# Facility-Level Maternal and Neonatal Indicators

## Technical Documentation 2015/16

Perinatal Services BC

An agency of the Provincial Health Services Authority

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# A. Introduction

Perinatal Services BC (PSBC), an agency of the Provincial Health Services Authority, provides leadership, support, and coordination for the strategic planning of perinatal services in British Columbia in collaboration with the Ministry of Health, health authorities, and other key stakeholders. PSBC is the central source in the province for evidence-based perinatal information.

PSBC collects comprehensive perinatal information through the BC Perinatal Data Registry, a quality-controlled database containing clinical information on all births collected from acute care facilities and registered midwives who attend births at home throughout BC.

In partnership with regional health authorities, PSBC publishes six facility-level maternity and neonatal indicators on its website. The six indicators were selected based on widespread relevance and validity of data from facilities.

| Indicator | Short Title |
|---|---|
| 1. Vaginal delivery rate for eligible nulliparous women aged 20 to 39 years with a singleton vertex pregnancy at term | Vaginal Delivery for Eligible First-Time Mothers |
| 2. Early term repeat cesarean delivery without medical indication | Early Repeat Cesarean Delivery |
| 3. Post-date induction before 41+0 weeks gestation for women under 40 years of age at time of delivery | Post-Date Inductions Done Early |
| 4. Exclusive use of intermittent auscultation in labouring women without risk factors who delivered vaginally | Only Intermittent Auscultation in Low-Risk Deliveries |
| 5. Healthy term singletons receiving exclusive breast milk from birth to discharge | Healthy Babies Fed Only Breast Milk |
| 6. Attempted vaginal birth rate for eligible parous women under 40 years of age with a history of cesarean and a singleton vertex pregnancy at term | Attempted VBAC for Eligible Women |

With the 2017 release (data from April 1, 2011 to March 31, 2016), PSBC has retired the indicator *Vaginal Delivery for First-Time Mothers;* only *Vaginal Delivery for Eligible First-Time Mothers* is reported. We have introduced a new indicator, *Attempted VBAC for Eligible Women*.

The data may help to inform expectant mothers and families about the health services they receive and prepare for their birth experience. Women and their families with questions or concerns are encouraged to discuss them with their health care providers.

Perinatal Services BC and regional health authorities use the data to learn from each other and share best practices in order to ensure that maternity and newborn care meets the highest possible quality and safety standards.

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# B. Delivery Episodes Eligible for Inclusion in Facility-Level Indicators

All indicators are restricted to singleton deliveries meeting the following minimum criteria:

| **Include:** | |
|---|---|
| Delivery episode | MOTHER_ADMISSION.screen_source = “DL” AND<br>BABY_ADMISSION.screen_source = “NB” |
| Singleton delivery | BABY_ADMISSION.multiple_birth_count=1 AND<br>BABY_ADMISSION.baby_sequence=1 AND<br>MULTIPLE_LABOURS.baby_sequence=1 |
| Linked maternal-newborn records | BABY_ADMISSION.mother_id is not null |
| **Exclude:** | |
| Termination of pregnancy | DIAGNOSES.diagnosis_cd begins with O04 (Mother) OR P96.4 (Infant)<br>OR<br>PROCEDURES_PERFORMED.procedure_code begins with 5CA88 OR 5CA89 (Mother) |

Fiscal year is assigned based on MOTHER_ADMISSION.discharge_date where MOTHER_ADMISSION.screen_source = “DL”.

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# C. Detailed Indicator Definitions

## 1. Vaginal Delivery for Eligible First-Time Mothers

**Detailed Title**
Vaginal delivery rate for eligible nulliparous women aged 20 to 39 years with a singleton vertex pregnancy at term.

**Definition**
The proportion of nulliparous women without a medical contraindication to vaginal delivery 20 to 39 years of age with a term, singleton infant in a vertex position who deliver vaginally.

**Denominator**
Nulliparous women aged 20-39 years with an estimated gestational age of 37+0 or more weeks, a singleton infant with the head as the presenting part, and who have no documented pre-existing medical conditions, pregnancy, or obstetric complications that contraindicate vaginal delivery. See table below for complete inclusion and exclusion criteria.

**Numerator**
The number of women described above who deliver vaginally.

**Importance**
This indicator was added for the 2014/15 data release; effective 2015/16, it has replaced the indicator *Vaginal delivery for first-time mothers*.

While most nulliparous women are at lower medical and obstetric risk, there are medical and obstetric conditions that are absolute or strong contraindications to vaginal delivery, or that increase the risks associated with cesarean delivery. Clinical practice guidelines recommend cesarean delivery for women diagnosed with placenta previa (Oppenheimer, 2007; National Institute for Health and Clinical Excellence, 2011), vasa previa (Gagnon et al., 2009; Edmonds et al., 2013), cord prolapse (Royal College of Obstetricians and Gynaecologists, 2014), and active genital herpes (Edmonds et al., 2013; Liu et al., 2007; National Institute for Health and Clinical Excellence, 2011).

Medical and obstetric complications that may necessitate immediate delivery, often by cesarean, include severe pre-eclampsia (Magee et al., 2014; National Institute for Health and Clinical Excellence, 2014; Edmonds et al., 2013), antepartum hemorrhage (Liu et al., 2007; National Institute for Health and Clinical Excellence, 2011), and placental abruption (Liu et al., 2007; National Institute for Health and Clinical Excellence, 2014).

Other conditions that may increase the risks associated with vaginal delivery and are thus excluded from this indicator include pre-pregnancy body mass index above 35 (National Institute for Health and Clinical Excellence, 2014), pelvic abnormality or previous uterine surgery (Edmonds et al., 2013; National Institute for Health and Clinical Excellence, 2014) and central nervous system anomaly of the fetus (Liu et al., 2007).

This indicator may be used to monitor, support, and promote initiatives in normalizing births in BC.

**Variables Used in Calculation**

| Table | Variables |
|---|---|
| MOTHER_ADMISSION | mother_id, screen_source, date_of_birth, discharge_date |
| PREGNANCY | mother_id, term, premature, previous_cesarian_deliv, prev_vaginal_deliv, gravida, living, pre_pregnancy_weight, height |
| MULTIPLE_LABOURS | mother_id, baby_presentation_delivery, cesarean_type, primary_ind_operative_delivery |
| POSTPARTUM | mother_id, pp_hellp_syndrome |
| DIAGNOSES | patient_id, diagnosis_code |
| PROCEDURES_PERFORMED | patient_id, procedure_code |
| BABY_ADMISSION | mother_id, baby_id, date_of_birth, screen_source |

| Denominator | PDR Variables | ICD/CCI Codes |
|---|---|---|
| ***Include:*** | | |
| Nulliparas | term=0 and premature=0 and prev_cesarian_deliv=0 and prev_vaginal_deliv=0<br>OR<br>If any of term, premature, prev_cesarian_deliv, or prev_vaginal_deliv is null AND gravida=1<br>OR<br>If any of term, premature, prev_cesarian_deliv, or prev_vaginal_deliv is null AND living=0 | |
| Term gestation | Gestational age by the algorithm is at least 37 weeks | |
| Vertex presentation | baby_presentation_delivery = 6 (vertex) | |
| | baby_presentation_delivery = 9 (unknown) | procedure_code begins with 5MD5 and not 5MD60 |
| Age at delivery between 20 and 39 years | FLOOR(BABY_ADMISSION.date_of_birth – MOTHER_ADMISSION.date_of_birth)/365.25 | |
| | Is between 20 and 39 | |

| Denominator | PDR Variables | ICD/CCI Codes |
|---|---|---|
| ***Exclude: Contraindications to vaginal delivery; conditions that increase the risks associated with emergency timing cesarean*** | | |
| BMI ≥35 | pre_pregnancy_weight/(height/100)$^2$<br>is ≥35 (neither variable is missing) | |
| Known or suspected pelvic abnormality | | diagnosis_code is O34001, O34002, O34101, O34102, O34291, O34301, O34302, O34401, O34402, O34501, O34502, O34601, O34602, O34701, O34702, O34801, O34802, O34901, O34902, O65001, O65101, O65201, O65301, O65501, O65801, O65901 |
| Severe pre-eclampsia, HELLP, or eclampsia | pp_hellp_syndrome = "Y" | diagnosis_code is O14001, O14002, O14101, O14102, O14201, O14202, O15001, O15101, O15202 |
| Genital herpes | primary_ind_operative_delivery=11 | diagnosis_code begins with (N770 or N771) AND A60 |
| Fetal central nervous system anomaly | | diagnosis_code begins with Q00-Q07 (baby) OR<br>diagnosis_code is O35001, O35011, O35021, O35031, O35081, O35091 (woman) |
| Placenta previa | | diagnosis_code is O44001, O44101 |
| Placental abruption | | diagnosis_code is O45001, O45011, O45081, O45091, O45801, O45901 |
| Antepartum hemorrhage | | diagnosis_code is O46001, O46011, O46081, O46091, O46801, O46901 |
| Obstetric embolism | | diagnosis_code is O88001, O88101, O88201, O88301, O88801 |
| Placental disorders | | diagnosis_code is O43001, O43091, O43101, O43201, O43801, O43811, O43881, |

