulliparous who had a breech presentation.

For both nulliparous and multiparous women with GDM who had an induction of labor (groups *2(a)* and *4(a)*) there was an increase in the rate of CS compared with women without diabetes in the same groups (AOR 1.1, 95% CI, 1.0-1.1 for nulliparous women) and (AOR 1.2, 95% CI, 1.1-1.3 for multiparous women) (Table 5).

Discussion

Our study is the first population-based study to use the Robson classification to compare CS rates among women with and without diabetes during pregnancy. Previous published studies that used the Robson classification to analyze CS rates among women with diabetes during pregnancy are hospital-based studies with limited sample size and generalizability.[9-11] Our study provides population data and confirms these hospital studies' results.[9-11]

We found previous CS was the main driver for CS, regardless of whether the women had diabetes during pregnancy or not. A previous study that used the Robson classification on the Australian general population also found that previous CS was the highest

contributor to the total number of CSs.[18] Our results also confirm results from international studies that found group 5 is the main contributor to the total number of CSs.[19-22]

Among women in the Robson group 5 (women with a history of CS), we found the CS rate was significantly higher among women with pre-gestational diabetes and women with GDM compared with women without diabetes. One explanation may be that women with diabetes during pregnancy have lower rates of successful VBAC than women without diabetes.[23, 24] This is supported by data showing the rate of unsuccessful VBAC among women who trialed labor is 38% among women with pre-gestational diabetes, [24] and 36% among women with GDM,[23] compared to 24% among women without diabetes. [24] Among our study population, women without diabetes had more than double the rate of successful VBAC than women with pre-gestational diabetes and were five percentage points more likely to have a successful VBAC compared with women with GDM. This indicates that primary CS among women with diabetes during pregnancy has a greater effect on consecutive methods of birth than among women without diabetes. There is compelling evidence, therefore, to suggest that reducing the rate of the primary CS can help to reduce the overall rate of CS.

The second highest contributor to the total number of CSs was group 2 (nulliparous who had induction of labor or no-labor CS), regardless of whether women had diabetes or not. However, within this group, the contribution of CS relative to the total population rate was significantly higher among women with diabetes during pregnancy than women without diabetes. This is due in part to the over-representation of women with diabetes during pregnancy in this group (20.8% of women with pre-gestational diabetes and 21.4% of women with GDM, compared to 14.4% of women without diabetes) (Table 3).

In addition, previously published research shows that women with diabetes during pregnancy who had induction of labor are at higher risk of CS than women without diabetes [25]. In our population, nulliparous women with pre-gestational diabetes who had induction of labor had double the odds of having a CS compared to women without diabetes. Half (49.6%) of these women had a CS, which is consistent with the rate of 48.5 % among women with Type one diabetes published by Carroll et al. (2013).[10] The evidence, therefore, suggests a more judicious approach to inducing labor in nulliparous women with diabetes may help reduce the primary CS rate.

In women with pre-gestational diabetes, the rate of preterm labor is high.[2, 16, 26, 27] Among our population, group 10 women with preterm birth represented 16.8% of women with pre-gestational diabetes. The high rate of preterm birth is likely related to iatrogenic interventions among women with pre-gestational diabetes.[27,28] In our study only one third (32.2%) of these women with pre-gestational diabetes in group 10 had a spontaneous preterm birth, while the majority of them had either no labor CS (46.2%) or induction of labor (21.6%) before 37 weeks gestation. CS among women in group 10 contributed 20.5% of the total number of CSs among women with pre-gestational diabetes. Our research is consistent with the findings of a 2009 Brazilian tertiary hospital study using the Robson classification to investigate the rate of CS among women with diabetes during pregnancy, which found that 21.0% of the total CS was contributed by women in group 10.[9] Among our study population in group 10, women with pre-gestational diabetes had double the rate of CS than among women without diabetes.

We found the rates of CS among women with diabetes during pregnancy were higher than those among women without diabetes across most Robson groups. This is consistent for both women with pre-gestational diabetes and women with GDM. Although,

the difference in CS rates between women with GDM and women without diabetes was statistically significant, it is difficult to draw definitive conclusions regarding the clinical significance of this finding due to the large sample size.

