Perinatal Services BC
An agency of the Provincial Health Services Authority

Examining cesarean delivery rates in British Columbia using the Robson Ten Classification

Part 1: Understanding the Ten Groups

A Perinatal Services BC Surveillance Special Report

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Examining cesarean delivery rates in British Columbia using the Robson Ten Classification. Part 1: Understanding the Ten Groups is Volume 1 Issue No. 4, 2011 of the Perinatal Services BC's Surveillance Special Reporting Series. The goal of this publication is to provide information to maternity health care providers, researchers and health information specialists on the use of the Robson Ten Group Classification in analyzing cesarean delivery rates in British Columbia. This Special Report examines data for two fiscal years – 2001/2002 and 2010/2011.

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About Perinatal Services British Columbia

The Ministry of Health and the British Columbia Medical Association (BCMA) initiated the British Columbia Reproductive Care Program (BCRCP) in June 1988. One of the mandates of the BCRCP was "the collection and analysis of data to evaluate perinatal outcomes, care processes and resources via a province-wide computerized database". This mandate was fundamental to the development of the British Columbia Perinatal Data Registry (BCPDR), which was initiated in 1993. Individuals instrumental in the creation of the BCPDR included Dr. Sidney Effer, Dr. William J. Ehman, Dr. Margaret Pendray, Mr. Peter Hayles and Dr. Alan Thomson with the support of the BC Ministry of Health.

The BCRCP became part of the Provincial Health Services Authority (PHSA) in 2001 when the government of British Columbia introduced five geographically based health authorities and one provincial health service authority.

In 2007, with the addition of the Provincial Specialized Perinatal Services (PSPS), the BCRCP was renamed the BC Perinatal Health Program (BCPHP). The BCPHP continued to work towards optimizing neonatal, maternal and fetal health in the province through educational support to care providers, outcome analysis and multidisciplinary perinatal guidelines. The BCPHP was overseen by a Provincial Perinatal Advisory Committee with representation from the Ministry of Health Services (MOHS), the Provincial Health Services Authority (PHSA), Children's and Women's Health Centre of BC, Health Authorities, health care providers and academic organizations.

In 2010, Perinatal Services BC (PSBC) was created to replace its predecessors, the BC Reproductive Care Program and the BC Perinatal Health Program. PSBC is overseen by a Provincial Perinatal Services Oversight Council and provides strategic leadership on the full continuum of perinatal care throughout the province focusing on perinatal care planning, service delivery and quality improvement. PSBC works collaboratively with local health authorities and stakeholders to improve perinatal health outcomes and enhance the quality of perinatal services in BC.

Executive Summary

Cesarean delivery (CD) rates in British Columbia (BC) are among the highest in Canada and have been scrutinized by the public and the health care system for some time. Several methods of grouping and analyzing CD rates have been proposed, but recent work suggests methodologies that examine CD rates among relatively similar groups of women are subject to the least bias and are easiest to replicate. One such woman-based grouping method is the Robson Ten Group Classification; it uses four obstetric characteristics – parity, labour type, gestational age, and fetal presentation/count – to classify women into one of ten groups within which CD rates can be examined.

Part one of this special report series on CD applies the Robson Ten Group Classification to data for British Columbia delivery for two fiscal years – 2001/2002 and 2010/2011 – and use the results to demonstrate how to interpret output using this methodology. We also assess how results from BC compare with those published by other jurisdictions.

Application of the Robson Classification identifies several groups as candidates for more detailed examination: nulliparous women with a singleton vertex, term delivery (Groups 1 and 2); multiparous women with a uterine scar and a singleton vertex, term delivery (Group 5); and women who cannot be classified into one of the ten groups because of incomplete information (Group 99).