| | | |
|---|---|---|
| | | O43901 |
| Uterine dehiscence or rupture before onset of labour | | diagnosis_code is O71001, O71011, O71081, O71101, O71111, O71181 |
| Vasa previa | | diagnosis_code is with O69401 |
| Prolapsed cord | | diagnosis_code is O69001 (mom) or begins with P024 (infant) |
| **Numerator** | **PDR Variables** | **ICD/CCI Codes** |
| ***Include all cases in denominator with:*** | | |
| Vaginal delivery | | procedure_code begins with 5MD5 |
| | cesarean_type=0 AND | no procedure code beginning with 5MD5 or 5MD60 |
| ***But not:*** | | |
| Cesarean delivery | | procedure_code begins with 5MD60 |
| | cesarean_type=1 or 2 or 3 or 4 AND | no procedure code beginning with 5MD5 or 5MD60 |

**Data Notes**
Vaginal deliveries with unknown delivery presentation are assumed to be vertex for the purposes of this indicator.

Accuracy of this indicator is also contingent upon correct assignment of gestational age. Early ultrasound (<20 weeks) and last menstrual period are the primary sources used in assessment of gestational age, but in their absence information from the newborn exam or other chart documentation must be used. PSBC uses an algorithm consistent with that recommended by the Society of Obstetricians and Gynaecologists of Canada. See Section D. Assignment of Gestational Age for further details.

Delivery method is assigned using the PDR field cesarean_type only when the maternal delivery record lacks a procedure code indicating delivery.

**References**
Edmonds JK, Yehezkel R, Liao X, Moore Simas TA. *Racial and ethnic differences in primary, unscheduled cesarean deliveries among low-risk primiparous women at an academic medical center: a retrospective cohort study*. BMC Pregnancy and Childbirth 2013, 13:168.

Gagnon R, Morin L, Bly S, Butt K, Cargill YM, Denis N, Hietala-Coyle MA, Lim KI, Ouellet A, Raciot MH, Salem S; Diagnostic Imaging Committee, Hudon L, Basso M, Bos H, Delisle MF, Farine D, Grabowska K, Menticoglou S, Mundle W, Murphy-Kaulbeck L, Pressey T, Roggensack A; Maternal Fetal Medicine Committee. *Guidelines for the Management of Vasa Previa*. J Obstet Gynaecol Can 2009 Aug;31(8):748-760.

Liu S, Liston RM, Joseph KS, Heaman M, Sauve R, Kramer MS; Maternal Health Study Group of the Canadian Perinatal Surveillance System. *Maternal mortality and severe morbidity associated with low-risk planned cesarean delivery versus planned vaginal delivery at term*. CMAJ 2007 Feb 13;176(4):455-60.

Magee LA, Pels, A, Helewa M, Rey, E, von Daldelszen, P, et al. *Diagnosis, evaluation, and management of the hypertensive disorders of pregnancy: Executive summary*. JOGC 2014 36 (5):416-438.

National Institute for Health and Clinical Excellence. *Caesarean section (update)*. (Clinical guideline 132). 2011, http://guidance.nice.org.uk/CG132.

National Institute for Health and Care Excellence. *Intrapartum care: care of healthy women and their babies during childbirth*. (Clinical Guideline 190.) 2014, www.nice.org.uk/guidance/cg190.

Oppenheimer L, Society of Obstetricians and Gynaecologists of Canada. *Diagnosis and Management of Placenta Previa*. J Obstet Gynaecol Can 2007 Mar;29(3):261-266.

Royal College of Obstetricians and Gynaecologists. *Umbilical cord prolapse Guideline No 50*. London 2014, https://www.rcog.org.uk/en/guidelines-research-services/guidelines/gtg50.

## 2. Early Repeat Cesarean Delivery

**Detailed Title**
Early term repeat cesarean delivery without medical indication

**Definition**
The proportion of repeat cesarean deliveries between 37+0 and 38+6 weeks gestation among all women who underwent repeat cesarean delivery without medical indication at term.

**Denominator**
Women with a history of cesarean delivery who, in the current pregnancy, delivered by cesarean without labour at or after 37+0 weeks gestation, excluding women with a condition which might warrant early delivery (The Joint Commission, 2011). See table below for complete list of exclusions.

**Numerator**
The number of women described above who delivered between 37+0 and 38+6 weeks gestation.

**Importance**
Early elective repeat cesarean delivery without medical or obstetrical indication has no clear benefit to the woman or infant and is associated with increased adverse neonatal outcomes, such as increased risk of neonatal respiratory complications, admission to neonatal intensive care unit, sepsis, and feeding problems with delivery at early term ages (37+0 to 38+6 weeks) compared with late term ages (39+0 to 41+6 weeks) (Main et al., 2010).

A pregnant woman who is healthy and has no medical reasons for delivering early benefits from staying pregnant to at least 39 weeks as the baby's lungs and brain are still developing in the last weeks of pregnancy.

This measure has been recommended as an indicator of quality perinatal care (The Joint Commission, 2011; ACOG, 2013) and has also been used in Ontario by BORN (Dunn et al., 2013).

It is important for pregnant women to seek early and regular prenatal care from a primary maternity care provider (doctor, midwife, or nurse practitioner) and have an accurate assessment of the expected due date. If a pregnant woman is planning for a repeat cesarean section, she should discuss with her primary maternity care provider to schedule it as close to 39 weeks as possible. Access to operating room and staff are important considerations for a planned cesarean section. The woman is advised to discuss the availability of these resources with her primary maternity care provider as these can differ between hospitals and can affect the scheduling of the cesarean section.

**Variables Used in Calculation**

| Table | Variables |
|---|---|
| MOTHER_ADMISSION | mother_id, discharge_date, screen_source |
| PREGNANCY | mother_id, prev_cesarian_deliv |
| MULTIPLE_LABOURS | mother_id, labour_spont_flg, labour_aug_flg, labour_ind_flg, labour_none_flg |
| RISK_ASSESSMENT | mother_id, risk_code |
| BABY_ADMISSION | baby_id, mother_id |
| BABY_DELIVERY | baby_id, stillbirth |
| DIAGNOSES | patient_id, diagnosis_cd, diagnosis_type |
| PROCEDURES_PERFORMED | patient_id, procedure_code |

| Denominator | PDR Variables | ICD/CCI Codes |
|---|---|---|
| ***Include:*** | | |
| Women with previous cesarean delivery | prev_cesarian_deliv >=1 | |
| Term gestation | Gestational age by the algorithm is at least 37 weeks | |
| Women without labour | labour_none_flg = "Y" AND<br>labour_spont_flg is not "Y" AND<br>labour_aug_flg is not "Y" AND<br>labour_ind_flg is not "Y" | |
| Delivery by cesarean | | procedure_code begins with 5MD60 |
| ***Exclude: Conditions warranting early delivery*** | | |
| HIV disease | | diagnosis_cd begins with B24, O987, Z21 |
| Pre-existing hypertension | | diagnosis_cd is O10001, O10002, O10101, O10102, O10201, O10202, O10301, O10302, O10401, O10402, O10901, O10902, O11001, O11002 |
| Gestational hypertension or pre-eclampsia | | diagnosis_cd is O13001, O13002, O14001, O14002 |
| | discharge_date ≥ April 1, 2012 AND | diagnosis_cd is O14101, O14102, O14201, O14202 O14901, O14902 |
| Eclampsia | | diagnosis_cd is O15001, O15101, O15202 |

| | | |
|---|---|---|
| Other hypertension | | diagnosis_cd is O16001, O16002 |
| Pre-existing diabetes (Type 1 or 2) | risk_code = 15, 16 | diagnosis_cd is O24501, O24502, O24601, O24602, O24701, O24702 |
| Gestational diabetes | risk_code = 13, 14 | diagnosis_cd is O24801, O24802 |
| Liver disorders in pregnancy | | diagnosis_cd is O26601, O26602 |

