BRITISH COLUMBIA PERINATAL HEALTH PROGRAM

# Perinatal Health Report 2008


*Optimizing Neonatal, Maternal and Fetal Health*

Provincial Health Services Authority
Province-wide solutions. Better health.

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ISBN: 978-0-9811237-2-1

Published: March 2010

Printed in Canada / Graphic Production: Angela G. Atkins

# Acknowledgements

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We would like to acknowledge Ms. Kristin Atwood of Agency Research Consultants for her assistance in preparing this report. As well, we would like to thank Lisa Miyazaki, Provincial Perinatal Analyst, BC Perinatal Health Program, for her editorial expertise.

Special thanks to the staff of the BC Perinatal Health Program for their assistance and contributions in completing this report.

The BCPHP gratefully acknowledges the assistance of health records staff at the participating hospitals, as well as the physicians, midwives and nurses who generated the records, in addition to the data analysts for their valuable work in the collection, extraction and analysis of data. The program also wishes to acknowledge the BC Ministry of Health Services and the BC Vital Statistics Agency for their ongoing support in data quality initiatives.

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# Executive Summary

In 1988, the Ministry of Health and the BC Medical Association initiated the BC Reproductive Care Program (BCRCP). The BC Perinatal Database Registry (BCPDR), an important component of the BCRCP was developed in 1993. The BCRCP was renamed the BC Perinatal Health Program (BCPHP) in 2007 when the Provincial Specialized Perinatal Services (PSPS) became part of the Program. In 2010, the Perinatal Services British Columbia (PSBC) was created to replace BCPHP and to provide strategic leadership on the full continuum of perinatal care across the province, focusing on perinatal system planning, service delivery and quality improvement. The surveillance function of the Program will continue and strengthen under PSBC. Through the pragmatic analysis of temporal trends and geographic variations on a broad spectrum of perinatal health indicators, PSBC intends to work collaboratively with local health authorities and stakeholders to improve on perinatal health outcomes and enhance the quality of perinatal services in BC.

One of the mandates of the BC Perinatal Health Program (now PSBC) has been the collection and analysis of provincial perinatal data for the purpose of monitoring perinatal care and outcomes at the institutional, regional and provincial levels. Historically, the BCPHP published an Annual Report to describe this analysis. In the current year, the Annual Report has been expanded to include additional information and is titled, ***BCPHP Perinatal Health Report 2008***.

The 2008 BC Perinatal Health Report includes perinatal data from eight fiscal years (April 1 to March 31), 2000/2001 to 2007/2008 inclusive. The data provide information regarding issues pertaining to the care, treatment and outcomes of mothers and newborns in British Columbia. Section 1 provides an examination of normal births in BC. Sections 2 through 5 describe maternal determinants of health, labour and birth processes, maternal health outcomes, and fetal and infant health outcomes, respectively. Appendix 1 is a glossary of terms and definitions used throughout this report. This report can be accessed at the BCPHP website (www.bcphp.ca). Paper copies can be obtained through the BCPHP office (check website for contact information).

## Highlights

Over the last eight years in British Columbia, the average age of women giving birth has slowly increased, with the largest increase among women between the ages of 35 and 39. The majority of women access antenatal care early in pregnancy. Rates of smoking in pregnancy, alcohol and drug use, severe maternal morbidity during delivery, and postpartum readmission to hospital are low and steadily declining since 2000/2001. More women are choosing midwives to deliver their babies, and of those, more are delivering in hospital than at home. Length of stay in hospital after delivery is becoming shorter. Among pregnant women, labour induction rates are stabilizing, while caesarean section rates continue to rise. As well, rates of preterm births have increased slightly, and in particular, rates of preterm births that are the result of either elective caesarean section or labour induction are increasing. For first time mothers, epidural use in labour and delivery is increasing. The number of births are on the rise in British Columbia, with 44,200 total births in 2007/2008, approximately a 9% increase over the last eight years. Similar to their moms, term newborn length of stay in hospital is decreasing over time, and the incidence of neonatal morbidity is rare.

This section summarizes the overall state of obstetric and perinatal health in British Columbia. The subsequent tables include a set of summary indicators for BC overall, for each Health Authority within BC, as well as for births in BC that involve the care of a registered midwife (both home and hospital births). A more detailed examination follows in Sections 1 through 5 of the Perinatal Health Report.

### Normal Birth

The BCPHP has identified a category of pregnant women using a modification of the SOGC normal birth definition to identify pregnant women who enter spontaneous labour at term. These women have a singleton in vertex presentation, and no history of previous caesarean section. In 2007/2008, **53.2%** of all women delivering in BC were "normal" at the onset of labour using this definition. Of these women, **76.4%** went on to have a spontaneous vaginal delivery, while **12.4%** had an assisted vaginal delivery and **11.3%** had a caesarean section. "Normal" birth women who delivered by caesarean section had, on average, longer first and second stage of labour, were more likely to have augmented labour and to have cervical dilation on admission of less than three centimeters than those who had a vaginal delivery.

### Maternal Determinants of Health

The average age for women having their first live birth in British Columbia has remained stable at **28.8** years for the last five years. In 2007/2008, over half (**53.8%**) of live born deliveries in BC were to women age 30 and above. Age of mothers varied geographically throughout the province, with the Northern Health Authority having the youngest mothers in 2007/2008, with **65.5%** of deliveries to women under the age of 30, compared to the Vancouver Coastal Health Authority, where only **29.1%** of deliveries were to women under the age of 30.

The rate of pre-pregnancy obesity (BMI ≥ 30) increased slightly, from **10.2%** in 2000/2001 to **12.2%** in 2007/2008. Women who were obese pre-pregnancy (BMI ≥ 30) in BC had higher rates of emergent caesarean section (**25.9%**), preterm birth (**9.7%**), stillbirth (**5.4** per 1,000 births), and higher average birth weight for term singletons (**3,649** grams), when compared to women with lower pre-pregnancy weight. Unfortunately, lack of recorded pre-pregnancy weight and/or height on the maternal record continues to be an issue, with **33.9%** unknown pre-pregnancy body mass index in BC in 2007/2008.

The average weight gain in pregnancy in 2007/2008 for all mothers was **15.1 kg** and varied by pre-pregnancy BMI, with the highest average weight gain (**16.0 kg**) in pregnancy in women who were underweight pre-pregnancy. Large-for-gestational-age newborns were more frequent among mothers who experienced above recommended weight gain (**17.3%**), compared to **8.9%** for women who were within the recommended weight gain, as was the proportion of babies who weighed 4,500 grams or more at birth (**3.4%**, compared to **2.1%**). Conversely, the proportion of small-for-gestational-age infants was higher among mothers who gained less weight than is recommended (**11.5%** compared to **7.5%**).

The majority of women (**68%**) initiated antenatal care prior to 20 weeks' gestation and **84.1%** of women had between 5 and 15 visits throughout pregnancy (2007/2008). In fact, it was very uncommon for women to have four or fewer antenatal visits throughout their pregnancy (only **7.7%**).

Fewer women were smoking cigarettes during pregnancy (**10.0%** in 2007/2008), compared to **13.2%** in 2000/2001. As well, the number of women for whom alcohol was identified as a risk factor was low, **0.9%** in 2007/2008. The proportion of deliveries in which the use of drugs was identified as a risk factor increased from **1.9%** in 2000/2001 to **2.4%** in 2007/2008.

### Labour and Birth Processes

Labour induction rates remained consistent during the last eight fiscal years, with **21.2%** of all pregnant women in British Columbia having labour induced in 2007/2008. Women having their first birth had higher induction rates than women with previous births; this trend held true for all years studied. Among women having their first birth, **35.8%** of all labour inductions in 2007/2008 were as a result of post date pregnancy (the most common primary indication for induction). Among women who had given birth previously, being post dates was also the most frequent reason for labour induction (**32.7%** of all labour inductions in 2007/2008). There has been a steady increase over the past six years in the induction rate among women between 33 and 36 weeks gestation, rising to **24.7%** of all inductions for 2007/2008.

In 2004/2005, **26.4%** of labours included monitoring with electronic fetal monitoring only, but by 2007/2008, this number had fallen to **22.0%**. Conversely, the percentage in which auscultation methods alone were used increased from **18.6%** in 2004/2005 to **23.7%** in 2007/2008. These trends are in keeping with national recommendations.