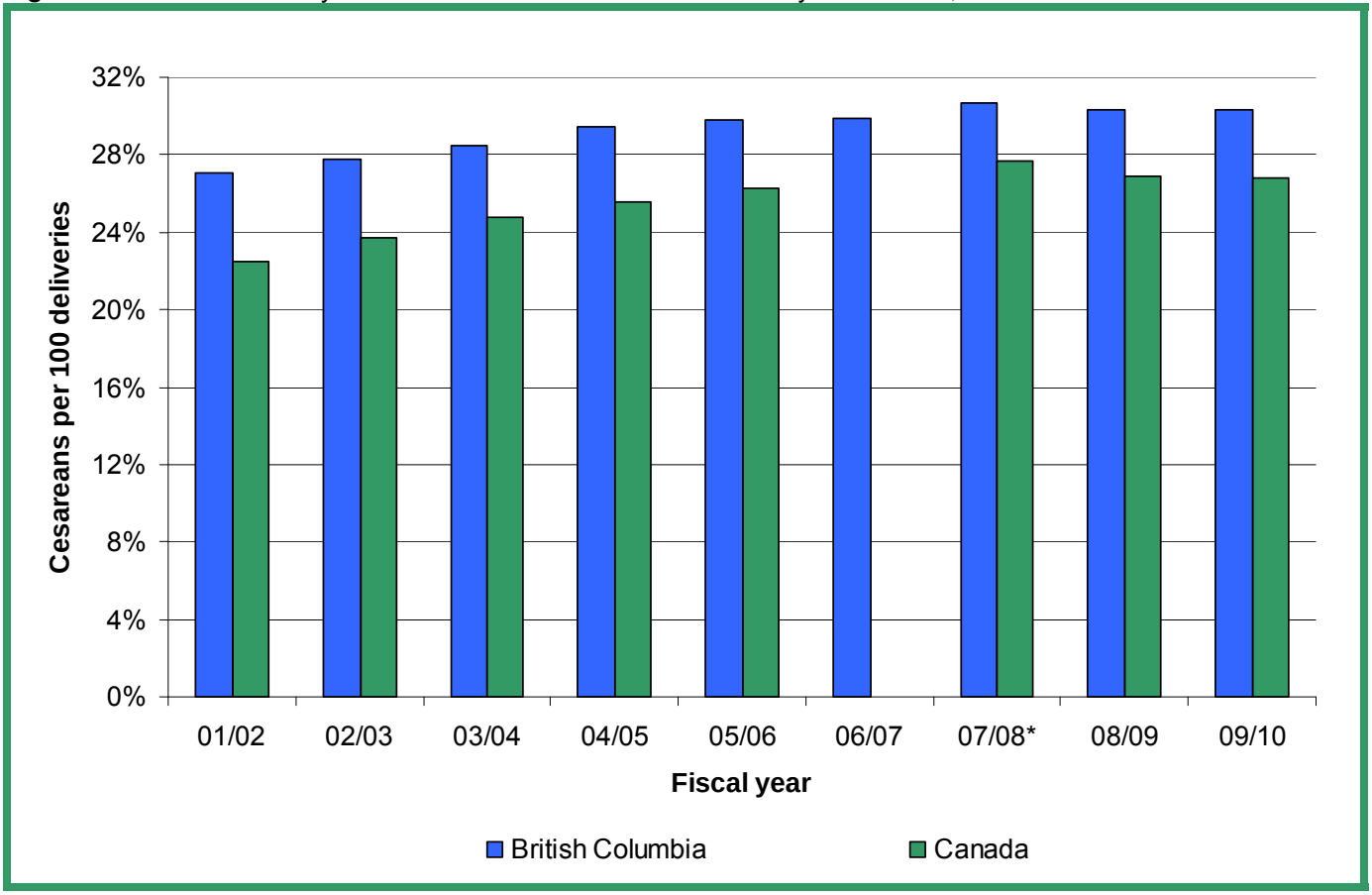
While this is a useful classification for beginning the exploration of the CD rate, facilities must conduct further investigation to assess the maternal, neonatal, policy, and practice factors associated with operative delivery.

Part two of Perinatal Services BC's series on the Robson Ten Group Classification will suggest additional analyses – statistical and based on record review – that may assist facilities in identifying the reasons for and appropriateness of their CD rate.

Introduction

The rate of cesarean delivery (CD) in British Columbia (BC) is one of the highest in Canada, and has increased steadily and significantly over the last decade from 27.1% in 2001/2002 to 31.0% in 2010/2011 [1] (Figure 1). The Canadian Institute for Health Information (CIHI) has reported an increase in the number and rate of births by cesarean across Canada [2-9]. Between 2001/2002 and 2009/2010, the CD rate increased 12% in BC and 19% across Canada. The BC rate was 13% higher than the Canadian rate in 2009/2010 (30.3% vs. 26.8%).