| Denominator | PDR Variables | ICD/CCI Codes |
|---|---|---|
| ***Exclude: Conditions warranting early delivery (cont'd)*** | | |
| Continuing pregnancy after loss/termination | | diagnosis_cd is O31111, O31121, O31201 |
| Malpresentation | | diagnosis_cd is O32001, O32201 |
| Known or suspected fetal abnormality | | diagnosis_cd is O35001, O35011, O35021, O35031, O35081, O35091, O35101, O35301, O35401, O35501, O35601, O35701, O35801, O35901 |
| Isoimmunization | risk_code = 11, 12 | diagnosis_cd is O36021, O36031, O36091, O36121, O36131, O36191 |
| Fetal asphyxia | | diagnosis_cd is O36321, O36331, O36391 |
| Intrauterine death | stillbirth = "P" | diagnosis_cd is O36421, O36431, O36491 |
| Known or suspected restricted fetal growth | risk_code = 28 | diagnosis_cd is O36521, O36531, O36591 |
| Polyhydramnios, Oligohydramnios, or amniotic sac infection | | diagnosis_cd is O40021, O40031, O40091, O41021, O41031, O41091, O41121, O41131, O41191 |
| Premature rupture of membranes | | diagnosis_cd is O42011, O42021, O42091, O42111, O42121, O42191, O42901 |

| | | |
|---|---|---|
| Fetomaternal transfusion syndromes | | diagnosis_cd is O43001, O43011, O43091 |
| Placenta previa | | diagnosis_cd is O44001, O44101 |
| Placental abruption | | diagnosis_cd is O45001, O45011, O45081, O45091, O45801, O45901 |

| Denominator | PDR Variables | ICD/CCI Codes |
|---|---|---|
| ***Exclude: Conditions warranting early delivery (cont'd)*** | | |
| Antepartum or intrapartum hemorrhage | | diagnosis_cd is O46001, O46011, O46081, O46091, O46801, O46901, O67001, O67801, O67901 |
| Fetal stress/distress | | diagnosis_cd is O68001, O68101, O68201, O68301 |
| Vasa previa | | diagnosis_cd is O69401, O69409 |
| Prolonged rupture of membranes | | diagnosis_cd is O75601 |
| Maternal circulatory disease | | diagnosis_cd is O99401, O99402<br>OR<br>diagnosis_cd with diagnosis_type M, 1, W, X, Y is O99801 or O99802 AND diagnosis_cd beginning with Q20-Q28 as diagnosis_type 3 |
| Poor reproductive history | | diagnosis_cd begins with Z352 |
| Multiple pregnancy with some liveborn infant (see note) | | diagnosis_cd begins with Z373, Z3760, Z3761, Z3762, Z3763, Z3768, Z3769 |

| Numerator | PDR Variables | ICD/CCI Codes |
|---|---|---|
| ***Include all cases in denominator with:*** | | |
| Gestational age between 37+0 and 38+6 | Gestational age by the algorithm is 37 or 38 completed weeks | |

**Data Notes**
Using the PDR, we are unable to identify women with planned repeat cesarean delivery who present for care in spontaneous labour before their scheduled cesarean delivery date.

Accuracy of this indicator is also contingent upon correct assignment of gestational age. Early ultrasound (<20 weeks) and last menstrual period are the primary sources used in assessment of gestational age, but in their absence information from the newborn exam or other chart documentation must be used. PSBC uses an algorithm consistent with that recommended by the SOGC. See Section D. Assignment of Gestational Age for further details.

Codes for multiple pregnancies with some liveborn (Z37.3^ and Z37.6^) are retained in this definition to ensure that any cases with termination or loss early in pregnancy but resulting in a singleton delivery are considered indicated cesarean deliveries.

Effective April 1, 2012, discharges, classification of gestational hypertension, and pre-eclampsia per ICD-10-CA changed significantly. Additional codes have been added to the list of exclusions for discharges in Fiscal Year 2012/13 forward.

**References**
ACOG Committee Opinion No. 561. *Nonmedically indicated early term deliveries*. American college of obstetricians and gynecologists. Obstet Gyne 2013;121:911-5.

Dunn S, Sprague AE, Fell DB, Dy J, Harrold J, Lamontagne B, Walker M. *The use of a quality indicator to reduce elective repeat Caesarean section for low-risk women before 39 weeks' gestation: the Eastern Ontario experience*. J Obstet Gynaecol Can. 2013 Apr;35(4):306-16.

Main E, Oshiro B, Chagolla B, Bingham D, Dang-Kilduff L, and Kowalewski L. Elimination of Non-medically Indicated (Elective) Deliveries Before 39 Weeks Gestational Age. (California Maternal Quality Care Collaborative Toolkit to Transform Maternity Care) Developed under contract #08-85012 with the California Department of Public Health; Maternal, Child and Adolescent Health Division; First edition published by March of Dimes, July 2010.

The Joint Commission. Table Number 11.07: Conditions Possibly Justifying Elective Delivery Prior to 39 weeks Gestation, v2011A.

## 3. Post-Date Inductions Done Early

**Detailed Title**
Post-date induction before 41+0 weeks gestation for women under 40 years of age at time of delivery

**Definition**
The proportion of women under 40 years of age who delivered before 41+0 weeks gestation with an indication for induction of 'post-dates', among all term singleton deliveries (live births and stillbirths) to women under 40 years of age.

**Denominator**
All women under the age of 40 who deliver a singleton infant at term (i.e., 37+0 or more weeks gestational age).

**Numerator**
Number of women described above whose labour was induced for 'post-dates' but gestational age at delivery was <41+0 weeks.

**Importance**
A post-date pregnancy is defined by the World Health Organisation as a pregnancy that extends to at least 42+0 weeks gestation. Post-term pregnancies may be associated with higher rates of obstetrical and perinatal complications including fetal distress, operative vaginal or cesarean delivery, macrosomia, shoulder dystocia, and birth injury (Delaney & Roggensack, 2008; Olesen et al., 2003).

The Society of Obstetricians and Gynaecologists of Canada recommends that induction of labour be offered at 41+0 to 42+0 weeks to decrease perinatal mortality without increased risk of cesarean delivery (Delaney & Roggensack, 2008).

This indicator measures the proportion of women with an indication for post-dates who deliver prior to 41+0 weeks. While pregnancies that continue past 41+0 weeks gestation are of legitimate concern to women and their providers, post-dates is not a valid indication for induction when the pregnancy has not reached at least 41+0 weeks gestation.

It is important for pregnant women to seek early and regular prenatal care from a primary maternity care provider (doctor, midwife, or nurse practitioner) and have an accurate assessment of the expected due date.

**Variables Used in Calculation**

| Table | Variables |
|---|---|
| MOTHER_ADMISSION | mother_id, screen_source, date_of_birth, discharge_date |
| MULTIPLE_LABOURS | mother_id, indication_for_induction, baby_delivered_date |
| LABOUR | mother_id, labour_ind_flg |

| Denominator | PDR Variables | ICD/CCI Codes |
|---|---|---|
| ***Include:*** | | |
| Term gestation | Gestational age by the algorithm is ≥37 | |
| Age at delivery <40 years | FLOOR(MULTIPLE_LABOURS.baby_delivered_date – MOTHER_ADMISSION.date_of_birth)/365.25 | |
| | Is less than 40 | |
| **Numerator** | **PDR Variables** | **ICD/CCI Codes** |
| ***Include with:*** | | |
| Induced labour | labour_ind_flg = "Y" | |
| Induced for post dates | indication_for_induction=1 (post dates) | |
| Gestational age at delivery is <41 weeks | Gestational age by the algorithm is between 37 and 40 | |
| Age at delivery <40 years | FLOOR(MULTIPLE_LABOURS.baby_delivered_date – MOTHER_ADMISSION.date_of_birth)/365.25 | |
| | Is less than 40 | |

**Data Notes**

Accuracy of this indicator is also contingent upon correct assignment of gestational age. Early ultrasound (<20 weeks) and last menstrual period are the primary sources used in assessment of gestational age, but in their absence information from the newborn exam or other chart documentation must be used. PSBC uses an algorithm consistent with that recommended by the Society of Obstetricians and Gynaecologists of Canada. See Section D. Assignment of Gestational Age for further details.

**References**

Olesen AW, Westergaard JG, and Olsen J. *Perinatal and maternal complications related to postterm delivery: A national register-based study, 1978-1993*. Am J Obstet Gynecol 2003;189:222-7.