Among women having their first births, the use of epidural anesthesia in labour and delivery has increased steadily from **42.5%** in 2000/2001 to **48.1%** in 2007/2008, whereas the use of narcotics has shown a small decrease from **50.0%** in 2000/2001 to **47.5%** in 2007/2008. The use of anesthetics and analgesics in labour and delivery was lower among women who had given birth previously compared to women having their first birth. Entonox remained the pain control method most commonly used among women who had given birth previously with a slight decrease in use from **46.2%** in 2000/2001 to **43.4**% in 2007/2008.

From 2000/2001 to 2007/2008, the percentage of deliveries attended by British Columbia obstetricians increased from **46.9%** to **49.9%**. Although the proportion of deliveries attended by registered midwives continues to be far lower at **6.3%** in 2007/2008, this is a considerable increase from 2000/2001 when only **2.6%** of deliveries in BC were attended by registered midwives.

Among women having their first birth, spontaneous vaginal deliveries decreased from **52.0%** in 2000/2001 to **49.7%** in 2007/2008. Over the same time period, the percent of instrument assisted vaginal deliveries also decreased from **20.5%** in 2000/2001 to **17.3%** in 2007/2008. The percent of caesarean section deliveries among first time mothers increased from **27.5%** in 2000/2001 to **33.0%** in 2007/2008.

Women who have given birth previously were considerably more likely to have a spontaneous vaginal delivery, however, the rate of spontaneous vaginal delivery in this group declined as well from **72.9%** in 2000/2001 to **66.5%** in 2007/2008. The rate of instrumental assisted deliveries also decreased from **5.8%** in 2000/2001 to **4.8%** in 2007/2008, while the rate of caesarean section deliveries increased from **21.2%** in 2000/2001 to **28.7%** in 2007/2008.

In 2007/2008, among nulliparous women who had an assisted vaginal birth, the vacuum was the most commonly used instrument with **61.5%** of assisted vaginal deliveries employing this technique. In 2007/2008, **72.8%** of assisted vaginal deliveries among women of parity $\geq 1$ used the vacuum, an increase from 2000/2001 when **68.7%** employed this technique.

During the period from 2000/2001 to 2007/2008 there was an increase in caesarean section rates from **24.5%** to **30.7%**. Elective c-sections increased from **8.0%** in 2000/2001 to **11.7%** in 2007/2008; in addition, emergent c-sections increased from **16.0%** to **19.0%** in the same time period. Rates of primary caesarean delivery were consistently higher than rates of repeat caesarean. In 2007/ 2008, **18.6%** of all deliveries were primary caesarean sections, while only **12.1%** were repeat caesareans. However, repeat caesarean deliveries experienced greater increase between 2000/2001 and 2007/2008, increasing at a rate of **41.8%** compared to only **20.0%** for primary caesarean procedures, a reflection of the declining use of attempted vaginal birth after a previous caesarean section. Among the term singleton births to women who had given birth via caesarean section in the past, the caesarean rate increased from **64.9%** in 2000/2001 to **80.6%** in 2007/2008. This group of births accounted for **5.8%** of all births in 2000/2001 increasing to **8.9%** in 2007/2008, making it the largest contributor to the c-section rate in both years.

In 2007/2008, there were **6,327** mothers delivering with at least one previous c-section (**14.5%** of total mothers in 2007/2008). Of these mothers, close to one-quarter (n=**1,486**, **23.5%**) had a trial of labour (i.e. attempted a VBAC), leaving **76.5%** (n=**4,838**) who had no trial of abour. Of the **6,327** delivering women in BC who had previously delivered via c-section in 2007/2008, **4,789** were considered eligible for VBAC (**75.7%**). Of these, **27.0%** attempted VBAC, with a success rate of **70.8%**.

The rate of both attempted and successful VBAC has been declining over time. Between 2000/2001 and 2007/2008, the attempted VBAC rate for all mothers with a previous caesarean delivery (regardless of eligibility) in BC declined substantially; **40.6%** to less than one-quarter (**23.5%**) of mothers with a previous caesarean delivery. The rate of successful VBAC expressed as a percentage of all attempted VBAC, however, has remained relatively constant, increasing from **68.8%** of all attempted VBAC in 2000/2001 to **69.8%** in 2007/2008 and fluctuating between a low of **67.5%** and a high of **70.8%** in the intervening years.

During the period between 2000/2001 and 2007/2008 episiotomy rates (in vaginal deliveries) declined in each region throughout the province by an average of **5.4%**. Despite the significant decreases in episiotomy rates there were no corresponding changes in the rates of third and fourth degree lacerations (**4.2%** in 2007/2008).

### Maternal Health Outcomes

Both gestational diabetes and gestational hypertension rates have been increasing, from **6.0%** to **7.1%** (gestational diabetes), and from **4.4%** to **5.1%** (gestational hypertension), between 2000/2001 and 2007/2008. Women with chronic hypertension or pre-existing diabetes were more likely to deliver via c-section, and consequently have longer lengths of stay in hospital, than women without either condition.

Severe maternal morbidities (which include conditions such as anesthetic complications, postpartum hemorrhage with transfusion, eclampsia, stroke, pulmonary embolism) were rare in British Columbia. Less than one percent of delivering women experienced any of these morbidities in BC in the last four years. Moreover, for nearly all conditions, the rate has remained relatively stable over time.

Length of stay in hospital following delivery continues to decline in British Columbia. After vaginal delivery, average postpartum length of stay decreased from **46.7** hours in 2000/2001 to **40.9** hours (less than two days) in 2007/2008. Although lengths of stay among women having a caesarean section continue to be longer on average than those having vaginal delivery, these also decreased, with an average postpartum length of stay after caesarean of **76.1** hours (just over three days) in 2007/2008, down from **86.2** hours in 2000/2001. There were differences based on place of delivery as well as whether mothers were experiencing their first or subsequent deliveries. Postpartum inpatient readmissions were uncommon among women delivering in British Columbia. The readmission rate for women delivering in 2006/2007 was **2.7%** (the most recent year for which figures are available), with postpartum hemorrhage being the most common diagnosis (**30.3%** of all readmissions).

### Fetal and Infant Health Outcomes

The stillbirth rate in British Columbia was **5.0** per 1,000 total births in 2007/2008. In 2007/2008, the stillbirth rate among women who smoked during pregnancy was **7.5** per 1,000 total births, compared to **4.7** per 1,000 for women who did not smoke. In 2007/2008, women with a history of prior stillbirth had a stillbirth rate of **32.6** per 1,000 total births compared to **4.7** per 1,000 total births among women without a history of stillbirth. In 2003/2004 (the most recent year mortality data was available), mortality was higher in the early neonatal period (less than 7 days after birth) than in the late neonatal period (7-27 days after birth): at **2.4** and **0.4** deaths per 1,000 live births, respectively.

Neonatal morbidity, as diagnosed among newborns in the NICU during the birth admission, is rare in BC. In fact, the provincial incidence of each of the neonatal morbidity conditions studied in this report was less than 2% in 2007/2008. The rate of congenital anomalies in live births declined from **3.94** per 100 live births in 2000/2001 to **2.59** per 100 in 2007/2008.

Total births in British Columbia have risen approximately 9% over the last eight years, from **40,517** in 2000/2001 to **44,196** in fiscal 2007/2008. Among live births, **9.4%** were born preterm in 2007/2008, a slight increase from **8.1%** in 2000/2001. Of those births that were preterm, the majority (**76.1** per 100 preterm live births in 2007/2008) were between 34 and 36 weeks' gestation at birth. There has been a notable increase in the rate of iatrogenic preterm births (births before 37 weeks delivered via elective caesarean section or after labour induction), from **2.9%** of all births in 2000/2001 to **4.2%** in 2007/2008.

The twin birth rate increased between 2000/2001 and 2007/2008, from **2.52** per 100 births to **3.13** per 100. During the same time period, the multiple (3+) birth rate decreased from **1.41** per 1,000 total births to **0.41** per 1,000 births. In BC in 2007/2008, the majority (**62%**) of multiple births occurred prior to 37 weeks' gestational age; the majority of these occurred between 34 and 36 weeks.

In BC, the average length of stay for all newborns born in hospital (including preterm infants and infants with morbidities) has decreased over the last eight years, from **73.8** hours in 2000/2001 to **70.1** hours in 2007/2008.

The newborn readmission to hospital rate in 2007/2008 was **6.71**%. The most frequent diagnosis responsible for newborn readmissions to hospital was 'neonatal jaundice'. 'Low birth weight' and 'other preterm infants' diagnoses were also common.

