

# Facility-Level Indicators

**Technical Documentation  
2019/20**



**Perinatal  
Services BC**

Provincial Health Services Authority

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## A. Introduction

Perinatal Services BC (PSBC) 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

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.

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

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

<b>Include:</b>	
Delivery episode	MOTHER_ADMISSION.screen_source = "DL" AND BABY_ADMISSION.screen_source = "NB"
Singleton delivery	BABY_ADMISSION.multiple_birth_count=1 AND BABY_ADMISSION.baby_sequence=1 AND MULTIPLE_LABOURS.baby_sequence=1
Linked maternal-newborn records	BABY_ADMISSION.mother_id is not null
<b>Exclude:</b>	
Termination of pregnancy	DIAGNOSES.diagnosis_cd begins with O04 (Mother) OR P96.4 (Infant) OR 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".

## 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 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
<b>Include:</b>		
Nulliparas	<p>term=0 and premature=0 and prev_cesarian_deliv=0 and prev_vaginal_deliv=0</p> <p>OR</p> <p>If any of term, premature, prev_cesarian_deliv, or prev_vaginal_deliv is null AND gravida=1</p> <p>OR</p> <p>If any of term, premature, prev_cesarian_deliv, or prev_vaginal_deliv is null AND living=0</p>	
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 (vaginal delivery) and not 5MD60 (cesarean section delivery).
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
<b><i>Exclude: Contraindications to vaginal delivery; conditions that increase the risks associated with emergency timing cesarean</i></b>		
BMI ≥35	$\text{pre\_pregnancy\_weight}/(\text{height}/100)^2$ is ≥35	
Known or suspected pelvic abnormality		<code>diagnosis_code</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	<code>pp_hellp_syndrome</code> = "Y"	<code>diagnosis_code</code> is O14001, O14002, O14101, O14102, O14201, O14202, O15001, O15101, O15202
Genital herpes	<code>primary_ind_operative_delivery</code> =11	<code>diagnosis_code</code> begins with (N770 or N771) AND A60
Fetal central nervous system anomaly		<code>diagnosis_code</code> begins with Q00-Q07 (baby) OR <code>diagnosis_code</code> is O35001, O35011, O35021, O35031, O35081, O35091 (woman)
Placenta previa		<code>diagnosis_code</code> is O44001, O44101
Placental abruption		<code>diagnosis_code</code> is O45001, O45011, O45081, O45091, O45801, O45901
Antepartum hemorrhage		<code>diagnosis_code</code> is O46001, O46011, O46081, O46091, O46801, O46901
Obstetric embolism		<code>diagnosis_code</code> is O88001, O88101, O88201, O88301, O88801

Placental disorders		<a href="#">diagnosis_code</a> is O43001, O43091, O43101, O43201, O43801, O43811, O43881, O43901
Uterine dehiscence or rupture before onset of labour		<a href="#">diagnosis_code</a> is O71001, O71011, O71081, O71101, O71111, O71181
Vasa previa		<a href="#">diagnosis_code</a> is with O69401
Prolapsed cord		<a href="#">diagnosis_code</a> is O69001 (mom) or begins with P024 (infant)
<b>Numerator</b>	<b>PDR Variables</b>	<b>ICD/CCI Codes</b>
<b><i>Include all cases in denominator with:</i></b>		
Vaginal delivery		<a href="#">procedure_code</a> begins with 5MD5
	<a href="#">cesarean_type</a> =0 AND	no <a href="#">procedure code</a> beginning with 5MD60
<b><i>Exclude all cases with:</i></b>		
Cesarean delivery		<a href="#">procedure_code</a> begins with 5MD60
	<a href="#">cesarean_type</a> =1 or 2 or 3 or 4 AND	no <a href="#">procedure code</a> beginning with 5MD5

### 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.



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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](http://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. 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
<b>Include:</b>		
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 labour_spont_flg is not "Y" AND labour_aug_flg is not "Y" AND labour_ind_flg is not "Y"	
Delivery by cesarean		procedure_code begins with 5MD60
<b>Exclude: Conditions warranting early delivery</b>		
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, O14101, O14102, O14201, O14202 O14901, O14902

Eclampsia		<a href="#">diagnosis_cd</a> is O15001, O15101, O15202
Other hypertension		<a href="#">diagnosis_cd</a> is O16001, O16002
Pre-existing diabetes (Type 1 or 2)	<a href="#">risk_code</a> = 15, 16	<a href="#">diagnosis_cd</a> is O24501, O24502, O24601, O24602, O24701, O24702
Gestational diabetes	<a href="#">risk_code</a> = 13, 14	<a href="#">diagnosis_cd</a> is O24801, O24802
Liver disorders in pregnancy		<a href="#">diagnosis_cd</a> is O26601, O26602