Figure 1. Cesarean delivery rate for British Columbia and Canada by Fiscal Year, 2001/2002 to 2009/2010



Sources: BC Perinatal Database Registry [1] and Canadian Institute for Health Information [2-9].
CIHI Notes: Canada rate not available in 2006/2007. *Canada rate for 2007/2008 excludes data from Quebec.

Among Organisation for Economic Cooperation and Development (OECD) countries in 2009, the CD rate per 100 live births ranged from 14.3% in the Netherlands to 47.4% in Brazil [10] At 26.6%, Canada's rate was the 16th highest of the 36 countries listed, and the 2009/2010 BC rate of 30.3% was above the OECD average of 25.8%.

The most recent provincial task force to study the issue in depth was convened in 2006 and issued the Cesarean Birth Task Force Report in 2008 [11]. The Task Force reported that rates of CD increased for nearly all groups of women between 2000 and 2005. Rates increased irrespective of weight gain during pregnancy, pre-pregnancy body mass index (BMI), maternal age, parity, and for most gestational ages. The CD rate was particularly high among women with hypertension, diabetes, and nulliparous women with induced labour. CD rates for all types of maternity care providers increased between 2000 and 2005 [11]. One of the recommendations from this report was that the British Columbia Perinatal Health Program – now Perinatal Services BC – would continue to monitor CD rates and factors associated with CD.

Among the reasons for the sustained interest in BC's CD rate are patient and system-level costs of the procedure. Cesarean delivery is the most common surgical procedure in Canada [7], and the total length of stay for women who deliver by cesarean is more than 40 hours longer than that for women who deliver vaginally [12]. The rate of maternal adverse events including anaesthetic complications, infection, and hysterectomy are higher after a cesarean than a vaginal delivery [13]. These risks and costs apply to the current and any future pregnancies given the high rate of repeat cesarean delivery [12, 14].

Several classification schemes have been proposed to understand the factors contributing to the overall CD rate. The simplest of these employ dichotomous groups. Cesarean deliveries can be performed before or during labour, they can be primary or repeat, and the decision to perform one can be elective (planned) or because of an emergency related to maternal or fetal health. Despite the apparent simplicity of these binary constructs, the wide variety of patient characteristics within each group reduces their usefulness as analytic constructs.

To move beyond these simple groupings and to facilitate monitoring across time and jurisdictions, clinicians and academics have developed classification systems based on routinely collected information [15]. Indication-based systems answer *why* CD was performed, and take maternal and fetal indications into account; however, standardized definitions are lacking, analysis can only be conducted retrospectively, and multiple indications may be present in a pregnancy, making classification challenging. Urgency-based systems answer *when* the CD was performed (urgently, emergently, or electively); this approach also suffers from unclear definitions and poor reproducibility. Woman-based systems answer *who* delivers by CD, and usually contain mutually exclusive categories that are easy to reproduce, but they do not assess why CD was performed. All the above rubrics aim to provide information on CD that can be used to classify cesarean deliveries into clinically relevant constructs and use this information to assess whether the right women are undergoing operative delivery at the right time [16].

A successful and useful grouping methodology will be simple, prospectively determined, clinically relevant, accountable, replicable, and verifiable [17]. A recent review of various CD classification systems suggests that woman-based approaches – such as the Robson Ten Group Classification (RTGC) – are easier to replicate and less biased than indication- or urgency-based approaches [15]. The purpose of this paper is to demonstrate how to examine a report using the Robson classification and to identify where further analysis might be warranted.

The Robson Ten Group Classification

First published in 1997, the Robson Ten Group Classification [18] aims to prospectively identify well-defined, clinically relevant groups of women so that differences in CD rates within relatively homogeneous groups can be investigated. The classification system can be used to compare CD rates over time and across jurisdictions in order to improve perinatal care and maternal and newborn outcomes. The groups were designed to be simple, mutually exclusive but completely inclusive, clinically relevant, and based on obstetric characteristics, and the information required to place a woman into a group is collected routinely for all maternity patients.