Exclusive breastfeeding rates are essentially unchanged over the last four fiscal years. A small increase in the proportion of newborns fed partial breast milk on discharge from hospital has occurred in the last four years (from **25.3%** to **27.0%**). Method of delivery is associated with the extent to which newborns are breastfed during their birth admission: in 2007/2008, **74.4%** of newborns born by spontaneous vaginal delivery were fed exclusive breast milk, compared to **66.5%** of newborns born through assisted vaginal delivery and **52.1%** of newborns born through caesarean delivery.

## Summary Indicator Tables

In this section, Tables 1 through 8 provide a summary set of indicators for British Columbia, for each Health Authority in BC, as well as births in BC involving midwifery care, providing a brief look at trends over eight fiscal years.

**Table 1. Summary indicators for British Columbia[1], 2000/2001 to 2007/2008**

| | Fiscal Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 | 07/08 |
| Maternal Age, All Births – Average (years) | 29.9 | 30.0 | 30.1 | 30.3 | 30.3 | 30.4 | 30.4 | 30.4 |
| Maternal Age, First Live Births – Average (years) | 28.2 | 28.4 | 28.6 | 28.8 | 28.8 | 28.8 | 28.8 | 28.8 |
| First Time Mothers – Proportion of all deliveries | 45.0 | 44.5 | 44.8 | 45.3 | 46.0 | 46.1 | 46.5 | 46.5 |
| First Time Mothers with Four or Fewer Antenatal Visits – Proportion of all first time mothers | 4.7 | 4.3 | 4.3 | 4.8 | 5.3 | 5.4 | 5.7 | 5.8 |
| Pre-pregnancy Obesity[2] – Proportion of all mothers with known pre-pregnancy BMI | 10.2 | 10.6 | 10.7 | 10.8 | 11.2 | 11.4 | 11.8 | 12.2 |
| Unknown Pre-pregnancy BMI[2] – Proportion of all deliveries | 27.0 | 26.4 | 27.7 | 32.5 | 30.4 | 30.1 | 32.2 | 33.9 |
| Smoking During Pregnancy – Proportion of all deliveries | 13.2 | 12.3 | 11.6 | 10.8 | 11.0 | 10.4 | 10.7 | 10.0 |
| Maternal Request Caesarean Section/VBAC Declined[3] – Proportion of all deliveries | n/a | n/a | n/a | n/a | 3.8 | 4.0 | 3.9 | 4.1 |
| Stillbirths[4] – Rate per 1,000 births | 5.6 | 5.1 | 5.1 | 4.6 | 4.2 | 4.7 | 5.4 | 5.0 |
| Multiple Births[5] – Rate per 100 live births | 2.7 | 2.7 | 3.1 | 3.0 | 3.0 | 3.2 | 3.1 | 3.2 |
| Total Number of Births | 40,517 | 40,351 | 40,380 | 40,427 | 40,608 | 41,005 | 42,179 | 44,196 |
| Midwifery Deliveries[6] – Proportion of all deliveries | 2.7 | 3.4 | 3.6 | 4.3 | 4.8 | 5.3 | 5.7 | 6.3 |
| Labour Induction – Rate per 100 deliveries | 21.3 | 22.6 | 21.6 | 21.3 | 20.1 | 20.9 | 21.2 | 21.2 |
| Caesarean Section – Rate per 100 deliveries | 24.1 | 26.7 | 27.5 | 28.2 | 29.4 | 29.8 | 29.9 | 30.7 |
| Intermittent Auscultation Only[7] – Rate per 100 deliveries with labour | n/a | n/a | n/a | n/a | 18.6 | 20.4 | 22.6 | 23.7 |
| Epidural Use in First Time Mothers – Rate per 100 first time mothers with labour | 42.8 | 44.8 | 45.2 | 46.4 | 46.8 | 46.9 | 48.1 | 48.4 |
| Preterm Births[8] – Rate per 100 live births | 8.1 | 8.0 | 8.9 | 9.1 | 9.3 | 9.7 | 9.6 | 9.4 |
| Iatrogenic Preterm Births[9] – Rate per 100 live births | 2.9 | 3.1 | 3.4 | 3.7 | 3.9 | 4.2 | 4.2 | 4.2 |
| Postpartum Length of Stay after Caesarean Section – Average (hours) | 86.2 | 84.4 | 82.6 | 81.7 | 80.5 | 79.1 | 76.6 | 76.1 |
| Postpartum Length of Stay after Vaginal Delivery – Average (hours) | 46.7 | 45.6 | 44.6 | 44.3 | 43.4 | 43.3 | 42.9 | 40.9 |
| Exclusive Breastfeeding During Delivery Admission[10] – Rate per 100 live births | n/a | n/a | n/a | n/a | 68.2 | 68.6 | 67.2 | 66.5 |

Data Source: BC Perinatal Database Registry
Note: Late terminations have been excluded.
1 The population used for this table includes all mothers and all newborns, regardless of place of residence or place of delivery.
2 Pre-pregnancy body mass index was calculated using the formula, BMI = weight (kg)/height (m)$^2$.
3 This identifies the primary indication for caesarean section; the primary indication of 'maternal request CS/VBAC declined' did not exist prior to fiscal year 2004/2005. 'Maternal request CS/VBAC declined' exists as a single indicator in the BCPDR; this data cannot specifically identify medical indication for a caesarean section.
4 Stillbirth is defined as the complete expulsion or extraction after at least 20 weeks of gestation or after attaining a weight of at least 500 grams of a fetus in which at birth, there is no breathing, beating heart, pulsation of the umbilical cord or unmistakable movement of voluntary muscle.
5 Multiple births are births of twins or greater (triplets, quadruplets, etc).
6 This identifies only the care provider who delivers the baby and does not necessarily reflect midwifery involvement throughout pregnancy or at delivery.
7 Intermittent auscultation only could not be identified prior to fiscal year 2004/2005.
8 Preterm is indicated by a final gestational age of less than 37 completed weeks' gestation.
9 Iatrogenic refers to labour that is non-spontaneous, i.e. labour was induced or mother had caesarean section with no labour.
10 This variable did not exist prior to fiscal year 2004/2005.