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

Premature rupture of membranes		<a href="#">diagnosis_cd</a> is O42011, O42021, O42091, O42111, O42121, O42191, O42901
Fetomaternal transfusion syndromes		<a href="#">diagnosis_cd</a> is O43001, O43011, O43091
Placenta previa		<a href="#">diagnosis_cd</a> is O44001, O44101
Placental abruption		<a href="#">diagnosis_cd</a> is O45001, O45011, O45081, O45091, O45801, O45901

Denominator	PDR Variables	ICD/CCI Codes
<b><i>Exclude: Conditions warranting early delivery (cont'd)</i></b>		
Antepartum or intrapartum hemorrhage		<a href="#">diagnosis_cd</a> is O46001, O46011, O46081, O46091, O46801, O46901, O67001, O67801, O67901
Fetal stress/distress		<a href="#">diagnosis_cd</a> is O68001, O68101, O68201, O68301
Vasa previa		<a href="#">diagnosis_cd</a> is O69401, O69409
Prolonged rupture of membranes		<a href="#">diagnosis_cd</a> is O75601
Maternal circulatory disease		<a href="#">diagnosis_cd</a> is O99401, O99402  OR <a href="#">diagnosis_cd</a> with <a href="#">diagnosis_type</a> M, 1, W, X, Y is O99801 or O99802 AND <a href="#">diagnosis_cd</a> beginning with Q20-Q28 as <a href="#">diagnosis_type</a> 3
Poor reproductive history		<a href="#">diagnosis_cd</a> begins with Z352

Multiple pregnancy with some liveborn infant (see note)		<a href="#">diagnosis_cd</a> begins with Z373, Z3760, Z3761, Z3762, Z3763, Z3768, Z3769
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Numerator	PDR Variables	ICD/CCI Codes
<b><i>Include all cases in denominator with:</i></b>		
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<sup>^</sup> and Z37.6<sup>^</sup>) 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.

### 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
<b><i>Include:</i></b>		
Term gestation	Gestational age by the algorithm is $\geq 37$	
Age at delivery <40 years	$\text{FLOOR}((\text{MULTIPLE\_LABOURS.baby\_delivered\_date} - \text{MOTHER\_ADMISSION.date\_of\_birth})/365.25)$	
	Is less than 40	
Numerator	PDR Variables	ICD/CCI Codes
<b><i>Include with:</i></b>		
Induced labour	$\text{labour\_ind\_flg} = \text{"Y"}$	
Induced for post dates	$\text{indication\_for\_induction}=1$ (post dates)	
Gestational age at delivery is <41 weeks	Gestational age by the algorithm is between 37 and 40	
Age at delivery <40 years	$\text{FLOOR}((\text{MULTIPLE\_LABOURS.baby\_delivered\_date} - \text{MOTHER\_ADMISSION.date\_of\_birth})/365.25)$	
	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. 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.

The two most common methods of monitoring in labor are intermittent auscultation (IA), which is listening to fetal heartbeats at specified intervals, and 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
<b>Include:</b>		
Unaugmented spontaneous labour	labour_spont_flg= "Y" AND labour_aug_flg is not "Y" AND labour_ind_flg is not "Y" AND 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) <sup>2</sup> is <40 OR height AND/OR pre_pregnancy_weight is missing	

Denominator	PDR Variables	ICD/CCI Codes
<b>Exclude:</b>		
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
<b><i>Include all cases in denominator with:</i></b>		
Auscultation only	<a href="#">auscultation</a> = "Y" and <a href="#">elec_fetal_monitor_internal</a> is not "Y" <a href="#">elec_fetal_monitor_external</a> is not "Y" <a href="#">no_fetal_monitoring</a> 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.

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## 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. 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, Dietitians 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	<a href="#">mother_id</a> , <a href="#">screen_source</a> , <a href="#">discharge_date</a>
RISK_ASSESSMENT	<a href="#">mother_id</a> , <a href="#">risk_code</a>
BABY_ADMISSION	<a href="#">baby_id</a> , <a href="#">mother_id</a> , <a href="#">admission_weight</a> , <a href="#">sex</a> , <a href="#">newborn_feeding</a>
BABY_DELIVERY	<a href="#">baby_id</a> , <a href="#">stillbirth</a>
DIAGNOSES	<a href="#">patient_id</a> , <a href="#">diagnosis_cd</a>