Delaney M and Roggensack A. *Guidelines for the management of pregnancy at 41+0 to 42+0 weeks*. J Obstet Gynaecol Can 2008;30(9):800–810.

## 4. Only Intermittent Auscultation in Low-Risk Deliveries

**Detailed Title**
Exclusive use of intermittent auscultation in labouring women without risk factors who delivered vaginally

**Definition**
The proportion of women with a vaginal delivery, but without specific risk factors, whose labour was monitored only using intermittent auscultation.

Intermittent auscultation (IA) involves listening to the fetal heart beats at specified intervals during labour. The fetal heart rate and rhythm provide information on how well the fetus is tolerating labour, and abnormal results may lead to changes in the management of labour and delivery processes.

**Denominator**
Women with unaugmented spontaneous labour that led to vaginal delivery of a singleton infant with the head as the presenting part at 37+0 to 41+6 weeks gestation. Women with selected pregnancy characteristics are excluded. See table below for complete list of exclusions.

**Numerator**
The number of women described above whose labour was monitored only with intermittent auscultation. Women with internal or external electronic monitoring at any point during labour are excluded from the numerator.

**Importance**
Fetal heart rate and rhythm provide information on how well the fetus is tolerating labour. For example, changes in fetal heart rate and rhythm precede fetal brain injury. The goal of fetal monitoring during labour is to prevent injury or death to the fetus through early detection of fetal distress and subsequent clinical intervention.

There are two methods of monitoring in labor: 1) intermittent auscultation (IA), which is listening to fetal heartbeats at specified intervals; and 2) external electronic fetal monitoring (EEFM), which is using an instrument to continuously record the fetal heartbeat. Historically, EEFM was the most common method of fetal surveillance used in British Columbia. However, research comparing IA and EEFM has shown that EEFM does not decrease neonatal morbidity or mortality, but rather leads to increased use of interventions such as anesthesia, operative vaginal delivery (forceps or vacuum extraction), and cesarean delivery (Cahill 2015, Rossignol 2013, Rossignol 2014).

The Society of Obstetricians and Gynaecologists of Canada recommends IA for fetal monitoring during labour for low-risk women (Liston et al., 2007). Abnormal fetal heart rate detected during labour requires investigation to find the cause, and if unresolved, electronic fetal monitoring and/or prompt delivery may be necessary.

This indicator is a measure of utilization of IA among women who deliver vaginally and are eligible for this method of labour monitoring.

**Variables Used in Calculation**

| Table | Variables |
|---|---|
| MOTHER_ADMISSION | mother_id, screen_source, discharge_date |
| LABOUR | mother_id, auscultation, elec_fetal_monitor_external, elec_fetal_monitor_internal, no_fetal_monitoring |
| PREGNANCY | mother_id, prev_cesarian_deliv, height, pre_pregnancy_weight, |
| MULTIPLE_LABOURS | mother_id, baby_sequence, baby_presentation_delivery, labour_spont_flg, labour_aug_flg, labour_ind_flg, labour_none_flg |
| RISK_ASSESSMENT | mother_id, risk_code |
| ANESTHESIA | mother_id, epidural_flg |
| BABY_ADMISSION | baby_id, mother_id, screen_source, multiple_birth_count, baby_sequence |
| BABY_DELIVERY | baby_id, stillbirth, meconium |
| DIAGNOSES | patient_id, diagnosis_cd |
| PROCEDURES_PERFORMED | patient_id, procedure_code, anesthetic_agent |

| Denominator | PDR Variables | ICD/CCI Codes |
|---|---|---|
| ***Include:*** | | |
| Unaugmented spontaneous labour | labour_spont_flg= "Y" AND<br>labour_aug_flg is not "Y" AND<br>labour_ind_flg is not "Y" AND<br>labour_none_flg is not "Y" AND | |
| No history of cesarean | prev_cesarian_deliv=0 | |
| Vaginal deliveries | | procedure_code begins with 5MD5 |
| Gestational age 37-41 completed weeks | Gestational age by the algorithm is between 37 and 41 | |
| Vertex presentation | baby_presentation_delivery = 6 (vertex) or 9 (unknown) | |
| BMI <40 or missing | pre_pregnancy_weight/(height/100)$^2$<br>is <40 (neither variable is missing)<br>OR<br>height AND/OR pre_pregnancy_weight is missing | |

| Denominator | PDR Variables | ICD/CCI Codes |
|---|---|---|
| ***Exclude:*** | | |
| Epidural anesthesia | epidural_flg= "Y" | procedure_code beginning with 5MD5 has anesthetic_agent= 3 |
| Cesarean delivery | | procedure_code beginning with 5MD60 |
| Antepartum stillbirth | stillbirth = "P" | diagnosis_cd is O36421, O36431, O36491 |
| Gestational diabetes | risk_code = 13, 14 | diagnosis_cd begins with O248 |
| Pre-existing diabetes | risk_code = 15, 16 | diagnosis_cd begins with O245, O246, O247 |
| Gestational hypertension or pre-eclampsia | risk_code = 9 | diagnosis_cd begins with O13 or O14 |
| Eclampsia | | diagnosis_cd begins with O15 |
| Antepartum hemorrhage | risk_code = 8 | diagnosis_cd begins with O20, O45, O46, O67, O441, O694 |
| Isoimmunization | risk_code = 11, 12 | diagnosis_cd is O36021, O36031, O36091, O36121, O36131, O36191 |
| Suspected IUGR | risk_code=28 | diagnosis_cd is O36521, O36531, O36591 |
| Cardiac disease | | diagnosis_cd is O99401, O99402 |
| Anemia | | diagnosis_cd is O99001, O99002 |
| Hyperthyroidism | | diagnosis_cd is O99201, O99202 |
| Renal disease | | diagnosis_cd is O99801, O99802 |
| Oligohydramnios | | diagnosis_cd is O41021, O41031, O41091 |
| Intrauterine infection / chorioamnionitis | | diagnosis_cd is O41121, O41131, O41191 |
| Prolonged (>24h) rupture of membranes at term | | diagnosis_cd is O42121 |
| Meconium | meconium = "Y" | diagnosis_cd begins with P240 |

| Numerator | PDR Variables | ICD/CCI Codes |
|---|---|---|
| ***Include all cases in denominator with:*** | | |
| Auscultation only | auscultation = "Y" and<br>elec_fetal_monitor_internal is not "Y"<br>elec_fetal_monitor_external is not "Y"<br>no_fetal_monitoring is not "Y" | |

**Data Notes**
Singleton vaginal deliveries at term with unknown delivery presentation are treated as vertex.

Height and/or pre-pregnancy weight are unavailable, and Body Mass Index (BMI) therefore cannot be calculated, for approximately one third of all women who deliver in BC. Women for whom a BMI cannot be calculated are included in this indicator unless they satisfy one of the other exclusion criteria. Improved documentation of maternal height and weight will assist with increasing the accuracy of this indicator.

Accuracy of this indicator is contingent upon correct assignment of gestational age. Early ultrasound (<20 weeks) and last menstrual period are the primary sources used in assessment of gestational age, but in their absence information from the newborn exam or other chart documentation must be used. PSBC uses an algorithm consistent with that recommended by the SOGC. See Section D. Assignment of Gestational Age for further details.

**References**
Cahill AG and Spain J. Intrapartum Fetal Monitoring. Clinical Obstetrics and Gynecology. Clin Obstet Gynecol. 2015 Jun;58(2):263-8.

Liston R, Sawchuck D, Young D et al. *Fetal Health Surveillance: Antepartum and Intrapartum Consensus Guideline*. Journal of Obstetrics and Gynecology in Canada. September 2007(197):ppS3-S56.

Rossignol M, Moutquin JM, Boughrassa F, Bédard MJ, Chaillet N, Charest C, Ciofani L, Dumas-Pilon M, Gagné GP, Gagnon A, Gagnon R, Senikas V. Preventable obstetrical interventions: how many caesarean sections can be prevented in Canada? J Obstet Gynaecol Can. 2013 May;35(5):434-43.

Rossignol M, Chaillet N, Boughrassa F, Moutquin J-M. Interrelations Between Four Antepartum Obstetric Interventions and Cesarean Delivery in Women at Low Risk: A Systematic Review and Modeling of the Cascade of Interventions. Birth. 2014 Mar;41(1):70-8

## 5. Healthy Babies Fed Only Breast Milk

**Detailed Title**
Healthy term singletons receiving exclusive breast milk from birth to discharge

**Definition**
The proportion of healthy term singletons that were fed only breast milk during their birth episode (from birth to discharge).