**Table 2. Summary indicators for Fraser Health Authority, 2000/2001 to 2007/2008**

| | Fiscal Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 | 07/08 |
| **Resident Based Indicators[1]** | | | | | | | | |
| Maternal Age, All Births – Average (years) | 29.4 | 29.5 | 29.7 | 29.8 | 29.9 | 29.9 | 29.9 | 30.0 |
| Maternal Age, First Live Births – Average (years) | 27.6 | 27.7 | 28.0 | 28.1 | 28.2 | 28.2 | 28.1 | 28.3 |
| First Time Mothers – Proportion of all deliveries | 43.3 | 43.3 | 43.9 | 44.0 | 44.5 | 44.7 | 45.2 | 44.5 |
| First Time Mothers with Four or Fewer Antenatal Visits – Proportion of all first time mothers | 4.9 | 3.9 | 4.2 | 4.2 | 5.4 | 5.6 | 5.1 | 6.3 |
| Pre-pregnancy Obesity[2] – Proportion of all mothers with known pre-pregnancy BMI | 10.4 | 10.8 | 11.2 | 11.3 | 11.8 | 11.8 | 12.4 | 12.8 |
| Unknown Pre-pregnancy BMI[2] – Proportion of all deliveries | 21.3 | 20.0 | 21.9 | 29.0 | 25.5 | 25.6 | 27.4 | 31.4 |
| Smoking During Pregnancy – Proportion of all deliveries | 11.6 | 11.1 | 10.2 | 9.4 | 9.6 | 8.2 | 9.0 | 8.2 |
| Deliveries Outside Home Health Authority[3] – Proportion of all deliveries | 17.0 | 17.0 | 17.1 | 17.6 | 17.5 | 18.3 | 16.5 | 14.5 |
| Maternal Request Caesarean Section/VBAC Declined[4] – Proportion of all deliveries | n/a | n/a | n/a | n/a | 4.6 | 4.2 | 4.0 | 4.4 |
| Stillbirths[5] – Rate per 1,000 births | 5.8 | 5.5 | 5.7 | 4.7 | 3.8 | 4.7 | 5.3 | 4.4 |
| Multiple Births[6] – Rate per 100 live births | 2.8 | 2.8 | 3.2 | 3.0 | 2.9 | 3.2 | 3.2 | 3.3 |
| **Facility Based Indicators[7]** | | | | | | | | |
| Total Number of Births | 13,255 | 13,424 | 13,551 | 13,497 | 13,543 | 13,354 | 14,045 | 15,023 |
| Proportion of Total Provincial Births | 32.7 | 33.3 | 33.6 | 33.4 | 33.4 | 32.6 | 33.3 | 34.0 |
| Midwifery Deliveries[8] – Proportion of all deliveries | 1.9 | 2.5 | 2.5 | 2.9 | 3.1 | 3.4 | 3.6 | 4.2 |
| Labour Induction – Rate per 100 deliveries | 22.6 | 25.1 | 23.9 | 23.9 | 22.1 | 23.4 | 23.2 | 22.5 |
| Caesarean Section – Rate per 100 deliveries | 22.8 | 25.9 | 26.4 | 27.7 | 29.1 | 29.0 | 29.4 | 31.7 |
| Intermittent Auscultation Only[9] – Rate per 100 deliveries with labour | n/a | n/a | n/a | n/a | 17.4 | 20.2 | 22.1 | 25.1 |
| Epidural Use in First Time Mothers – Rate per 100 first time mothers with labour | 36.6 | 40.4 | 40.8 | 41.7 | 41.3 | 39.6 | 43.1 | 41.9 |
| Preterm Births[10] – Rate per 100 live births | 8.0 | 7.5 | 8.6 | 8.5 | 8.8 | 9.9 | 9.7 | 9.6 |
| Iatrogenic Preterm Births[11] – Rate per 100 live births | 2.4 | 2.6 | 3.0 | 3.3 | 3.4 | 4.3 | 4.1 | 4.0 |
| Postpartum Length of Stay after Caesarean Section – Average (hours) | 79.3 | 78.1 | 74.9 | 74.6 | 73.6 | 73.8 | 72.0 | 71.8 |
| Postpartum Length of Stay after Vaginal Delivery – Average (hours) | 42.2 | 40.6 | 38.6 | 37.9 | 36.7 | 37.2 | 36.9 | 35.1 |
| Exclusive Breastfeeding During Delivery Admission[12] – Rate per 100 live births | n/a | n/a | n/a | n/a | 68.5 | 68.2 | 64.5 | 62.8 |

Data Source: BC Perinatal Database Registry

Note: Late terminations have been excluded.

1 Mothers and babies were assigned to a resident HA based on documented postal code. Some mothers and babies will be included in the provincial total but will not be assigned to a resident HA due to missing postal codes (approx 0.2%). The denominator for resident based indicators are all mothers and babies who live in the HA, regardless of where the birth/delivery occurred.

2 Pre-pregnancy body mass index was calculated using the formula, BMI = weight (kg)/height $(m)^2$.

3 This identifies mothers whose resident Health Authority (based on resident postal code) does not equal their delivery Health Authority (based on delivery facility).

4 This identifies the primary indication for caesarean section; the primary indication of 'maternal request CS/VBAC declined' did not exist prior to fiscal year 2004/2005. 'Maternal request CS/VBAC declined' exists as a single indicator in the BCPDR; this data cannot specifically identify medical indication for a caesarean section.

5 Stillbirth is defined as the complete expulsion or extraction after at least 20 weeks of gestation or after attaining a weight of at least 500 grams of a fetus in which at birth, there is no breathing, beating heart, pulsation of the umbilical cord or unmistakable movement of voluntary muscle.

6 Multiple births are births of twins or greater (triplets, quadruplets, etc).

7 Mothers and babies were assigned to a delivery HA based on the delivery/birth facility; where mothers delivered at home, the delivery HA was set to equal the resident HA. The denominator for the facility based indicators are all births/deliveries occurring at facilities within the HA, regardless of where the mothers/babies reside.

8 This identifies only the care provider who delivers the baby and does not necessarily reflect midwifery involvement throughout pregnancy or at delivery.

9 Intermittent auscultation only could not be identified prior to fiscal year 2004/2005.

10 Preterm is indicated by a final gestational age of less than 37 completed weeks' gestation.

11 Iatrogenic refers to labour that is non-spontaneous, i.e. labour was induced or mother had caesarean section with no labour.

12 This variable did not exist prior to fiscal 2004/2005.

**Table 3. Summary indicators for Interior Health Authority, 2000/2001 to 2007/2008**

| | Fiscal Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 | 07/08 |
| **Resident Based Indicators[1]** | | | | | | | | |
| Maternal Age, All Births – Average (years) | 28.0 | 28.3 | 28.3 | 28.5 | 28.5 | 28.5 | 28.5 | 28.4 |
| Maternal Age, First Live Births – Average (years) | 26.0 | 26.3 | 26.3 | 26.7 | 26.6 | 26.5 | 26.5 | 26.5 |
| First Time Mothers – Proportion of all deliveries | 43.2 | 41.9 | 42.0 | 42.3 | 43.6 | 43.3 | 44.1 | 45.5 |
| First Time Mothers with Four or Fewer Antenatal Visits – Proportion of all first time mothers | 3.9 | 4.2 | 4.9 | 5.3 | 6.5 | 5.9 | 5.8 | 5.8 |
| Pre-pregnancy Obesity[2] – Proportion of all mothers with known pre-pregnancy BMI | 11.9 | 12.7 | 12.4 | 12.5 | 13.7 | 13.7 | 14.1 | 14.1 |
| Unknown Pre-pregnancy BMI[2] – Proportion of all deliveries | 35.9 | 35.4 | 37.3 | 44.1 | 41.1 | 41.0 | 39.4 | 38.5 |
| Smoking During Pregnancy – Proportion of all deliveries | 20.2 | 17.7 | 18.3 | 16.0 | 16.6 | 15.9 | 16.3 | 16.2 |
| Deliveries Outside Home Health Authority[3] – Proportion of all deliveries | 2.4 | 2.0 | 1.6 | 1.8 | 1.6 | 1.3 | 1.6 | 1.4 |
| Maternal Request Caesarean Section/VBAC Declined[4] – Proportion of all deliveries | n/a | n/a | n/a | n/a | 0.8 | 1.2 | 1.2 | 1.9 |
| Stillbirths[5] – Rate per 1,000 births | 4.7 | 3.7 | 4.4 | 4.4 | 5.7 | 5.4 | 6.3 | 4.9 |
| Multiple Births[6] – Rate per 100 live births | 2.7 | 2.8 | 3.0 | 2.8 | 3.1 | 3.5 | 3.2 | 2.9 |
| **Facility Based Indicators[7]** | | | | | | | | |
| Total Number of Births | 5,737 | 5,648 | 5,492 | 5,484 | 5,660 | 5,784 | 6,007 | 6,485 |
| Proportion of Total Provincial Births | 14.2 | 14.0 | 13.6 | 13.6 | 13.9 | 14.1 | 14.2 | 14.7 |
| Midwifery Deliveries[8] – Proportion of all deliveries | 1.9 | 2.3 | 2.8 | 3.4 | 4.5 | 4.5 | 4.7 | 4.6 |
| Labour Induction – Rate per 100 deliveries | 22.5 | 23.0 | 22.1 | 23.1 | 21.3 | 20.6 | 24.3 | 23.2 |
| Caesarean Section – Rate per 100 deliveries | 23.6 | 25.2 | 27.8 | 28.6 | 30.0 | 29.8 | 30.6 | 30.2 |
| Intermittent Auscultation Only[9] – Rate per 100 deliveries with labour | n/a | n/a | n/a | n/a | 13.3 | 16.1 | 16.6 | 17.1 |
| Epidural Use in First Time Mothers – Rate per 100 first time mothers with labour | 35.6 | 37.1 | 36.8 | 38.5 | 40.5 | 38.9 | 41.0 | 53.6 |
| Preterm Births[10] – Rate per 100 live births | 7.1 | 8.0 | 8.8 | 9.2 | 9.3 | 9.8 | 10.0 | 9.0 |
| Iatrogenic Preterm Births[11] – Rate per 100 live births | 2.4 | 2.5 | 3.1 | 3.4 | 3.7 | 3.1 | 3.7 | 3.4 |
| Postpartum Length of Stay after Caesarean Section – Average (hours) | 84.3 | 84.4 | 82.6 | 82.3 | 80.7 | 81.1 | 79.1 | 76.8 |
| Postpartum Length of Stay after Vaginal Delivery – Average (hours) | 47.0 | 46.6 | 46.5 | 46.7 | 46.8 | 46.6 | 45.8 | 42.8 |
| Exclusive Breastfeeding During Delivery Admission[12] – Rate per 100 live births | n/a | n/a | n/a | n/a | 81.5 | 78.2 | 75.7 | 75.6 |

Data Source: BC Perinatal Database Registry
For notes (1-12), please refer to annotations for Table 2.