Denominator	PDR Variables	ICD/CCI Codes
<b><i>Include:</i></b>		
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	
<b><i>Exclude:</i></b>		
Infant with metabolic disease		diagnosis_cd begins with E70-E90 (infant)
SGA	<p>Male infant:</p> <p>admission_weight &lt;2560 at 37 weeks  admission_weight &lt;2790 at 38 weeks  admission_weight &lt;2948 at 39 weeks  admission_weight &lt;3080 at 40 weeks  admission_weight &lt;3201 at 41 weeks  admission_weight &lt;3232 at 42 weeks  admission_weight &lt;3260 at 43 weeks  admission_weight &lt;3175 at 44 weeks</p> <p>Female infant:</p> <p>admission_weight &lt;2460 at 37 weeks  admission_weight &lt;2680 at 38 weeks  admission_weight &lt;2835 at 39 weeks  admission_weight &lt;2950 at 40 weeks  admission_weight &lt;3062 at 41 weeks  admission_weight &lt;3090 at 42 weeks  admission_weight &lt;3090 at 43 weeks  admission_weight &lt;3025 at 44 weeks</p>	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
<b>Exclude: (cont'd)</b>		
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
<b>Include all cases in denominator with:</b>		
Breast milk only	newborn_feeding = "BR" Exclusive breast milk (includes expressed breast milk and donor milk)	

### 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 indicator was added for the 2015/16 data release.

Among deliveries in British Columbia, one in seven (14%) are singleton term infants born to women with at least one previous cesarean delivery. 81% 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
<b>Include:</b>		
Women with no more than four previous cesarean deliveries	prev_cesarian_deliv = 1 to 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 delivery episode in BC	(previous) MOTHER_ADMISSION.discharge_date ≥ April 1, 2000	
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Denominator	PDR Variables	ICD/CCI Codes
<b><i>Exclude: Contraindication to vaginal delivery; factors that increase the risks associated with emergency timing cesarean</i></b>		
BMI ≥35	pre_pregnancy_weight/(height/100) <sup>2</sup> is ≥35	
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 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		diagnosis_code is O46001,

Denominator	PDR Variables	ICD/CCI Codes
hemorrhage		O46011, O46081, O46091, O46801, O46901
Placental disorders		<a href="#">diagnosis_code</a> is O43001, O43091, O43101, O43201, O43801, O43811, O43881, O43901
Uterine dehiscence or rupture before onset of labour		<a href="#">diagnosis_code</a> is O71001, O71011, O71081, O71101, O71111, O71181
Vasa previa		<a href="#">diagnosis_code</a> is O69401
Prior neonatal death	<a href="#">risk_code</a> = 1	
Prior stillbirth	<a href="#">risk_code</a> = 2	
Prior fetus with major congenital anomaly	<a href="#">risk_code</a> = 6	
<b>Exclude: Contraindication to vaginal delivery after cesarean</b>		
Previous uterine dehiscence or rupture in BC	MOTHER_ADMISSION. <a href="#">discharge_date</a> between April 1, 2000 and March 31, 2004 AND	<a href="#">diagnosis_cd</a> begins with 6650 or 6651
	MOTHER_ADMISSION. <a href="#">discharge_date</a> ≥ April 1, 2004 AND	<a href="#">diagnosis_cd</a> begins with O710 or O711
<b>Exclude: Factors associated with increased risk of uterine rupture</b>		
Previous non-lower segment transverse cesarean incision in BC (i.e. low segment vertical, classical, or other incision)	<a href="#">cesarean_incision</a> = 2, 3, or 4 AND MOTHER_ADMISSION. <a href="#">discharge_date</a> ≥ April 1, 2000	
Previous cesarean delivery in BC within 540 days	[(current) MULTIPLE_LABOURS. <a href="#">baby_delivered_date</a> - (previous) MULTIPLE_LABOURS. <a href="#">baby_delivered_date</a> < 540 days]	<a href="#">procedure_code</a> for the previous episode begins with 5MD60

Numerator	PDR Variables	ICD/CCI Codes
<b><i>Include all cases in denominator with:</i></b>		
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

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Gagnon R, Morin L, Bly S, Butt K, Cargill YM, Denis N, Hietala-Coyle MA, Lim KI, Ouellet A, Racioc 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.

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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](http://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.perinatalervicesbc.ca/Documents/Data-Surveillance/Reports/SpecialReports/BC\\_RobsonGroups\\_2016.pdf](http://www.perinatalervicesbc.ca/Documents/Data-Surveillance/Reports/SpecialReports/BC_RobsonGroups_2016.pdf).