In the BC Perinatal Data Registry, "exclusive breast milk" means that the baby received only breast milk as a food source during the birth episode. This may have included milk from the breast or expressed breast milk from the mother or a donor. The baby may have also received undiluted drops of vitamins, minerals, or medicine in addition to breast milk.

**Denominator**
All healthy live born singletons with a gestational age of at least 37+0 weeks. Infants with a medical indication for formula supplementation are excluded (WHO, 2009). See table below for complete list of excluded maternal and neonatal conditions.

**Numerator**
The number of infants described above who were only fed breast milk from birth to discharge.

**Importance**
The Canadian Paediatric Society, Dieticians of Canada, and Health Canada recommend that healthy term infants receive only breast milk and Vitamin D drops during their first six months of life and continue to receive breast milk up to two years of age (Health Canada et al., no date). Breastfed infants have lower rates of gastrointestinal and respiratory infection and may be less likely to develop allergies (Health Canada et al., no date). Furthermore, women who breastfeed their infants have delayed return of their periods, which can contribute to increased birth spacing, increased iron stores, and more rapid weight loss compared to women who feed their infants with formula.

The World Health Organisation (WHO), as part of the Baby-Friendly Hospital Initiative, recommends that women initiate breastfeeding within 30 minutes of delivery (World Health Organisation, 2009). The WHO also recommends feeding liquids other than breast milk only where medically indicated.

**Variables Used in Calculation**

| Table | Variables |
|---|---|
| MOTHER_ADMISSION | mother_id, screen_source, discharge_date |
| RISK_ASSESSMENT | mother_id, risk_code |
| BABY_ADMISSION | baby_id, mother_id, admission_weight, sex, newborn_feeding |
| BABY_DELIVERY | baby_id, stillbirth |
| DIAGNOSES | patient_id, diagnosis_cd |

| Denominator | PDR Variables | ICD/CCI Codes |
|---|---|---|
| ***Include:*** | | |
| Term gestation | Gestational age by the algorithm is at least 37 completed weeks | |
| Live births | stillbirth is "N" | |
| Male or female sex | sex is "M" or "F" | |
| Valid birthweight | admission_weight between 5 and 8999g | |
| ***Exclude:*** | | |
| Infant with metabolic disease | | diagnosis_cd begins with E70-E90 (infant) |
| SGA | Male infant:<br>admission_weight <2560 at 37 weeks<br>admission_weight <2790 at 38 weeks<br>admission_weight <2948 at 39 weeks<br>admission_weight <3080 at 40 weeks<br>admission_weight <3201 at 41 weeks<br>admission_weight <3232 at 42 weeks<br>admission_weight <3260 at 43 weeks<br>admission_weight <3175 at 44 weeks<br><br>Female infant:<br>admission_weight <2460 at 37 weeks<br>admission_weight <2680 at 38 weeks<br>admission_weight <2835 at 39 weeks<br>admission_weight <2950 at 40 weeks<br>admission_weight <3062 at 41 weeks<br>admission_weight <3090 at 42 weeks<br>admission_weight <3090 at 43 weeks<br>admission_weight <3025 at 44 weeks | diagnosis_cd begins with P059 (infant) |
| Hypoglycemia | | diagnosis_cd begins with P700, P701, P703, or P704 (infant) |
| Exposure to noxious maternal substances or experiencing substance withdrawal | | diagnosis_cd begins with P041-P049, P961 (infant) |
| Asphyxia | | diagnosis_cd begins with P20, P21 (infant) |

| Denominator | PDR Variables | ICD/CCI Codes |
|---|---|---|
| ***Exclude: (cont'd)*** | | |
| Gestational diabetes | risk_code = 13, 14 | diagnosis_cd begins with O248 (woman) |
| Pre-existing diabetes | risk_code = 15, 16 | diagnosis_cd begins with O245, O246, O247 (woman) |
| HIV disease | | diagnosis_cd begins with B24, O987, Z21 (woman) |
| Sepsis | | diagnosis_cd begins with O85 (woman) |
| Epilepsy | | diagnosis_cd begins with G40, G41 (woman) |
| **Numerator** | **PDR Variables** | **ICD/CCI Codes** |
| ***Include all cases in denominator with:*** | | |
| Breast milk only | newborn_feeding = "BR" | |

**Data Notes**
Accuracy of this indicator is also contingent upon correct assignment of gestational age. Early ultrasound (<20 weeks) and last menstrual period are the primary sources used in assessment of gestational age, but in their absence information from the newborn exam or other chart documentation must be used. PSBC uses an algorithm consistent with that recommended by the Society of Obstetricians and Gynaecologists of Canada. See Section D. Assignment of Gestational Age for further details.

Infant growth status is assessed using BC-specific fetal growth charts.

**References**
Health Canada, Canadian Paediatric Society, Dietitians of Canada, and Breastfeeding Committee for Canada. *Nutrition for Healthy Term Infants: Recommendations from Birth to Six Months*. (no date). Accessed March 22, 2013 from: http://www.hc-sc.gc.ca/fn-an/nutrition/infant-nourisson/recom/index-eng.php.

World Health Organisation, UNICEF, and Wellstart International. *Baby-friendly hospital initiative: revised, updated and expanded for integrated care*. Section 1, Background and implementation. Geneva, 2009.

## 6. Attempted VBAC for Eligible Women

**Detailed Title**
Attempted vaginal birth rate for eligible parous women under 40 years of age with a history of cesarean and a singleton vertex pregnancy at term.

**Definition**
The proportion of eligible parous women under 40 years of age with a history of cesarean and a term, singleton infant with a vertex presentation who attempt to give birth vaginally.

**Denominator**
Parous women under 40 years of age with a history of cesarean delivery, an estimated gestational age of 37+0 or more weeks, and a singleton infant with the head as the presenting part. Women with pre-existing medical conditions, pregnancy, or obstetric complications that contraindicate vaginal delivery are excluded, as are women whose obstetric history increases their risk of uterine rupture. See table below for complete inclusion and exclusion criteria.

**Numerator**
The number of women described above who attempt to deliver vaginally.

**Importance**
This is a new indicator added for the 2015/16 data release.

Among deliveries in British Columbia, more than one in eight (12.8%) are singleton term infants born to women with at least one previous cesarean delivery. Nearly 80% of these women deliver by repeat cesarean. Due to the high cesarean rate among these women, this small group of women accounts for more than 30% of all cesareans in BC (Perinatal Services BC, 2016a). While most women with a history of cesarean will have a repeat cesarean, many are medically eligible to attempt a vaginal delivery in subsequent pregnancies. Based on BC data from 2010/11 to 2014/15, approximately 70% of women who were eligible for and attempted a VBAC had a vaginal delivery (Perinatal Services BC, 2016b).

Some women have medical or obstetric conditions in the current pregnancy that are absolute or strong contraindications to labour or vaginal delivery, independent of their cesarean history (see Indicator 1) (Oppenheimer, 2007; National Institute for Health and Clinical Excellence, 2011; Gagnon et al., 2009; Edmonds et al., 2013; Liu et al., 2007; Magee et al., 2014; National Institute for Health and Clinical Excellence, 2014).

In addition to contraindications to vaginal delivery such as placenta previa or vasa previa, a small number of conditions are often noted as absolute contraindications to vaginal birth after cesarean, including previous vertical or inverted T cesarean incision (Martel, 2005; Guise et al., 2010), previous uterine rupture (Martel, 2005), and previous single layer closure (Guise et al., 2010). While older guidelines recommend that trial of labour be offered to women with one previous cesarean (Martel 2005), more recent guidelines recommend that planned vaginal delivery be offered to women with up to and including four previous cesarean deliveries (National Institute for Health and Clinical Excellence, 2011).

A rare but serious risk associated with attempting a vaginal delivery for women with a previous cesarean is uterine rupture. The risk of rupture is significantly higher among women with more

than four previous cesarean deliveries (National Institute for Health and Clinical Excellence, 2011) and women with an interdelivery interval <18 months (Martel, 2005; Bujold, 2010).

Despite the presence of one or more of these risks or contraindications, some women—in conjunction with their health care provider—may decide to plan a vaginal birth after cesarean. These women are not captured in this definition for surveillance purposes.

This indicator may be used to monitor, support, and promote initiatives to increase access to vaginal birth after cesarean in BC.