The Robson classification scheme was applied to deliveries in British Columbia using data from the BCPDR. This classification characterizes all women according to four objective and mutually exclusive characteristics of the pregnancy. **Category of pregnancy** was derived from the number of fetuses in the pregnancy and the documented delivery presentation. Four groups were possible: singleton vertex, singleton breech, singleton with abnormal lie, and multiple pregnancies. Singleton vaginal deliveries at ≥37 weeks with unknown presentation were treated as vertex. **Parity** was calculated based on the following fields: number previous preterm deliveries, number previous term deliveries, number previous vaginal deliveries, and number of previous cesarean deliveries. If all of these fields were blank, parity was proxied by the number of living children. Parity had three possible values: nulliparous, multiparous with a uterine scar, and multiparous without a uterine scar. **Labour and delivery type** indicated

whether there was spontaneous, induced, or no labour. **Gestational age** in completed weeks was calculated using an algorithm that includes date of the last menstrual period, early ultrasound, newborn exam, and chart documentation. Gestational age was grouped as preterm (≤36 weeks) or term (≥37 weeks). Late pregnancy terminations were excluded from all calculations. These four characteristics were used to create 10 mutually exclusive groups (Table 1).

Table 1. Robson's Ten Groups

GROUP	DESCRIPTION
1	Nulliparous women with a single vertex* pregnancy, at ≥37 weeks gestation in spontaneous labour
2	Nulliparous women with a single vertex* pregnancy, at ≥37 weeks gestation, who had labour induced or who had CD before labour
3	Multiparous women, without a uterine scar, with a single vertex* pregnancy at ≥37 weeks gestation in spontaneous labour
4	Multiparous women, without a uterine scar, with a single vertex* pregnancy at ≥37 weeks gestation, who had labour induced or who had CD before labour
5	Multiparous women, with at least one previous uterine scar with a single vertex* pregnancy at ≥37 weeks gestation
6	All nulliparous women with a single breech pregnancy
7	All multiparous women with a single breech pregnancy, including women with a uterine scar
8	All women with multiple pregnancies, including women with a uterine scar
9	All women with a single pregnancy with a transverse or other† abnormal presentation, including women with a uterine scar
10	All women with a single vertex* pregnancy at ≤36 weeks gestation, including women with a uterine scar
99	*Women who cannot be placed into one of the above groups due to incomplete information.*

In many jurisdictions – including BC – incomplete data preclude placing all women into one of the ten groups. "Group 99" comprises those women who cannot be classified because of missing information. While some analyses exclude these women from the calculations [19], we have elected to retain them because of the high proportion of these women with a cesarean delivery.

Four aspects of each group should be examined – the number of cesareans and total deliveries, relative group size (number of deliveries in the group / total number of deliveries), CD rate, and contribution to the total CD rate (number of cesarean deliveries in the group / total number of cesareans). The size and CD rate of a group must be considered together – a low CD rate in a large group contributes more to the total CD rate than a high CD rate in a very small group.

Understanding the Robson Ten Group Classification Table

Using BC data for 2010/2011^, we will demonstrate how to interpret and assess the information provided by the application of the Robson Ten Group Classification.

Table 2. Robson Ten Classification Information for British Columbia, 2010/2011

GROUP	NUMBER OF	NUMBER OF	RELATIVE	CESAREAN	CONTRIBUTION

* Robson's classification refers to cephalic presentation; however, vertex (cephalic occipital) presentation is captured in the BCPDR.

† Cephalic non-occiput presentations such as face and brow are classified as "other" presentations in BC; these deliveries are therefore found here rather than in Groups 1-5 or 10.

^ Data for 2010/2011 are preliminary and subject to revision.