Strength and limitations

The use of the WHO-recommended Robson classification with large population data provides population-based information on the rate of CS among women with diabetes during pregnancy and the contribution of each group to the total number of CS. Hospital-based studies have provided the impetus for this study, but they have not delivered results of sufficient scope, reliability and generalizability to inform clinical decision making. By using population data that reports childbirth related diagnosis and procedures with high levels of accuracy,[29] our results can be used as a reference population for other studies investigating the method of birth and diabetes during pregnancy.

There were no data items on the management of diabetes during pregnancy, nor maternal Body Mass Index (BMI) in the NSW PDC data set. This is a limitation of the study because a large proportion of women with diabetes during pregnancy have high BMI which is associated with increases in the risk of CS among women with diabetes during pregnancy.[30] Further studies are required to evaluate the impact of maternal BMI on CS.

A further limitation of our study was the possible underestimation of the number of women with diabetes. In our study the proportion of GDM from the NSW PDC data was 5.1%, which is marginally lower than that found in an earlier validation study based on two data sets – the Admitted Patient Data Collection (APDC) and PDC – which found 5.6% of primiparous and 6.1% of multiparous had GDM.[31] However, that study reassuringly found that irrespective of the data source of GDM status the odds ratio of CS among women with GDM compared with women without GDM was consistent at 1.4 (95% CI, 1.3-1.5) for PDC

versus 1.5 (95% CI, 1.4-1.6) from the combined data from the PDC and APDC for primiparous and 1.4 (95% CI, 1.3-1.5) versus 1.5 (95% CI, 1.4-1.6) for multiparous women.[31]

The Robson classification is a clinically informative and simple classification system for examining CS among women with medical conditions and obstetric complications such as diabetes during pregnancy. It provides a granularity around a set of actions leading to CS.

In our population-based study, the highest contributing factor to having a CS was from women with a history of CS, whether or not they had diabetes during pregnancy. For women with diabetes during pregnancy, the CS is high across most Robson groups compared with women without diabetes. Focusing on primary prevention of CS would help in reducing the overall rate of CS among women with diabetes during pregnancy.

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Disclosure

No author has any potential conflict of interest**.**

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Table 1: Extended Robson 10 groups[8]

1	Nulliparous, single cephalic, gestational age ≥37 weeks, spontaneous labor
2	Nulliparous, single cephalic, gestational age ≥37 weeks, induction of labor or no labor CS
2(a)	*Nulliparous, single cephalic, gestational age ≥37 weeks, induction of labor*
2(b)	*Nulliparous, single cephalic, gestational age ≥37 weeks, no labor CS*
3	Multiparous, without previous CS, single cephalic, gestational age ≥37 weeks, spontaneous labor
4	Multiparous, without previous CS, single cephalic, gestational age ≥37 weeks, induction of labor or no labor CS
4(a)	*Multiparous, without previous CS, single cephalic, gestational age ≥37 weeks, induction of labor*
4(b)	*Multiparous, without previous CS, single cephalic, gestational age ≥37 weeks, no labor CS*
5	All multiparous, with at least one previous CS, single cephalic, gestational age ≥37 weeks
6	All nulliparous, single breech pregnancy
7	All multiparous, single breech, including women with previous CS
8	All women, multiple pregnancies including women with previous CS
9	All women, single transverse, oblique or other lie including women with previous CS
10	All women, single cephalic, gestational age ≤36 weeks, including women with previous CS

Table 2: Women's socio-demographic factors by diabetes status 2002-2012.