**Variables Used in Calculation**

| Table | Variables |
|---|---|
| MOTHER_ADMISSION | mother_id, screen_source, date_of_birth, discharge_date |
| PREGNANCY | mother_id, term, premature, previous_cesarian_deliv, prev_vaginal_deliv, gravida, living, pre_pregnancy_weight, height |
| MULTIPLE_LABOURS | mother_id, baby_presentation_delivery, cesarean_type, primary_ind_operative_delivery, cesarean_incision |
| POSTPARTUM | mother_id, pp_hellp_syndrome |
| DIAGNOSES | patient_id, diagnosis_code |
| PROCEDURES_PERFORMED | patient_id, procedure_code |
| BABY_ADMISSION | mother_id, baby_id, date_of_birth, screen_source |
| RISKS | mother_id, risk_code |

| Denominator | PDR Variables | ICD/CCI Codes |
|---|---|---|
| ***Include:*** | | |
| Women with no more than four previous cesarean deliveries | prev_cesarian_deliv is between 1 and 4 | |
| Term gestation | Gestational age by the algorithm is at least 37 weeks | |
| Vertex presentation | baby_presentation_delivery = 6 (vertex) | |
| | baby_presentation_delivery = 9 (unknown) AND | procedure_code begins with 5MD5 and not 5MD60 |
| Age at delivery <40 years | FLOOR(BABY_ADMISSION.date_of_birth – MOTHER_ADMISSION.date_of_birth)/365.25 | |
| | Is less than 40 | |
| Delivery episode linked to at least one | (previous) MOTHER_ADMISSION.discharge_date ≥ | |

| | | |
|---|---|---|
| previous delivery episode in BC | April 1, 2000 | |

| Denominator | PDR Variables | ICD/CCI Codes |
|---|---|---|
| ***Exclude: Contraindication to vaginal delivery; factors that increase the risks associated with emergency timing cesarean*** | | |
| BMI ≥35 | pre_pregnancy_weight/(height/100)$^2$<br>is ≥35 (neither variable is missing) | |
| Known or suspected pelvic organ abnormality | | diagnosis_code is O34001, O34002, O34101, O34102, O34291, O34301, O34302, O34401, O34402, O34501, O34502, O34601, O34602, O34701, O34702, O34801, O34802, O34901, O34902 , O65501, O65801, O65901 |
| Known or suspected pelvic bone abnormality | | diagnosis_code is O33001, O33101, O33201, O33301, O65001, O65101, O65201, O65301 |
| Severe pre-eclampsia, HELLP, or eclampsia | pp_hellp_syndrome = "Y" | diagnosis_code is O14001, O14002, O14101, O14102, O14201, O14202, O15001, O15101, O15202 |
| Genital herpes | primary_ind_operative_delivery=11 | diagnosis_code begins with (N770 or N771) AND A60 |
| Fetal central nervous system anomaly | | diagnosis_code begins with Q00-Q07, Q792 (baby) OR<br>diagnosis_code is O35001, O35011, O35021, O35031, O35081, O35091, O33601, O33701, O36321 (woman) |
| Placenta previa | | diagnosis_code is O44001, O44101 |
| Placental abruption | | diagnosis_code is O45001, O45011, O45081, O45091, O45801, O45901 |
| Antepartum hemorrhage | | diagnosis_code is O46001, O46011, O46081, O46091, O46801, O46901 |

| Denominator | PDR Variables | ICD/CCI Codes |
|---|---|---|
| Placental disorders | | diagnosis_code is O43001, O43091, O43101, O43201, O43801, O43811, O43881, O43901 |
| Uterine dehiscence or rupture before onset of labour | | diagnosis_code is O71001, O71011, O71081, O71101, O71111, O71181 |
| Vasa previa | | diagnosis_code is O69401 |
| Prior neonatal death | risk_code = 1 | |
| Prior stillbirth | risk_code = 2 | |
| Prior fetus with major congenital anomaly | risk_code = 6 | |
| ***Exclude: Contraindication to vaginal delivery after cesarean*** | | |
| *Previous* uterine dehiscence or rupture in BC | MOTHER_ADMISSION.discharge_date between April 1, 2000 and March 31, 2004 AND | diagnosis_cd begins with 6650 or 6651 |
| | MOTHER_ADMISSION.discharge_date ≥ April 1, 2004 AND | diagnosis_cd begins with O710 or O711 |
| ***Exclude: Factors associated with increased risk of uterine rupture*** | | |
| *Previous* non-lower segment transverse cesarean incision in BC (i.e. low segment vertical, classical, or other incision) | cesarean_incision = 2, 3, or 4 AND MOTHER_ADMISSION.discharge_date ≥ April 1, 2000 | |
| *Previous* cesarean delivery in BC within 540 days | [(current) MULTIPLE_LABOURS.baby_delivered_date - (previous) MULTIPLE_LABOURS.baby_delivered_date < 540 days] | procedure_code for the previous episode begins with 5MD60 |
| **Numerator** | **PDR Variables** | **ICD/CCI Codes** |
| ***Include all cases in denominator with:*** | | |
| Attempted vaginal delivery | labour_ind_flg= "Y" OR labour_aug_flg = "Y" OR vbac_attempted= "Y" | |

**Data Notes**

Vaginal deliveries with unknown delivery presentation are assumed to be vertex for the purposes of this indicator.

Accuracy of this indicator is also contingent upon correct assignment of gestational age. Early ultrasound (<20 weeks) and last menstrual period are the primary sources used in assessment of gestational age, but in their absence information from the newborn exam or other chart documentation must be used. PSBC uses an algorithm consistent with that recommended by the Society of Obstetricians and Gynaecologists of Canada. See Section D. Assignment of Gestational Age for further details.

Delivery method is assigned using the PDR field cesarean_type only when the maternal delivery record lacks a procedure code indicating delivery.

Only data available since the PDR achieved provincial coverage are available for inclusion in this indicator—that is, delivery episodes occurring in BC either in acute care or at home with a registered health care provider, discharged on or after April 1, 2000.

Information on delivery episodes in other provinces or countries is not available in the PDR and therefore cannot be incorporated into this indicator. This information is often available to health care providers from patient records and is used by clinicians to determine whether a woman is medically eligible for VBAC.

Because details about previous deliveries outside British Columbia—including type of cesarean incision, uterine dehiscence or rupture, and date—are not captured in the PDR, only women who have had at least one previous delivery in BC since April 1, 2000 are eligible for inclusion in this indicator.

Deliveries for the same woman are identified through deterministic linkage that is primarily based on personal health number, given name(s), surname(s), and date of birth.

**References**

Bujold E and Gauthier EJ. Risk of Uterine Rupture Associated With an Interdelivery Interval Between 18 and 24 Months. Obstet Gynecol 2010;115:1003–6.

Gagnon R, Morin L, Bly S, Butt K, Cargill YM, Denis N, Hietala-Coyle MA, Lim KI, Ouellet A, Raciot MH, Salem S; Diagnostic Imaging Committee, Hudon L, Basso M, Bos H, Delisle MF, Farine D, Grabowska K, Menticoglou S, Mundle W, Murphy-Kaulbeck L, Pressey T, Roggensack A; Maternal Fetal Medicine Committee. *Guidelines for the Management of Vasa Previa*. J Obstet Gynaecol Can 2009 Aug;31(8):748-760.

Guise J-M, Eden K, Emeis C, Denman MA, Marshall N, Fu R, Janik R, Nygren P, Walker M, McDonagh M. Vaginal Birth After Cesarean: New Insights. Evidence Report/Technology Assessment No.191. (Prepared by the Oregon Health & Science University Evidence-based Practice Center under Contract No. 290-2007-10057-I). AHRQ Publication No. 10-E003. Rockville, MD: Agency for Healthcare Research and Quality. March 2010.

Liu S, Liston RM, Joseph KS, Heaman M, Sauve R, Kramer MS; Maternal Health Study Group of the Canadian Perinatal Surveillance System. *Maternal mortality and severe morbidity associated with low-risk planned cesarean delivery versus planned vaginal delivery at term*. CMAJ 2007 Feb 13;176(4):455-60.

Magee LA, Pels, A, Helewa M, Rey, E, von Daldelszen, P, et al. *Diagnosis, evaluation, and management of the hypertensive disorders of pregnancy: Executive summary*. JOGC 2014 36 (5):416-438.