	CESAREANS	DELIVERIES	SIZE	DELIVERY RATE	TO CD RATE
TOTAL	[1] **13,376**	[1] **43,115**	**100%**	**31.0%**	**100%**
1 – Nulliparous women with a single vertex* pregnancy, at ≥37 weeks gestation in spontaneous labour	2,349	11,885	[3] 27.6%	[11] 19.8%	[14] 17.6%
2 – Nulliparous women with a single vertex* pregnancy, at ≥37 weeks gestation, who had labour induced or who had CD before labour	2,356	5,291	[3] 12.3%	44.5%	[14] 17.6%
3 – Multiparous women, without a uterine scar, with a single vertex* pregnancy at ≥37 weeks gestation in spontaneous labour	297	11,381	[4] 26.4%	[12] 2.6%	2.2%
4 – Multiparous women, without a uterine scar, with a single vertex* pregnancy at ≥37 weeks gestation, who had labour induced or who had CD before labour	402	3,073	[4] 7.1%	[5] 13.1%	3.0%
5 – Multiparous women, with at least one previous uterine scar with a single vertex* pregnancy at ≥37 weeks gestation	3,833	4,859	[6] 11.3%	[13] 78.9%	[14] 28.7%
6 – All nulliparous women with a single breech pregnancy	954	1,003	[7] 2.3%	95.1%	7.1%
7 – All multiparous women with a single breech pregnancy, including women with a uterine scar	573	659	[7] 1.5%	87.0%	4.3%
8 – All women with multiple pregnancies, including women with a uterine scar	478	679	[8] 1.6%	70.4%	3.6%
9 – All women with a single pregnancy with a transverse or other† abnormal presentation, including women with a uterine scar	208	258	[2] 0.6%	[2] 80.6%	1.6%
10 – All women with a single vertex* pregnancy at ≤36 weeks gestation, including women with a uterine scar	820	2,839	[9] 6.6%	[10] 28.9%	6.1%
99 – Women who cannot be placed into one of the above groups due to incomplete information	1,106	1,188	2.8%	93.1%	8.3%

* Robson's classification refers to cephalic presentation; however, vertex (cephalic occipital) presentation is captured in the BCPDR.

† Cephalic non-occiput presentations such as face and brow are classified as "other" presentations in BC; these deliveries are therefore found here rather than in Groups 1-5 or 10.

^ Data for 2010/2011 are preliminary and subject to revision.

Robson suggests reviewing 14 aspects of the above table (Table 2) before delving further into the data. The part of the table to which each point refers includes a matching boxed numeral. The values referenced below for the expected relative size and CD rate of each Group are based on the experience of Dr. M. Robson.

1 The total number of cesareans and deliveries should be the sum of the number of each event in Robson groups 1 to 10 combined [16].

2 Group 9 should comprise 0.2-0.6% of women with a CD rate of 100%. Other values may reflect data collection issues [20].

3 Groups 1 and 2 usually account for 35-40% of all deliveries; Group 1 should be larger than Group 2.

4 Groups 3 and 4 usually account for 30-40% of women; Group 3 should be larger than Group 4.

5 The CD rate in Group 4 should be below 20% [20].

6 Group 5 should comprise no more than 10% of women [20].

7 Groups 6 and 7 should include 3-4% of all women, and Group 6 is usually twice the size of Group 7 [20].

8 Unless the site has an IVF program or is a referral centre, Group 8 should include 1.5-2% of women [20].

9 Group 10 includes approximately 5% of women. Higher proportions (6-7%) may be seen at referral centres and facilities with a high risk of preterm delivery [20].

10 If the CD rate in Group 10 is 15-16% it suggests a high proportion of women with spontaneous onset of preterm labour. Higher CD rates (30-40%) in this Group reflect more women with CD following preterm labour induction or a cesarean delivery without labour.

11 A CD rate for Group 1 less than 10% is desirable [20] and below 15% is achievable (personal communication, Michael Robson, October 4, 2011).

12 The CD rate for Group 3 should be 2.5-3% [16]. If the CD rate exceeds 3%, inaccurate data collection should be investigated.

13 With good perinatal outcomes, a CD rate of 50-60% in Group 5 is excellent [20].

14 Groups 1, 2, and 5 usually account for two-thirds of all cesarean deliveries. The CD rate in Group 10 for 2010/2011 was 28.9%.

How do BC data compare over time and with other jurisdictions?

Now that we have assessed how BC's data fit within the template, we will compare the information for BC for two fiscal years – 2001/2002 and 2010/2011^ – to see if the Groups have changed over time, and will see how our data compare to those of other jurisdictions. Chi-square tests for linear trend were calculated using all years of data between 2001/2002 and 2010/2011, although only these two years of data are printed.