**Table 4. Summary indicators for Northern Health Authority, 2000/2001 to 2007/2008**

| | Fiscal Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 | 07/08 |
| **Resident Based Indicators[1]** | | | | | | | | |
| Maternal Age, All Births – Average (years) | 27.1 | 27.1 | 27.3 | 27.3 | 27.2 | 27.4 | 27.1 | 27.3 |
| Maternal Age, First Live Births – Average (years) | 25.1 | 25.0 | 25.0 | 25.2 | 25.2 | 25.2 | 24.9 | 25.0 |
| First Time Mothers – Proportion of all deliveries | 40.0 | 41.3 | 39.1 | 40.1 | 40.2 | 41.1 | 42.8 | 40.7 |
| First Time Mothers with Four or Fewer Antenatal Visits – Proportion of all first time mothers | 5.1 | 6.8 | 6.4 | 7.0 | 6.2 | 7.0 | 7.6 | 6.3 |
| Pre-pregnancy Obesity[2] – Proportion of all mothers with known pre-pregnancy BMI | 15.2 | 18.0 | 17.5 | 18.5 | 19.1 | 18.3 | 19.8 | 21.3 |
| Unknown Pre-pregnancy BMI[2] – Proportion of all deliveries | 47.2 | 51.0 | 48.9 | 49.4 | 47.5 | 47.6 | 50.7 | 53.5 |
| Smoking During Pregnancy – Proportion of all deliveries | 20.7 | 19.6 | 18.4 | 19.6 | 18.5 | 18.0 | 18.6 | 18.5 |
| Deliveries Outside Home Health Authority[3] – Proportion of all deliveries | 3.0 | 3.4 | 2.9 | 3.3 | 2.5 | 2.4 | 2.6 | 2.2 |
| Maternal Request Caesarean Section/VBAC Declined[4] – Proportion of all deliveries | n/a | n/a | n/a | n/a | 1.4 | 1.7 | 1.8 | 1.6 |
| Stillbirths[5] – Rate per 1,000 births | 7.1 | 7.5 | 6.7 | 6.2 | 3.9 | 7.6 | 2.9 | 5.7 |
| Multiple Births[6] – Rate per 100 live births | 2.6 | 2.4 | 2.8 | 6.0 | 2.3 | 3.3 | 2.4 | 2.5 |
| **Facility Based Indicators[7]** | | | | | | | | |
| Total Number of Births | 3.462 | 3.402 | 3,390 | 3,333 | 3,300 | 3,372 | 3,376 | 3,632 |
| Proportion of Total Provincial Births | 8.5 | 8.4 | 8.4 | 8.2 | 8.1 | 8.2 | 8.0 | 8.2 |
| Midwifery Deliveries[8] – Proportion of all deliveries | 0.6 | 1.1 | 2.0 | 2.0 | 1.7 | 2.3 | 2.3 | 3.8 |
| Labour Induction – Rate per 100 deliveries | 18.9 | 20.5 | 20.6 | 19.9 | 18.1 | 18.9 | 19.9 | 19.0 |
| Caesarean Section – Rate per 100 deliveries | 22.4 | 25.4 | 26.7 | 26.0 | 26.4 | 26.8 | 26.7 | 27.7 |
| Intermittent Auscultation Only[9] – Rate per 100 deliveries with labour | n/a | n/a | n/a | n/a | 11.0 | 12.2 | 20.5 | 25.6 |
| Epidural Use in First Time Mothers – Rate per 100 first time mothers with labour | 38.1 | 37.5 | 63.4 | 37.2 | 36.1 | 38.7 | 35.9 | 39.7 |
| Preterm Births[10] – Rate per 100 live births | 6.4 | 5.4 | 6.9 | 7.4 | 7.5 | 7.5 | 7.3 | 7.0 |
| Iatrogenic Preterm Births[11] – Rate per 100 live births | 1.5 | 1.0 | 1.9 | 2.1 | 1.8 | 2.4 | 2.3 | 2.3 |
| Postpartum Length of Stay after Caesarean Section – Average (hours) | 89.5 | 82.7 | 85.0 | 79.0 | 77.8 | 77.6 | 75.6 | 74.5 |
| Postpartum Length of Stay after Vaginal Delivery – Average (hours) | 52.7 | 50.3 | 48.8 | 46.5 | 45.9 | 44.8 | 44.5 | 40.9 |
| Exclusive Breastfeeding During Delivery Admission[12] – Rate per 100 live births | n/a | n/a | n/a | n/a | 64.3 | 72.8 | 70.4 | 68.3 |

Data Source: BC Perinatal Database Registry
For notes (1-12), please refer to annotations for Table 2.

**Table 5. Summary indicators for Vancouver Coastal Health Authority, 2000/2001 to 2007/2008**

| | Fiscal Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 | 07/08 |
| **Resident Based Indicators[1]** | | | | | | | | |
| Maternal Age, All Births – Average (years) | 31.2 | 31.5 | 31.5 | 31.8 | 31.9 | 31.9 | 32.0 | 32.1 |
| Maternal Age, First Live Births – Average (years) | 29.9 | 30.2 | 30.3 | 30.6 | 30.7 | 30.8 | 30.8 | 30.9 |
| First Time Mothers – Proportion of all deliveries | 50.8 | 49.3 | 50.2 | 50.2 | 51.4 | 51.4 | 51.4 | 51.9 |
| First Time Mothers with Four or Fewer Antenatal Visits – Proportion of all first time mothers | 5.0 | 4.0 | 3.3 | 4.4 | 4.3 | 4.4 | 4.8 | 4.7 |
| Pre-pregnancy Obesity[2] – Proportion of all mothers with known pre-pregnancy BMI | 5.9 | 6.3 | 5.3 | 5.6 | 5.4 | 6.2 | 5.7 | 6.0 |
| Unknown Pre-pregnancy BMI[2] – Proportion of all deliveries | 24.9 | 24.0 | 25.2 | 27.5 | 28.3 | 27.3 | 32.0 | 32.9 |
| Smoking During Pregnancy – Proportion of all deliveries | 5.9 | 5.2 | 5.2 | 4.5 | 4.3 | 4.3 | 4.0 | 3.4 |
| Deliveries Outside Home Health Authority[3] – Proportion of all deliveries | 25.0 | 26.2 | 25.8 | 26.9 | 27.6 | 26.9 | 25.5 | 25.5 |
| Maternal Request Caesarean Section/VBAC Declined[4] – Proportion of all deliveries | n/a | n/a | n/a | n/a | 4.3 | 5.0 | 5.2 | 5.3 |
| Stillbirths[5] – Rate per 1,000 births | 4.5 | 4.7 | 5.2 | 3.6 | 4.1 | 2.9 | 5.7 | 4.8 |
| Multiple Births[6] – Rate per 100 live births | 2.5 | 2.9 | 3.0 | 2.9 | 3.1 | 3.1 | 3.1 | 3.3 |
| **Facility Based Indicators[7]** | | | | | | | | |
| Total Number of Births | 5,275 | 5,222 | 5,145 | 5,007 | 4,995 | 4,870 | 5,106 | 5,247 |
| Proportion of Total Provincial Births | 13.0 | 12.9 | 12.7 | 12.4 | 12.3 | 11.9 | 12.1 | 11.9 |
| Midwifery Deliveries[8] – Proportion of all deliveries | 4.2 | 4.9 | 4.7 | 7.0 | 7.8 | 8.5 | 8.1 | 8.7 |
| Labour Induction – Rate per 100 deliveries | 21.7 | 20.4 | 19.7 | 18.0 | 17.3 | 19.2 | 19.6 | 20.6 |
| Caesarean Section – Rate per 100 deliveries | 24.8 | 27.7 | 27.8 | 28.8 | 27.4 | 30.9 | 29.8 | 31.9 |
| Intermittent Auscultation Only[9] – Rate per 100 deliveries with labour | n/a | n/a | n/a | n/a | 18.6 | 22.2 | 20.7 | 20.4 |
| Epidural Use in First Time Mothers – Rate per 100 first time mothers with labour | 48.6 | 50.0 | 50.7 | 49.6 | 49.3 | 51.8 | 50.9 | 53.6 |
| Preterm Births[10] – Rate per 100 live births | 6.5 | 6.5 | 6.5 | 6.0 | 7.0 | 6.8 | 7.8 | 6.9 |
| Iatrogenic Preterm Births[11] – Rate per 100 live births | 2.6 | 2.5 | 2.1 | 2.5 | 2.9 | 2.8 | 3.4 | 3.0 |
| Postpartum Length of Stay after Caesarean Section – Average (hours) | 90.5 | 89.8 | 86.0 | 85.5 | 80.2 | 78.6 | 76.3 | 74.0 |
| Postpartum Length of Stay after Vaginal Delivery – Average (hours) | 47.2 | 45.8 | 44.8 | 42.8 | 42.3 | 41.2 | 42.5 | 40.1 |
| Exclusive Breastfeeding During Delivery Admission[12] – Rate per 100 live births | n/a | n/a | n/a | n/a | 69.0 | 65.8 | 63.3 | 61.5 |

Data Source: BC Perinatal Database Registry
For notes (1-12), please refer to annotations for Table 2.