Martel MJ, MacKinnon CJ, et al. Guidelines for Vaginal Birth After Previous Caesarean Birth. J Obstet Gynaecol Can 2005;27(2):164–174

National Institute for Health and Clinical Excellence. *Caesarean section (update)*. (Clinical guideline 132). 2011, http://guidance.nice.org.uk/CG132.

National Institute for Health and Care Excellence. *Intrapartum care: care of healthy women and their babies during childbirth*. (Clinical Guideline 190.) 2014, www.nice.org.uk/guidance/cg190.

Oppenheimer L, Society of Obstetricians and Gynaecologists of Canada. *Diagnosis and Management of Placenta Previa*. J Obstet Gynaecol Can 2007 Mar;29(3):261-266.

Perinatal Services BC (2016a). *Robson groups, British Columbia*. Available from http://www.perinatalservicesbc.ca/Documents/Data-Surveillance/Reports/SpecialReports/BC_RobsonGroups_2016.pdf.

Perinatal Services BC (June 2016b). *Perinatal Health Report: Deliveries in British Columbia 2014/15.* Vancouver, BC. Available from http://www.perinatalservicesbc.ca/Documents/Data-Surveillance/Reports/PHR/PHR_BC_2014_15.pdf

# D. Assignment of Gestational Age

Gestational age at delivery is calculated using an algorithm consistent with that recommended by the Society of Obstetricians and Gynaecologists of Canada. The algorithm takes into account the last menstrual period (LMP), early ultrasound (EUS) before 20 weeks, newborn clinical exam, and chart documented estimate of gestational age. Accurate documentation of each of these on patient charts, including the estimated weeks and days gestation at early ultrasound, permits the most accurate calculation by PSBC.

Gestational age in completed weeks[§] based on LMP and EUS in days is calculated as follows:

1. If LMP[*] is recorded and there is no EUS, use GA from LMP.
2. If LMP is recorded, there is no EUS[^], but clinical exam of baby gives a GA at least 3 weeks different than LMP, use GA from newborn clinical exam.
3. If LMP is recorded and within 5 days of GA from EUS at <14 weeks, use GA from LMP. If difference is more than 5 days, use GA from EUS.
4. If LMP is recorded and within 7 days of GA from EUS at 14-17 weeks, use GA from LMP. If difference is more than 7 days, use GA from EUS.
5. If LMP is recorded and within 10 days of GA from EUS at 18-20 weeks, use GA from LMP. If difference is more than 10 days, use GA from EUS.
6. If LMP is not recorded but GA from EUS is recorded, use GA – using weeks and days – from EUS
7. If LMP and EUS are not recorded, use GA from newborn clinical exam.
8. If LMP, EUS, and newborn clinical exam are not recorded, use GA from chart documentation.
9. If all are missing or out of range, GA is missing.

**Variables Used in Calculation**

| Table | Variables |
|---|---|
| MOTHER_ADMISSION | mother_id, screen_source |
| PREGNANCY | mother_id, last_menstrual_period, first_us_date, first_us_g_age, first_us_g_age_days |
| MULTIPLE_LABOURS | mother_id, baby_delivered_date, baby_sequence |
| BABY_ADMISSION | baby_id, mother_id, date_of_birth, baby_sequence, screen_source |
| BABY_DELIVERY | baby_id, gest_age_by_exam, gest_age_from_document |

**Notes**

§ Completed weeks of gestation is a term used in the estimated age of the fetus calculated from the first day of the LMP or US. A completed week increments at seven-day intervals. For instance, 37 completed weeks includes the time span from 37 weeks and 0 days to 37 weeks and six days.

* Only LMP estimates of 15-45 weeks are considered. All others are treated as missing.

^ Only GA estimates of 17-43 weeks from EUS are considered. All others are treated as missing.

# E. Source Documentation for PDR Variables Used in Calculation

The BC Perinatal Data Registry is used to aggregate and report on perinatal events, care processes, and outcomes at the provincial, regional, community, and hospital levels. Data on all eligible delivery and birth episodes are submitted to Perinatal Services BC by hospitals as well as midwives attending deliveries at home for inclusion in the PDR.

Health information management staff use the medical chart to create data abstracts for submission to the Discharge Abstract Database (for inpatient hospital event) and to the PDR. Clear and complete documentation by care providers is essential in order to ensure accurate data collection by health information staff.

The table below indicates the most common source document(s) for the variables used in the calculation of the facility-level indicators. Only provincial perinatal forms produced by PSBC are included in the table. If a hospital uses other forms in lieu of or in addition to these provincial perinatal forms, the local health information staff will look at other documentation to generate abstracts for the PDR. Questions about abstracting processes should be directed to the facility's Health Records department.

PSBC provincial perinatal forms are available on our website at: www.perinatalservicesbc.ca/health-professionals/forms.

| Concept | Variable Name(s) | Primary and Alternate Source Documentation* |
|---|---|---|
| Obstetrical history | term<br>premature<br>gravida | **Antenatal Record 1**<br>Labour & Birth Summary<br>Labour Partogram<br>Triage and Assessment |
| | prev_cesarian_deliv<br>prev_vaginal_deliv | **Antenatal Record 1** |
| Reproductive history (previous neonatal death, previous stillbirth, previous fetus with major anomaly) | risk_code | **Antenatal Record 1** |
| Gestational age | last_menstrual_period | **Antenatal Record 1**<br>Antenatal Record 2<br>Triage and Assessment |
| | first_us_date | **Antenatal Record 1**<br>Antenatal Record 2 |
| | first_us_g_age<br>first_us_g_age_days | **Antenatal Record 1**<br>**Antenatal Record 2** |
| | gest_age_by_exam | **Newborn Record 1** |
| | gest_age_from_document | **Labour & Birth Summary** |

| Concept | Variable Name(s) | Primary and Alternate Source Documentation* |
|---|---|---|
| Height and weight | height<br>pre_pregnancy_weight | **Antenatal Record 1**<br>**Antenatal Record 2** |
| Maternal medical conditions (diabetes, hypertension, antepartum hemorrhage, suspected IUGR, isoimmunisation) | risk_code<br>diagnosis_code | **Antenatal Record 1**<br>**Antenatal Record 2** |
| HELLP syndrome | pp_hellp_syndrome<br>diagnosis_code | **Clinical Notes** |
| VBAC attempted | vbac_attempted | **Labour & Birth Summary** |
| Type of labour | labour_spont_flg<br>labour_aug_flg<br>labour_ind_flg<br>labour_none_flg | **Labour & Birth Summary**<br>**Labour Partogram** |
| Labour monitoring | auscultation<br>elec_fetal_monitor_external<br>elec_fetal_monitor_internal<br>no_fetal_monitoring | **Labour & Birth Summary**<br>**Labour Partogram** |
| Anesthetic and analgesic agent(s) | epidural_flg | **Labour & Birth Summary**<br>**Labour Partogram** |
| Primary indication for induction | indication_for_induction | **Labour & Birth Summary** |
| Primary indication for cesarean | primary_ind_operative_delivery | **Labour & Birth Summary** |
| Cesarean incision | cesarean_incision | **OR Report** |
| Delivery presentation | baby_presentation_delivery | **Labour & Birth Summary**<br>**Labour Partogram** |
| Baby sequence | baby_sequence | **Labour & Birth Summary** |
| Number fetuses in the pregnancy | multiple_birth_count | **Labour Partogram** |
| Baby date of birth | date_of_birth | **Newborn Record 1** |
| Live births | stillbirth | **Newborn Record 1** |
| Presence of meconium | meconium | **Newborn Record 1** |
| Infant sex | sex | **Newborn Record 1** |
| Newborn feeding | newborn_feeding | **Newborn Clinical Pathway**<br>Newborn Record 2 |

**Bolded Provincial perinatal form names indicate the primary source document(s).*

# F. Peer Groups

The following are the peer groups for 2015/16.