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## 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<sup>§</sup> 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<sup>^</sup>, 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	<a href="#">mother_id</a> , <a href="#">screen_source</a>
PREGNANCY	<a href="#">mother_id</a> , <a href="#">last_menstrual_period</a> , <a href="#">first_us_date</a> , <a href="#">first_us_g_age</a> , <a href="#">first_us_g_age_days</a>
MULTIPLE_LABOURS	<a href="#">mother_id</a> , <a href="#">baby_delivered_date</a> , <a href="#">baby_sequence</a>
BABY_ADMISSION	<a href="#">baby_id</a> , <a href="#">mother_id</a> , <a href="#">date_of_birth</a> , <a href="#">baby_sequence</a> , <a href="#">screen_source</a>
BABY_DELIVERY	<a href="#">baby_id</a> , <a href="#">gest_age_by_exam</a> , <a href="#">gest_age_from_document</a>

### Notes

<sup>§</sup> 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.

<sup>^</sup> 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](http://www.perinatalservicesbc.ca/health-professionals/forms).

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



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

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



## F. Peer Groups

The following are the peer groups for 2019/20.

Peer Group	Obstetrical Units in Peer Group
<p>Small Peer Group Facilities with &lt;250 deliveries per year* (n=20)</p>	<ul style="list-style-type: none"> <li>• Bulkley Valley District Hospital</li> <li>• Creston Valley Hospital &amp; Health Centre</li> <li>• Elk Valley Hospital</li> <li>• G. R. Baker Memorial Hospital</li> <li>• Golden &amp; District General Hospital</li> <li>• Invermere &amp; District Hospital<sup>†</sup></li> <li>• Kitimat Hospital and Health Centre</li> <li>• Kootenay Boundary Regional Hospital</li> <li>• Lady Minto/Gulf Islands Hospital<sup>†</sup></li> <li>• Lillooet Hospital &amp; Health Centre</li> <li>• Port McNeill Hospital<sup>†</sup></li> <li>• Powell River General Hospital</li> <li>• Prince Rupert Regional Hospital</li> <li>• Haida Gwaii Hospital and Health Centre<sup>†</sup></li> <li>• Queen Victoria Hospital</li> <li>• Sechelt Hospital</li> <li>• Shuswap Lake General Hospital</li> <li>• St. John Hospital</li> <li>• West Coast General Hospital</li> <li>• Wrinch Memorial Hospital</li> </ul>
<p>Medium Peer Group Facilities with 250-999 deliveries per year* (n=15)</p>	<ul style="list-style-type: none"> <li>• Cariboo Memorial Hospital</li> <li>• Chilliwack General Hospital</li> <li>• Cowichan District Hospital</li> <li>• Dawson Creek and District Hospital</li> <li>• East Kootenay Regional Hospital</li> <li>• Fort St. John Hospital</li> <li>• Kootenay Lake Hospital</li> <li>• Mills Memorial Hospital</li> <li>• North Island Hospital Campbell River and District</li> <li>• North Island Hospital Comox Valley</li> <li>• Peace Arch Hospital</li> <li>• Penticton Regional Hospital</li> <li>• Ridge Meadows Hospital</li> <li>• Squamish General Hospital</li> <li>• Vernon Jubilee Hospital</li> </ul>

Peer Group	Obstetrical Units in Peer Group
Large Peer Group Facilities with 1,000-2,499 deliveries per year* (n=9)	<ul style="list-style-type: none"> <li>• Burnaby Hospital</li> <li>• Kelowna General Hospital</li> <li>• Langley Memorial Hospital</li> <li>• Lions Gate Hospital</li> <li>• Nanaimo Regional General Hospital</li> <li>• Richmond Hospital</li> <li>• Royal Inland Hospital</li> <li>• St. Paul's Hospital</li> <li>• University Hospital of Northern British Columbia</li> </ul>
Extra Large Peer Group Facilities with 2,500+ deliveries per year* (n=5)	<ul style="list-style-type: none"> <li>• Abbotsford Regional Hospital &amp; Cancer Centre</li> <li>• BC Women's Hospital &amp; Health Centre</li> <li>• Royal Columbian Hospital</li> <li>• Surrey Memorial Hospital</li> <li>• Victoria General Hospital</li> </ul>

**Notes**

†Surgical capacity not routinely available.

\*Based on average delivery volume in the 2018/19 and 2019/20 fiscal years.

## H. Methods

### Stabilized Rates

Prior to the 2015/16 data release, 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% relative improvement on the BC rate from the 2015/16 data year. The targets for the year 2020/21 are as follows:

Indicator	BC Crude	Target
	Rate (%) 2015/16	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

Prior to the 2015/16 data release, 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 ( $6.26 = (0.75-0.85)/\sqrt{((0.85*0.15)/500)}$ ) 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 ( $1.25 = (0.75-0.85)/\sqrt{((0.85*0.15)/20)}$ ), which is not significantly different from the target rate.

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