**Table 6. Summary indicators for Vancouver Island Health Authority, 2000/2001 to 2007/2008**

| | Fiscal Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 | 07/08 |
| **Resident Based Indicators[1]** | | | | | | | | |
| Maternal Age, All Births – Average (years) | 28.9 | 28.9 | 29.0 | 29.1 | 29.1 | 29.2 | 29.2 | 29.2 |
| Maternal Age, First Live Births – Average (years) | 27.0 | 27.1 | 27.3 | 27.6 | 27.6 | 27.6 | 27.5 | 27.7 |
| First Time Mothers – Proportion of all deliveries | 44.9 | 43.8 | 44.6 | 44.0 | 44.5 | 44.7 | 45.2 | 44.5 |
| First Time Mothers with Four or Fewer Antenatal Visits – Proportion of all first time mothers | 3.9 | 3.7 | 4.2 | 4.7 | 4.9 | 5.4 | 7.0 | 5.4 |
| Pre-pregnancy Obesity[2] – Proportion of all mothers with known pre-pregnancy BMI | 13.5 | 12.5 | 14.5 | 14.2 | 13.9 | 14.4 | 14.3 | 14.9 |
| Unknown Pre-pregnancy BMI[2] – Proportion of all deliveries | 23.7 | 23.5 | 25.7 | 28.6 | 26.7 | 25.6 | 26.8 | 25.3 |
| Smoking During Pregnancy – Proportion of all deliveries | 18.4 | 17.6 | 15.5 | 15.3 | 15.8 | 16.0 | 16.0 | 14.5 |
| Deliveries Outside Home Health Authority[3] – Proportion of all deliveries | 1.0 | 1.0 | 1.0 | 1.1 | 1.1 | 1.1 | 1.0 | 1.4 |
| Maternal Request Caesarean Section/VBAC Declined[4] – Proportion of all deliveries | n/a | n/a | n/a | n/a | 5.0 | 5.7 | 5.3 | 5.1 |
| Stillbirths[5] – Rate per 1,000 births | 6.3 | 4.5 | 2.8 | 4.7 | 3.9 | 5.0 | 5.2 | 5.4 |
| Multiple Births[6] – Rate per 100 live births | 2.6 | 2.1 | 3.1 | 3.2 | 3.1 | 3.2 | 3.1 | 3.1 |
| **Facility Based Indicators[7]** | | | | | | | | |
| Total Number of Births | 5,662 | 5,804 | 5,716 | 5,807 | 5,834 | 5,938 | 6,016 | 6,332 |
| Proportion of Total Provincial Births | 14.0 | 14.4 | 14.1 | 14.4 | 14.4 | 14.5 | 14.3 | 14.3 |
| Midwifery Deliveries[8] – Proportion of all deliveries | 6.6 | 8.7 | 9.1 | 9.7 | 11.2 | 11.5 | 12.2 | 13.4 |
| Labour Induction – Rate per 100 deliveries | 23.7 | 24.9 | 23.4 | 22.8 | 21.6 | 22.3 | 21.9 | 21.9 |
| Caesarean Section – Rate per 100 deliveries | 23.9 | 26.9 | 28.7 | 29.2 | 31.2 | 31.2 | 31.0 | 31.7 |
| Intermittent Auscultation Only[9] – Rate per 100 deliveries with labour | n/a | n/a | n/a | n/a | 29.1 | 28.3 | 29.4 | 29.0 |
| Epidural Use in First Time Mothers – Rate per 100 first time mothers with labour | 38.8 | 38.8 | 40.3 | 42.2 | 41.3 | 42.3 | 44.1 | 45.8 |
| Preterm Births[10] – Rate per 100 live births | 9.0 | 8.5 | 10.5 | 10.1 | 10.2 | 10.6 | 10.1 | 10.1 |
| Iatrogenic Preterm Births[11] – Rate per 100 live births | 3.0 | 3.4 | 4.2 | 4.1 | 4.3 | 4.3 | 4.0 | 4.9 |
| Postpartum Length of Stay after Caesarean Section – Average (hours) | 89.2 | 88.0 | 89.0 | 87.7 | 88.8 | 83.6 | 80.7 | 82.1 |
| Postpartum Length of Stay after Vaginal Delivery – Average (hours) | 50.6 | 49.1 | 49.1 | 49.3 | 47.7 | 46.8 | 44.1 | 43.8 |
| Exclusive Breastfeeding During Delivery Admission[12] – Rate per 100 live births | n/a | n/a | n/a | n/a | 79.0 | 76.9 | 77.2 | 75.6 |

Data Source: BC Perinatal Database Registry
For notes (1-12), please refer to annotations for Table 2.

**Table 7. Summary indicators for Provincial Health Services Authority[1], 2000/2001 to 2007/2008**

| | Fiscal Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 | 07/08 |
| Maternal Age, All Births – Average (years) | 31.3 | 31.6 | 31.7 | 31.8 | 32.0 | 32.0 | 32.2 | 32.3 |
| Maternal Age, First Live Births – Average (years) | 29.9 | 30.3 | 30.5 | 30.6 | 30.8 | 30.8 | 31.0 | 31.0 |
| First Time Mothers – Proportion of all deliveries | 48.3 | 48.3 | 49.2 | 49.3 | 50.7 | 50.7 | 50.9 | 49.4 |
| First Time Mothers with Four or Fewer Antenatal Visits – Proportion of all first time mothers | 6.1 | 4.8 | 4.6 | 4.6 | 3.8 | 3.9 | 3.9 | 4.4 |
| Pre-pregnancy Obesity[2] – Proportion of all mothers with known pre-pregnancy BMI | 6.2 | 6.5 | 6.0 | 6.1 | 5.8 | 6.6 | 5.9 | 5.6 |
| Unknown Pre-pregnancy BMI[2] – Proportion of all deliveries | 22.8 | 18.3 | 19.5 | 22.2 | 22.9 | 20.3 | 27.8 | 29.3 |
| Smoking During Pregnancy – Proportion of all deliveries | 5.3 | 6.0 | 4.7 | 5.0 | 4.5 | 3.9 | 4.2 | 3.3 |
| Deliveries Outside Home Health Authority[3] – Proportion of all deliveries | 39.0 | 39.2 | 40.2 | 41.4 | 42.6 | 41.5 | 38.4 | 35.3 |
| Maternal Request Caesarean Section/VBAC Declined[4] – Proportion of all deliveries | n/a | n/a | n/a | n/a | 7.5 | 7.6 | 7.2 | 7.6 |
| Stillbirths[5] – Rate per 1,000 births | 6.7 | 6.0 | 7.2 | 5.8 | 5.1 | 4.6 | 7.3 | 6.1 |
| Multiple Births[6] – Rate per 100 live births | 4.5 | 4.9 | 4.5 | 4.6 | 4.4 | 4.5 | 4.5 | 4.9 |
| Total Number of Births | 7,115 | 6,846 | 7,078 | 7,288 | 7,273 | 7,682 | 7,620 | 7,391 |
| Proportion of Total Provincial Births | 17.6 | 17.0 | 17.5 | 18.0 | 17.9 | 18.7 | 18.1 | 16.8 |
| Midwifery Deliveries[7] – Proportion of all deliveries | 1.4 | 1.5 | 1.9 | 2.1 | 2.3 | 3.8 | 5.2 | 5.4 |
| Labour Induction – Rate per 100 deliveries | 17.0 | 17.8 | 17.1 | 16.6 | 16.8 | 17.8 | 16.4 | 18.0 |
| Caesarean Section – Rate per 100 deliveries | 27.2 | 29.3 | 28.3 | 29.0 | 30.9 | 30.6 | 30.9 | 31.7 |
| Intermittent Auscultation Only[8] – Rate per 100 deliveries with labour | n/a | n/a | n/a | n/a | 20.1 | 20.3 | 24.9 | 23.8 |
| Epidural Use in First Time Mothers – Rate per 100 first time mothers with labour | 59.4 | 62.5 | 62.0 | 64.5 | 67.1 | 66.8 | 67.5 | 69.0 |
| Preterm Births[9] – Rate per 100 live births | 12.6 | 12.9 | 13.1 | 13.7 | 13.6 | 13.3 | 13.0 | 12.9 |
| Iatrogenic Preterm Births[10] – Rate per 100 live births | 5.0 | 5.5 | 5.4 | 6.1 | 6.2 | 6.3 | 6.2 | 6.2 |
| Postpartum Length of Stay after Caesarean Section – Average (hours) | 91.8 | 89.2 | 87.7 | 87.9 | 87.0 | 83.7 | 80.0 | 80.8 |
| Postpartum Length of Stay after Vaginal Delivery – Average (hours) | 48.5 | 49.3 | 49.2 | 50.6 | 50.0 | 49.8 | 50.7 | 50.0 |
| Exclusive Breastfeeding During Delivery Admission[11] – Rate per 100 live births | n/a | n/a | n/a | n/a | 49.7 | 55.3 | 58.6 | 61.5 |