| Peer Group | Obstetrical Units in Peer Group |
|---|---|
| Small Peer Group<br>Facilities with <250 deliveries per year* (n=22) | • 100 Mile District General Hospital<br>• Bulkley Valley District Hospital<br>• Creston Valley Hospital & Health Centre<br>• Elk Valley Hospital<br>• G. R. Baker Memorial Hospital<br>• Golden & District General Hospital<br>• Invermere & District Hospital†<br>• Kitimat Hospital and Health Centre<br>• Kootenay Boundary Regional Hospital<br>• Lady Minto/Gulf Islands Hospital†<br>• Lillooet Hospital & Health Centre<br>• Port McNeill Hospital†<br>• Powell River General Hospital<br>• Prince Rupert Regional Hospital<br>• Haida Gwaii Hospital and Health Centre†<br>• Queen Victoria Hospital<br>• Sechelt Hospital<br>• Shuswap Lake General Hospital<br>• Squamish General Hospital<br>• St. John Hospital<br>• Stuart Lake Hospital†<br>• West Coast General Hospital |
| Medium Peer Group<br>Facilities with 250-999 deliveries per year* (n=13) | • Campbell River Hospital<br>• Cariboo Memorial Hospital<br>• Chilliwack General Hospital<br>• Cowichan District Hospital<br>• Dawson Creek and District Hospital<br>• East Kootenay Regional Hospital<br>• Fort St. John Hospital<br>• Kootenay Lake Hospital<br>• Mills Memorial Hospital<br>• Penticton Regional Hospital<br>• Ridge Meadows Hospital<br>• St. Joseph's General Hospital<br>• Vernon Jubilee Hospital |

| Peer Group | Obstetrical Units in Peer Group |
|---|---|
| Large Peer Group<br>Facilities with 1,000-2,499 deliveries per year* (n=11) | • Abbotsford Regional Hospital & Cancer Centre<br>• Burnaby Hospital<br>• Kelowna General Hospital<br>• Langley Memorial Hospital<br>• Lions Gate Hospital<br>• Nanaimo Regional General Hospital<br>• Peace Arch Hospital<br>• Richmond Hospital<br>• Royal Inland Hospital<br>• St. Paul's Hospital<br>• University Hospital of Northern British Columbia |
| Extra Large Peer Group<br>Facilities with 2,500+ deliveries per year* (n=4) | • BC Women's Hospital & Health Centre<br>• Royal Columbian Hospital<br>• Surrey Memorial Hospital<br>• Victoria General Hospital |

**Notes**

†Surgical capacity not routinely available.

*Based on average delivery volume in the 2014/15 and 2015/16 fiscal years.

# H. Methods

## Stabilized Rates

Historically, PSBC released annual rates for larger facilities but pooled rates for facilities in the small peer group (i.e. three years of data combined into one summary rate). This enabled PSBC to share information for all sites providing obstetric services, even those with low volume, while respecting privacy requirements. Combining several years of data for smaller sites also removed some of the year-to-year variation that may be due to chance. However, it meant that annual rates for these smaller sites were unavailable.

To overcome this challenge, PSBC has modified its methodology and will publicly release stabilized rates instead of crude rates. Stabilization is a methodology that helps to smooth out the effects of chance variation due to small numbers of deliveries at some sites. Stabilized facility rates are, on the whole, closer to the BC crude rate than the facility crude rate. Stabilization will tend to have the biggest impact on sites with lower volumes. As a result of this shift in methodology, we are now able to release annual data (stabilized rates with 95% confidence intervals) for all sites providing planned obstetric services, not just those with at least 250 deliveries. Removal of random variation in this way is also more appropriate for comparison to target rates.

PSBC generates these stabilized rates using multilevel, or hierarchical, regression models calculated with PROC GLIMMIX in SAS 9.4. These regression models include two components: a *fixed effect* and a *random effect*. The fixed effect in our model estimates a coefficient for the model's intercept, which reflects the average rate across all obstetric facilities. A random effect is included at the level of the facility and reflects that observations from one facility are more related to each other than to observations from other facilities. The random effect allows each facility's estimated average rate to vary around the population average rate, assuming that this variability follows a normal (bell-shaped) distribution. The model's regression equation, which combines the fixed 'average' effect and the random hospital effects, is used to predict a stabilized rate for each hospital.

Using the coefficients from these regression equations, for facility *i*, the stabilized rate is derived using the following formula:

$$E(p_i) = \frac{\exp(\alpha + \beta_i)}{1 + \exp(\alpha + \beta_i)}$$

where:

the expected value of $p_i$ is the stabilized rate for facility *i*, $\alpha$ is the *fixed effect*, and $\beta_i$ is the *random effect* for facility *i*. Models are built for each year of data.

## Targets for 2020/21

Although other jurisdictions define obstetric and neonatal process indicators that are similar to those reported by PSBC (Sprague 2013, Dunn 2013, Office of Disease Prevention and Health Promotion), indicator specifications vary because of differences in routinely available data. While some have defined benchmarks for their indicators, these targets may not be appropriate for British Columbia. PSBC has defined targets as a 10% improvement on the BC rate from the 2015/16 data year. The targets for the year 2020/21 are as follows:

| Indicator | BC Crude Rate 2015/16 | Target Rate 2020/21 |
|---|---|---|
| 1. Vaginal Delivery for Eligible First-Time Mothers | 71.4% | 78.5% |
| 2. Early Repeat Cesarean Delivery | 38.3% | 34.4% |
| 3. Post-Date Inductions Done Early | 0.8% | 0.7% |
| 4. Only Intermittent Auscultation in Low-Risk Deliveries | 74.3% | 81.7% |
| 5. Healthy Babies Fed Only Breast Milk | 77.6% | 85.4% |
| 6. Attempted VBAC for Eligible Women | 33.2% | 36.5% |

## Significance

In previous releases of the facility indicators, significance was defined relative to the crude BC rate: if a facility's 95% confidence interval did not overlap the confidence interval for the BC rate, the facility's rate was considered to be significantly different from the provincial average.

Beginning with the 2015/16 data release, significance is assessed relative to the target rate rather than the provincial rate. We calculated an 80% confidence limit around the target rate (1.28 standard deviations above and 1.28 standard deviations below). These confidence limits make a funnel shape—that is, the confidence limits are wider when there are fewer cases in the denominator (as occurs at smaller sites) and narrower when there are more cases in the denominator (as occurs at larger sites). Facilities whose stabilized rates fall within the funnel are not significantly different from the target rate (i.e. the facility stabilized rate is within 1.28 standard deviations of the target rate). Facilities whose stabilized rates are more than 1.28 standard deviations away from the target rate are considered to be significantly different from the target rate.

PSBC calculates the difference between a facility's stabilized rate and the target rate with the following formula:

$$\frac{p_{ij} - \hat{p}}{\sqrt{\frac{\hat{p}(1 - \hat{p})}{n_{ij}}}}$$

where $p_{ij}$ is the stabilized rate for hospital *i* in year *j*, $n_{ij}$ is the denominator for hospital *i* in year *j* for the indicator, and $\hat{p}$ is the target rate for the indicator.

For example:

> The target rate for an indicator is 85%. Hospital A has a stabilized rate of 75%, based on 500 patients. This facility's stabilized rate is 6.26 standard deviations below the target rate (6.26 = (0.75-0.85)/√((0.85*0.15)/500)) and thus is significantly below the target.
>
> If Hospital B has the same stabilized rate but based on only 20 patients, then the facility's stabilized rate would be 1.25 standard deviations below the target rate (1.25 = (0.75-0.85)/√((0.85*0.15)/20)), which is not significantly different from the target rate.

**Selected References**

Canadian Institute for Health Information. *Use of Funnel Plots for Reporting Indicator Results — Methodology Notes*. Ottawa, ON: CIHI; 2016. Accessed April 18, 2017 from http://indicatorlibrary.cihi.ca/download/attachments/1114124/Use%20of%20Funnel%20Plots%20for%20Reporting%20Performance%20Indicator%20Results_EN.pdf

Dunn S, Sprague AE, Fell DB, Dy J, Harrold J, Lamontagne B, Walker M. *The use of a quality indicator to reduce elective repeat Caesarean section for low-risk women before 39 weeks' gestation: the Eastern Ontario experience*. J Obstet Gynaecol Can. 2013 Apr;35(4):306-16.

Manktelow BM, Smith LK, Evans TA, Hyman-Taylor P, Kurinczuk JJ, Field DJ, Smith PW, Draper ES, on behalf of the MBRRACE-UK collaboration. Perinatal Mortality Surveillance Report UK Perinatal Deaths for births from January to December 2013. Leicester: The Infant Mortality and Morbidity Group, Department of Health Sciences, University of Leicester. 2015.

Office of Disease Prevention and Health Promotion. Healthy People 2020 Topics & Objectives: Maternal, Infant, and Child Health. Available from: https://www.healthypeople.gov/2020/topics-objectives/topic/maternal-infant-and-child-health/objectives

Sprague AE, Dunn S, Fell DB, Harrold J, Walker MC, Kelly S, Smith GN. *Measuring Quality in Maternal-Newborn Care: Developing a Clinical Dashboard*. J Obstet Gynaecol Can 2013;35(1):29–38.