Table 3. Robson Ten Group Information for British Columbia, 2001/2002 and 2010/2011^

GROUP	RELATIVE SIZE		CESAREAN DELIVERY RATE		CONTRIBUTION TO CD RATE	
	2001/2002	2010/2011^	2001/2002	2010/2011^	2001/2002	2010/2011^
1	26.1%	27.6%	18.9%	19.8%	18.5%	17.6%
2	11.1%	12.3%	39.3%	44.5%	16.4%	17.6%
3	29.1%	26.4%	2.7%	2.6%	2.9%	2.2%
4	9.0%	7.1%	10.0%	13.1%	3.4%	3.0%
5	9.2%	11.3%	72.9%	78.9%	25.1%	28.7%
6	2.4%	2.3%	94.8%	95.1%	8.6%	7.1%
7	1.7%	1.5%	90.5%	87.0%	5.8%	4.3%
8	1.4%	1.6%	63.1%	70.4%	3.2%	3.6%
9	0.6%	0.6%	82.0%	80.6%	2.0%	1.6%
10	5.6%	6.6%	24.0%	28.9%	5.0%	6.1%
99	3.8%	2.8%	64.8%	93.1%	9.3%	8.3%

^Data for 2010/2011 are preliminary and subject to revision.
Source: BC Perinatal Data Registry [1]

There were 12,270 cesareans and 41,927 deliveries in Groups 1 to 10 in 2010/2011. Once the women who could not be classified into one of the ten Groups (Group 99) are included, all deliveries in the province are captured. Consistent with guideline 14, above, 63.9% of all cesareans were to women in Groups 1, 2, and 5 in 2010/2011.

Groups 1 and 2 – Nulliparous women at term with a singleton vertex pregnancy in spontaneous labour (Group 1); or induced labour or CD without labour (Group 2).

In both years the relative size of Groups 1 and 2 combined is within the expected range of 35-40% (37.3% in 2001/2002 and 39.8% in 2010/2011), but the size of these groups increased significantly between these time points (Chi-square test for linear trend, $p<0.0001$). The relative size of Group 1 – nulliparous women with spontaneous labour at term – increased from 26.1% to 27.6% and the CD rate in this group increased from 18.9% to 19.8%. However, the contribution of this group to the CD rate declined from 18.5% to 17.6%. This seemingly paradoxical finding reflects the larger increases in the relative size and/or CD rate in other groups, since the contribution of any group to the CD rate depends in part on changes in other groups.

The CD rate for Groups 1 and 2 in BC is higher than in many other jurisdictions. Robson indicates that a CD rate of less than 10% is ideal and less than 15% is achievable for Group 1 – in BC the CD rate for this group was nearly 20% in both years examined and has not changed in the past ten years (Chi-square test for linear trend, $p=0.11$). For Group 1, CD rates of 15.4-23% have been reported in Australia [21, 22], and a 2009 paper indicated an average CD rate in Group 1 of 13.1% (range 5.7-20.6%) [23]; at 19.8% the rate in BC approaches the upper limit of this range. The CD rate for Group 2 has increased significantly from 39.3% to 44.5% (Chi-square test for linear trend, $p<0.0001$). At 44.5%, our CD rate in Group 2 was higher than the mean of 40.4% reported across nine perinatal centres [23], the rate of 42.6% reported in Melbourne, Australia [22], and well above the 2008 rate at one

facility in Dublin, Ireland (31.8%, [24]). The CD rate for all nulliparous women at term with a singleton vertex pregnancy was 25.0% in 2001/2002 and 27.4% in 2010/2011 (Chi-square test for linear trend, $p<0.0001$).

Recent research demonstrates that 97-99% [23-25] of the variation in the total CD rate can be explained by the CD rate of women in Groups 1 and 2. Research has also found that as the proportion of term singleton cephalic nulliparas who are induced increases, so does a facility's CD rate [23, 24]; one study attributed 69% of the variation in institutional CD rates to induction of nulliparas [24]. Recent data from Halifax, Nova Scotia indicate that women in Groups 1 and 2 with spontaneous or induced labour were among the largest contributors to the increase in CD rates for the period 2000-2007 [19].

Groups 3 and 4 – Multiparous women at term with a singleton vertex pregnancy and no uterine scar in spontaneous (Group 3) or induced (Group 4) labour.