	Pre-gestational diabetes		Gestational diabetes		No diabetes
	n=6030	P value[†‡]	n=51 135	P value[†§]	n=950 678
	n(%)		n(%)		n(%)
Age					
mean(SD)	31.7 (5.6)	<0.001[¶]	32.2 (5.3)	<0.001[¶]	29.9 (5.6)
< 20	96 (1.6)		511 (1.0)		36 205 (3.8)
20-24	584 (9.7)		3398 (6.6)		135 636 (14.3)
25-29	1353 (22.4)	<0.001	11 440 (22.4)	<0.001	263 235 (27.7)
30-34	2033 (33.7)		17 957 (35.1)		312 697 (32.9)
35-39	1499 (24.9)		13 607 (26.6)		168 304 (17.7)
≥ 40	463 (7.7)		4217 (8.2)		34 359 (3.6)
Not stated	2 (0.0)		5 (0.0)		242 (0.0)
Parity					
Nulliparous	2222 (36.8)	<0.001	20 570 (40.2)	<0.001	403 372 (42.4)
Multiparous	3799 (63.0)		30 540 (59.7)		545 804 (57.4)
Not stated	9 (0.1)		25 (0.0)		1502 (0.2)
Plurality					
Singleton	5912 (98.0)	0.004	50 130 (98.0)	<0.001	936 428 (98.5)
Multiple	118 (2.0)		1005 (2.0)		14 250 (1.5)
Country of birth					
Australian	4036 (66.9)	<0.001	25 527 (49.9)	<0.001	672 362 (70.7)
Overseas born	1979 (32.8)		25 436 (49.7)		275 022 (28.9)
Not stated	15 (0.2)		172 (0.3)		3294 (0.3)
Smoking					
Smoked	840 (13.9)	0.111	4769 (9.3)	<0.001	125 787 (13.2)
Did not smoke	5172 (85.8)		46 159 (90.3)		821 935 (86.5)
Not stated	18 (0.3)		207 (0.4)		2956 (0.3)

† Excludes not stated values

‡ P value for Pre-gestational diabetes compared to no diabetes
§ P value for GDM compared to no diabetes
¶ Using Independent Samples T Test

Table 3: Summary statistics for cesarean section by diabetes 2002-2012.

	Pre-gestational diabetes				Gestational diabetes				No diabetes			
		CS				CS				CS		
Robson groups	Women n (%)	n	Relative† %	Absolute rate‡ % (95% CI)	Women n (%)	n	Relative† %	Absolute rate‡ % (95% CI)	Women n (%)	n	Relative† %	Absolute rate‡ % (95% CI)
1	384 (6.4)	88	2.7	1.5 (1.2-1.8)	6777 (13.3)	1139	6.1	2.2 (2.1-2.4)	218 798 (23.3)	32 163	12.0	3.4 (3.4-3.5)
2	1244 (20.8)	771	24.1	12.9 (12.0-13.8)	10 860 (21.4)	4842	25.9	9.5 (9.3-9.8)	135 583 (14.4)	58 986	22.0	6.3 (6.2-6.3)
2(a)	938 (15.7)	465	14.5	7.8 (7.1-8.5)	9212 (18.1)	3194	17.1	6.3 (6.1-6.5)	11 2145 (11.9)	35 548	13.3	3.8 (3.7-3.8)
2(b)	306 (5.1)	306	9.5	5.1 (4.5-5.7)	1648 (3.2)	1648	8.8	3.2 (3.1-3.4)	23 438 (2.5)	23 438	8.8	2.5 (2.5-2.5)
3	604 (10.1)	36	1.1	0.6 (0.4-0.8)	9044 (17.8)	331	1.8	0.7 (0.6-0.7)	25 6210 (27.3)	5936	2.2	0.6 (0.6-0.6)
4	1167 (19.5)	250	7.8	4.2 (3.7-4.7)	9923 (19.5)	1590	8.5	3.1 (3.0-3.3)	111 002 (11.8)	17 904	6.7	1.9 (1.9-1.9)
4(a)	1030 (17.2)	113	3.5	1.9 (1.5-2.2)	8982 (17.7)	649	3.5	1.3 (1.2-1.4)	98 401 (10.5)	5303	2.0	0.6 (0.5-0.6)
4(b)	137 (2.3)	137	4.3	2. 3 (1.9-2.7)	941 (1.9)	941	5.0	1.9 (1.7-2.0)	12 601 (1.34)	12 601	4.7	1.3 (1.3-1.4)
5	1082 (18.1)	989	30.9	16.5 (15.5-17.6)	7562 (14.9)	6494	34.8	12.8 (12.5-13.1)	115 954 (12.4)	93 305	34.8	9.9 (9.9-10.0)
6	127 (2.1)	115	3.6	1.9 (1.6-2.3)	883 (1.7)	861	4.6	1.7 (1.6-1.8)	18 594 (2.0)	17 127	6.4	1.8 (1.8-1.9)
7	169 (2.8)	145	4.5	2.4 (2.0-2.8)	1031 (2.0)	957	5.1	1.9 (1.8-2.0)	15 456 (1.6)	13 350	5.0	1.4 (1.4-1.4)
8	118 (2.0)	90	2.8	1.5 (1.2-1.8)	1005 (2.0)	692	3.7	1.4 (1.3-1.5)	14 250 (1.5)	8914	3.3	0.9 (0.9-1.0)
9	75 (1.3)	64	2.0	1.1 (0.8-1.3)	455 (0.9)	389	2.1	0.8 (0.7-0.8)	6701 (0.7)	4859	1.8	0.5 (0.5-0.5)
10	1007 (16.8)	657	20.5	11.0 (10.2-11.8)	3259 (6.4)	1388	7.4	2.7 (2.6-2.9)	46 033 (4.9)	15 304	5.7	1.6 (1.6-1.7)
Total§	**5977 (100.0)**	**3205**	**100.0**	**53.6 (51.8-55.5)**	**50 799 (100.0)**	**18 683**	**100.0**	**36.8 (36.3-37.3)**	**938 581 (100.0)**	**267 848**	**100.0**	**28.5 (28.4-28.6)**