Data Source: BC Perinatal Database Registry
Note: Late terminations have been excluded.
1 The population used in this table includes all births and deliveries at PHSA, regardless of place of residence
2 Pre-pregnancy body mass index was calculated using the formula, BMI = weight (kg)/height (m)$^2$.
3 This identifies mothers whose resident Health Service Delivery Area is not equal to 'Vancouver'
4 This identifies the primary indication for caesarean section; the primary indication of 'maternal request CS/VBAC declined' did not exist prior to fiscal year 2004/2005. 'Maternal request CS/VBAC declined' exists as a single indicator in the BCPDR; this data cannot specifically identify medical indication for a caesarean section.
5 Stillbirth is defined as the complete expulsion or extraction after at least 20 weeks of gestation or after attaining a weight of at least 500 grams of a fetus in which at birth, there is no breathing, beating heart, pulsation of the umbilical cord or unmistakable movement of voluntary muscle.
6 Multiple births are births of twins or greater (triplets, quadruplets, etc).
7 This identifies only the care provider who delivers the baby and does not necessarily reflect midwifery involvement throughout pregnancy or at delivery.
8 Intermittent auscultation only could not be identified prior to fiscal year 2004/2005.
9 Preterm is indicated by a final gestational age of less than 37 completed weeks' gestation.
10 Iatrogenic refers to labour that is non-spontaneous, i.e. labour was induced or mother had caesarean section with no labour.
11 This variable did not exist prior to fiscal year 2004/2005.

**Table 8. Summary indicators for Midwifery Involved[1] Deliveries, 2000/2001 to 2007/2008**

| | Fiscal Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 00/01 | 01/02 | 02/03 | 03/04 | 04/05 | 05/06 | 06/07 | 07/08 |
| Maternal Age, All Births – Average (years) | 30.3 | 30.3 | 30.3 | 30.5 | 30.5 | 30.7 | 30.7 | 30.8 |
| Maternal Age, First Live Births – Average (years) | 29.3 | 29.1 | 29.3 | 29.6 | 29.7 | 29.7 | 29.7 | 30.0 |
| First Time Mothers – Proportion of all deliveries | 50.1 | 46.2 | 48.1 | 48.2 | 46.8 | 50.6 | 50.4 | 50.0 |
| First Time Mothers with Four or Fewer Antenatal Visits – Proportion of all first time mothers | 3.0 | 1.7 | 2.1 | 2.6 | 3.3 | 3.5 | 3.5 | 3.0 |
| Pre-pregnancy Obesity[2] – Proportion of all mothers with known pre-pregnancy BMI | 7.6 | 7.1 | 8.5 | 8.0 | 6.9 | 7.5 | 7.1 | 6.6 |
| Unknown Pre-pregnancy BMI[2] – Proportion of all deliveries | 13.0 | 15.3 | 14.2 | 16.7 | 20.5 | 17.7 | 18.5 | 19.5 |
| Smoking During Pregnancy – Proportion of all deliveries | 8.1 | 7.8 | 7.6 | 6.4 | 6.6 | 6.7 | 5.4 | 5..2 |
| Maternal Request Caesarean Section/VBAC Declined[3] – Proportion of all deliveries | n/a | n/a | n/a | n/a | 1.2 | 1.2 | 1.9 | 1.5 |
| Stillbirths[4] – Rate per 1,000 births | 4.2 | 3.2 | 5.5 | 1.8 | 3.0 | 4.5 | 4.3 | 2.6 |
| Multiple Births[5] – Rate per 100 live births | 0.8 | 0.7 | 1.5 | 1.1 | 1.7 | 1.6 | 1.7 | 1.0 |
| Total Number of Midwifery Involved[1] Deliveries | 1,420 | 1,879 | 1,987 | 2,273 | 2,639 | 3,112 | 3,457 | 3,895 |
| Midwifery Deliveries[6] – Proportion of all midwifery-involved deliveries | 74.9 | 72.3 | 72.8 | 75.1 | 72.8 | 69.2 | 68.8 | 70.4 |
| Intention to Deliver at Home – Proportion of midwifery-involved deliveries | 32.6 | 31.6 | 33.7 | 26.7 | 30.0 | 26.7 | 24.9 | 22.3 |
| Intention to Deliver at Hospital – Proportion of midwifery-involved deliveries | 67.4 | 68.4 | 66.3 | 73.3 | 70.0 | 73.3 | 75.1 | 77.7 |
| Deliveries at Home – Proportion of intended-at-home deliveries | 79.0 | 74.9 | 71.2 | 78.4 | 75.0 | 73.1 | 72.2 | 76.4 |
| Deliveries at Hospital – Proportion of intended-at-hospital deliveries | 98.4 | 97.2 | 97.9 | 96.3 | 98.4 | 98.2 | 98.0 | 99.1 |
| Labour Induction – Rate per 100 deliveries | 11.5 | 13.6 | 13.5 | 11.1 | 10.8 | 12.0 | 13.2 | 12.8 |
| Caesarean Section – Rate per 100 deliveries | 14.9 | 17.5 | 15.8 | 16.9 | 17.1 | 19.0 | 19.5 | 18.0 |
| Intermittent Auscultation Only[7] – Rate per 100 deliveries with labour | n/a | n/a | n/a | n/a | 55.9 | 53.7 | 53.6 | 52.0 |
| Epidural Use in First Time Mothers – Rate per 100 first time mothers with labour | 13.5 | 14.7 | 13.8 | 13.8 | 13.3 | 15.7 | 18.7 | 17.9 |
| Preterm Births[8] – Rate per 100 live births | 4.5 | 4.6 | 5.7 | 5.1 | 5.8 | 5.3 | 4.9 | 4.6 |
| Iatrogenic Preterm Births[9] – Rate per 100 live births | 1.6 | 2.1 | 2.0 | 2.0 | 1.9 | 1.9 | 2.2 | 1.7 |
| Postpartum Length of Stay after Caesarean Section[10] – Average (hours) | 77.1 | 79.4 | 77.3 | 77.4 | 82.9 | 74.7 | 73.6 | 73.9 |
| Postpartum Length of Stay after Vaginal Delivery[10] – Average (hours) | 28.2 | 29.7 | 30.2 | 30.9 | 28.5 | 29.4 | 30.0 | 27.4 |
| Exclusive Breastfeeding During Delivery Admission[11] – Rate per 100 live births | n/a | n/a | n/a | n/a | 90.9 | 89.2 | 79.3 | 79.8 |

Data Source: BC Perinatal Database Registry

Note: Late terminations have been excluded.

1 The population for this table includes all deliveries and births with a midwife coded on the abstract, regardless of resident or delivery Health Authority.