Groups 3 and 4 included 33.5% of deliveries in BC in 2010/2011, but the relative size of these groups decreased significantly from 38.1% in 2001/2002 (Chi-square test for linear trend, $p<0.0001$), but both numbers are within the expected range of 30-40%. As anticipated, Group 3 is much larger than Group 4. A decrease in the relative size of these two groups has been reported in Halifax, NS [19]. While the combined CD rate of Groups 3 and 4 together has not changed in the past decade (4.4% in 2001/2002 vs. 4.8% in 2010/2011, $p=0.56$), the CD rate for Group 4 has increased significantly (Chi-square test for linear trend, $p<0.0001$).The 2010/2011 CD rate in BC for women in Group 3 (2.6%) and Group 4 (13.1%) are within the anticipated range (see Table 2 above). The CD rate of Group 3 is unchanged from that in 2001/2001, but the CD

BC's CD rate in Group 4 is similar to rates in New South Wales, Australia (14.6%, 1998-2008 [25]), Dublin, Ireland (12.3%, [24]), and Halifax (11.1%, [19]), and below those reported in Melbourne (23.1%, [22]) and Queensland, Australia (16.6% of public patients, [21]).

Group 5 – Multiparous women at term with a singleton vertex pregnancy and a previous uterine scar.

As in other jurisdictions [16], the contribution to the CD rate made by Group 5 is both the largest of all groups, and has increased significantly. Between 2001/2002 and 2010/2011, the size of Group 5 increased from 9.2% to 11.3% (Chi-square test for linear trend, $p<0.0001$) and the CD rate within the Group increased from 72.9% to 78.9% (Chi-square test for linear trend, $p<0.0001$). Halifax reported similar findings: the size of this group increased from 8.2% to 10.1% and the CD rate from 53.9% to 76.6% between 1992-1999 and 2000-2007 [19]. At 11.1%, BC's Group 5 is among the largest published. We found only three places where this group accounts for more than 11% of all deliveries – London, England (11.5%) and Auckland, New Zealand (13.0%, [23]), and Queensland (Australia) (11.8% of public and 18.8% of private patients, [21]).

Groups 6 and 7 – Nulliparas and multiparas with a singleton term breech pregnancy

Breech deliveries accounted for 3.8% of all women in 2010/2011 (2.3% + 1.5%). There were 50% more nulliparous than multiparous breeches. The size, CD rate, and contribution to the total CD rate of breech deliveries in BC are consistent with data from other perinatal centres [19, 21-23]. Robson indicates that the contribution of this group to the overall CD rate is highly correlated with the total number of women with breech pregnancies and the success of external cephalic version [16].

Group 8 – All multiple gestations

In 2010/2011, 1.6% of women had a multiple pregnancy. While the relative size and contribution to the CD rate of Group 8 are consistent with those reported in other areas, the CD rate within this Group is higher than in some locations. At 70.4% in 2010/2011, it is above the average CD rate (57.7%) for nine obstetric centres, and above the site-specific rate in seven of these sites [23]. Our rate is higher than that reported at one facility in Nova Scotia for 2000-2007 (56.1%, [19]) and in Melbourne, Australia for 2005 (62.6%, [22]). Although this group has a high CD rate, its small size means it accounts for only a small proportion of all cesareans (3.6%).

Group 9 – All singleton, term pregnancies with transverse or other abnormal presentation

Due to the categorization of non-occiput cephalic presentations such as face and brow into this Group we expected this to be a slightly larger than in other jurisdictions – Group 9 is 0.6% in BC compared with less than 0.5% in other areas [23]. Notably the CD rate in this group is lower than anticipated – the minimum reported by others is 90% [22, 23] compared to our rate of 80.6% in 2010/2011. Despite this high CD rate, this Group accounted for only 1.6% of all cesarean deliveries in 2010/2011. Data quality and educational efforts to underline the difference between occiput transverse position (of the fetal head against the maternal pelvis) and fetal transverse presentation are underway. Documentation and abstraction/coding of information on delivery position and presentation should be examined.

Group 10 – All singleton preterm pregnancies

At 28.9%, BC's CD rate for singleton preterm pregnancies is slightly lower than that of many other jurisdictions (mean of 35.3% across nine centres [22, 23]). The relative size of Group 10 in BC increased significantly – from 5.6% to 6.6% – between 2001/2002 and 2010/2011 (Chi-square test for linear trend, $p<0.0001$) and is now in the range of an area with a high risk of premature delivery [20].