† Relative contribution: proportion of CS in each Robson group according to the total number of CS.

‡ Absolute contribution: rate of CS in each Robson group in relation to the total population.
§ Excludes 12 486 (1.2%) women with not stated Robson classification.

Table 4: Rate of CS within each Robson group for women with Pre-gestational diabetes compared to women who did not have diabetes 2002-2012.

Robson groups	Pre-gestational diabetes		No diabetes†
	CS%	**AOR‡ (95% CI)**	**CS%**
1	22.9	1.4* (1.1-1.8)	14.7
2	62.0	2.0* (1.7-2.2)	43.5
2(a)	49.6	2.0* (1.7-2.3)	31.7
2(b)	100.0	-	100.0
3	6.0	2.1* (1.5-2.9)	2.3
4	21.4	1.3* (1.1-1.5)	16.1
4(a)	11.0	1.8* (1.5-2.2)	5.4
4(b)	100.0	-	100.0
5	91.4	2.5* (2.0-3.1)	80.5
6	90.6	0.9 (0.4-1.7)	92.1
7	85.8	0.8 (0.5-1.3)	86.4
8	76.3	1.8* (1.2-2.8)	62.6
9	85.3	1.8 (0.9-3.5)	72.5
10	65.2	3.1* (2.7-3.5)	33.2
Total	**53.6**	**2.4* (2.3-2.6)**	**28.5**

† Reference group.

‡ AOR, odd ratio was adjusted for maternal age, maternal country of birth (Australian born Yes/No), smoking status, birthweight (< 2500g, 2500-3999g and ≥ 4000g) and maternal and obstetric hypertension.

* Significant.

Table 5: Rate of CS within each Robson group for women who had gestational diabetes compared to women who did not have diabetes 2002-2012.

Robson groups	Gestational diabetes		No diabetes†
	CS%	AOR‡ (95% CI)	CS%
1	16.8	1.1 (1.0-1.1)	14.7
2	44.6	0.9* (0.9-1.0)	43.5
2(a)	34.7	1.1* (1.0-1.1)	31.7
2(b)	100.0	-	100.0
3	3.7	1.4* (1.3-1.6)	2.3
4	16.0	0.9* (0.8-0.9)	16.1
4(a)	7.2	1.2* (1.1-1.3)	5.4
4(b)	100.0	-	100.0
5	85.9	1.4* (1.3-1.5)	80.5
6	97.5	4.2* (2.6-6.8)	92.1
7	92.8	1.7* (1.3-2.1)	86.4
8	68.9	1.2* (1.0-1.3)	62.6
9	85.5	1.7* (1.3-2.2)	72.5
10	42.6	1.2* (1.1-1.3)	33.2
Total	**36.8**	**1.3* (1.2-1.3)**	**28.5**

† Reference group

‡ AOR, odd ratio was adjusted for maternal age, maternal country of birth (Australian born Yes/No), smoking status, birthweight (< 2500g, 2500-3999g and ≥ 4000g) and maternal and obstetric hypertension.

* Significant