Group 99 – Women who cannot be placed into one of the above groups due to incomplete information.

The share of deliveries and cesareans included in Group 99 has decreased, but we remain unable to classify 2.8% of women and 8.3% of cesarean deliveries. While the size of this Group has decreased since 2001/2002, the CD rate within this group increased from 64.8% to 93.1%. Of the four obstetric concepts used to place women in a Robson group, baby's presentation at delivery is most often missing (97.1% of women in Group 99, 2.7% of all deliveries), followed by missing gestational age (2.5%). While the proportion of all deliveries with missing presentation is lower than in other reports (4.7% [19], 5.9%, [26]), further improvement is desirable.

In summary, the above data show that 84.7% of deliveries are found in Groups 1 through 5; these Groups also contain 69.1% of all cesareans. The size of most Groups in BC is similar to what is expected based on the observations of Dr. Robson, but Groups 5 and 10 are slightly larger than anticipated. The CD rate in several Groups – notably Groups 1 and 5 – is higher than expected, and the CD rate in Group 9 is lower than expected.

Next Steps

There are three general steps in interpreting the information presented in the Robson Ten Group Classification template:

1. Identify the Group(s) that account for the largest proportion of women (relative size);
2. Identify the Group(s) that contribute most to the CD rate (relative contribution); and
3. Undertake statistical and/or clinical analysis of the relevant Group(s) to understand the factors that contribute to the CD rate and identify areas for potential modification.

Based on the above examination of the number of deliveries per group, relative size, CD rate, and contribution to the total CD rate, we have identified that Groups 1, 2, 3, 4, and 5 account for the majority of deliveries in BC (84.7%), and that Groups 1, 2, and 5 account for nearly two-thirds of cesareans (63.9%). Group 10 is slightly larger

in BC than in some places, and data quality issues within Group 9 are suspected due to the CD rate of less than 100%. At 8.3%, the proportion of cesarean deliveries that cannot be placed into one of the ten groups (Group 99) is also notable. The second paper in this series will focus on detailed analyses of these Groups – including maternal demographic and health characteristics as well as indications for induction and cesarean delivery – to improve our understanding of the reasons for the CD rate in BC.

Perinatal Services BC chose the Robson Classification to facilitate analysis of our CD rate because it employs groups based on women's characteristics, and uses routinely collected objective information. The main limitation of this method is that its primary purpose is to identify differences in CD rates across patient subgroups, but neither provides an explanation for these differences nor looks at the specific reason for performing the CD.

Cesarean delivery rates must be considered as one of many indicators of the quality of prenatal and obstetrical care. The appropriateness of a facility's CD rate should take into account both short- and long-term maternal and neonatal outcomes, provider mix, and other relevant factors. Although provided here for context, the Group distribution and CD rates reported in other countries may not be achievable or appropriate for BC. The most appropriate CD rate for BC will be one that maximizes the short- and long-term health and well being of mothers and neonates, and is acceptable to providers and patients in our province.

Limitations

Although this grouping methodology has been shown to be useful and replicable, there are limitations to the approach and to the analyses presented here. The Robson classification creates mutually exclusive and clinically relevant subgroups of women, but heterogeneity within groups remains. None of the analyses presented here take into account the demographic changes in the population of childbearing women in British Columbia. For example, 15.1% of first time mothers were aged 35 years or more in 2009/2010 compared to 13.1% in 2001/2002. Where available, pre-pregnancy obesity (BMI >= 30) has increased from 10.6% in 2001/2002 to 12.9% in 2009/2010. We will assess the potential impact of some of these population changes in the second part of this report.

Women in Group 99 were included in our calculations of the relative size and contribution to the CD rate made by each Group. Removing these women from the calculation does not change the overall findings, but does change the relative size and contribution of each Group to the obstetric population and CD rate.

Although it is possible that the reason(s) women have missing data have changed over the past 10 years, recent efforts to improve documentation and reduce the size of Group 99 have led to a slight increase in the relative size of Group 5.

Significant changes in the relative size and contribution to the overall CD rate of a Group can result either from a change in demographics or clinical management of the Group itself, or from changes to other Groups. As Group 99 decreases and is hopefully eliminated, changes in the size of other groups are likely as these women are redistributed among the other 10 Groups.

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