2 Pre-pregnancy body mass index was calculated using the formula, BMI = weight (kg)/height (m)$^2$.

3 This identifies the primary indication for caesarean section; the primary indication of 'maternal request CS/VBAC declined' did not exist prior to fiscal year 2004/2005. 'Maternal request CS/VBAC declined' exists as a single indicator in the BCPDR; this data cannot specifically identify medical indication for a caesarean section.

4 Stillbirth is defined as the complete expulsion or extraction after at least 20 weeks of gestation or after attaining a weight of at least 500 grams of a fetus in which at birth, there is no breathing, beating heart, pulsation of the umbilical cord or unmistakable movement of voluntary muscle.

5 Multiple births are births of twins or greater (triplets, quadruplets, etc).

6 This identifies only the care provider who delivers the baby and does not necessarily reflect midwifery involvement throughout pregnancy or at delivery.

7 Intermittent auscultation only could not be identified prior to fiscal year 2004/2005.

8 Preterm is indicated by a final gestational age of less than 37 completed weeks' gestation.

9 Iatrogenic refers to labour that is non-spontaneous, i.e. labour was induced or mother had caesarean section with no labour.

10 Averages include hospital deliveries only.

11 This variable did not exist prior to fiscal year 2004/2005.

# Introduction

### Purpose of the Report

The main purpose of the Perinatal Health Report is to provide summary information to health authorities, policy makers, planners and perinatal health care providers in order to enable action, which may include policy development, service delivery planning, quality improvement initiatives, educational and research activities. The information contained in this Report may, as a first step, identify patterns of temporal or geographical variation that are of local interest. Further steps that are not conducted as part of this Report could involve in-depth analyses of confounding variables and an examination of practice patterns within a local context in order to gain insight on the causes of these variations.

### Background – The British Columbia Perinatal Health Program

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

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

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

In 2010, the Perinatal Services British Columbia (PSBC) was created and replaces the current BC Perinatal Health Program. Perinatal Services British Columbia provides strategic leadership on the full continuum of perinatal care across the province, focusing on perinatal system planning, service delivery and quality improvement. The surveillance function will continue and strengthen under PSBC. Through the pragmatic analysis of temporal trends and geographic variations on a broad spectrum of perinatal health indicators, PSBC intends to work collaboratively with local health authorities and stakeholders to improve on perinatal health outcomes and enhance the quality of perinatal services in BC.

### Data Collection – The British Columbia Perinatal Database Registry

The mission of the BCPDR is to collect, maintain, analyze and disseminate comprehensive, province-wide perinatal data for the purposes of monitoring and improving perinatal care. Rollout of the Registry began in 1994, with collection of data from a small number of hospital sites. Participation increased every year, resulting in full provincial data collection commencing April 1, 2000. The BCPDR is a database containing over 300 fields, and now with complete provincial data, is a valuable source of perinatal information.

The BCPDR consists of data collected from all obstetrical facilities as well as births occurring at home attended by BC Registered Midwives with records for close to 450,000 births currently in the provincial database. BC women who deliver in Alberta or in hospitals out of province are not captured in the BC Perinatal Database Registry. Therefore data from high outflow communities bordering Alberta will be under-reported. The

perinatal data presented in this report are collected from facilities throughout the province and imported into the central BC Perinatal Database Registry. Data from the Canadian Institute for Health Information (CIHI) and matched files from the British Columbia Vital Statistics Agency complement the data elements. Mortality data normally reported in BCPHP reports consists of singleton pregnancy deaths identified by the BCPDR supplemented by deaths identified by Vital Statistics records, in order to provide complete mortality data for babies up to one year of age. At the time of publication, mortality data after 2003/2004 was unavailable to the BCPHP. Please refer to the BCPDR Annual Report 2006 for mortality information.

**Table 9. Sources of Perinatal Data**

| Perinatal Data | BC Vital Statistics Agency | Discharge Abstract Database | BC Perinatal Database Registry |
|---|---|---|---|
| Miscarriages/Abortions | No | No, unless admitted to hospital | No |
| Therapeutic Abortions (<20 weeks gestational age) | No | Yes | No |
| Stillbirths | Yes | Yes | Yes |
| BC residents delivering out of province | No, but Stats Canada makes adjustments for these events | Yes, if in hospital in Canada (excluding Quebec) | No |
| Non-residents of BC delivering in BC hospitals | Yes | Yes | Yes |
| Fiscal/Calendar | Calendar | Fiscal | Fiscal |
| Home Births | Yes | No | Yes |
| Pregnancies vs. Births (i.e., are multiple births identified separately as 1 or as 2,3,4,5, etc.) | Both | Both | Both |

Source: BC Vital Statistics Agency, Canadian Institute for Health Information, BC Perinatal Database Registry

### The 2008 BC Perinatal Health Program Perinatal Health Report

The 2008 BC Perinatal Health Program Perinatal Health Report includes perinatal data from eight fiscal years (April 1 to March 31), 2000/2001 to 2007/2008 inclusive. The data provide information regarding issues pertaining to the care, treatment and outcomes of mothers and newborns in British Columbia. Section 1 provides an examination of normal births in BC. Sections 2 through 5 describe maternal determinants of health, labour and birth processes, maternal health outcomes, and fetal and infant health outcomes, respectively. Appendix 1 is a glossary of terms and definitions used throughout this report. This report can be accessed at the BCPHP website (www.bcphp.ca) Paper copies can be obtained through the BCPHP office (check website for contact information).

### Methodology and Limitations

- Late terminations are excluded from the entire report.
- Data on all births (singletons, twins and multiples) occurring in BC in the specified time period were included, regardless of place of residence (BC, out of province or unknown).
- Only linked mothers and newborns for each fiscal year are included (<0.02% of records are not linked)

- The linked mother-newborn is attributed to the health care facility reporting the delivery episode. The year in which the linked mother-newborn is contained is dependent on when the mother was discharged.

  For example:

  – if a woman gives birth March 28, 2008 and is discharged March 31, 2008 and the newborn is also discharged March 31, 2008, then their information is contained in the 2007/2008 fiscal year data.

  – if a woman gives birth March 28, 2008 and is discharged March 31, 2008 and the newborn is discharged April 4, 2008, then the data for both mother and newborn will be contained in the fiscal year 2007/2008 data set.

- Deliveries and births of BC residents occurring outside of BC are not included in the BC Perinatal Database Registry and therefore are not included in this report.

- Women and their babies were mapped to a resident level of geography based on the postal code recorded during the delivery admission.

- Similarly, women and their babies were mapped to a delivery level of geography based on the location of the facility in which they delivered/were born.

- Births occurring at home and attended by registered midwives are included in provincial totals, and for delivery aggregated analyses, women were mapped back to the Health Authority in which they reside.

- The updated data for fiscal years have been incorporated in the 2008 Perinatal Health Report. Slight differences may, therefore, be noted from previous reports and it is advisable that readers follow trends based on the current data rather than compare tables from earlier publications of BCPHP reports.

- Where rates are based on small numbers (e.g. rare events such as perinatal mortality or severe maternal morbidity), caution should be taken in interpreting these results.

- Reference is made throughout the document to BCPHP resources for select indicators (e.g., clinical practice guidelines). These references can be accessed on the BCPHP web site at www.bcphp.ca.

## SECTION ONE

# Normal Births


*Optimizing Neonatal, Maternal and Fetal Health*

Professional associations in Canada and other industrialized countries have become increasingly concerned about the evident rise in medical intervention in labour and delivery. For example, the Society of Obstetricians and Gynaecologists of Canada (SOGC) issued a statement in 2008 highlighting the increasing caesarean section rates in Canada.[1] Their Joint Policy Statement on Normal Childbirth expressed concern about the trend towards increasing intervention rates, and called for a focus on promoting the natural birthing process using minimal interventions while ensuring the safety of both mother and baby. Of equal concern is the fact that "social and cultural changes have fostered insecurity in women with regard to their ability to give birth without technological intervention".[1]

In order to determine when medical intervention may be necessary during labour and delivery, the SOGC distinguished between normal birth and births requiring intervention. Normal birth includes both normal labour and normal delivery. According to the Joint Policy Statement, normal labour is either spontaneous and occurs between 37 and 41 completed weeks' gestation or induced after 41 weeks' gestation, and proceeds routinely through the third stage. Normal delivery is unassisted (although the use of augmentation in established labour is not precluded), requires that the infant presents in vertex position, and includes the opportunity for skin-to-skin contact and breastfeeding within an hour after birth. This definition also includes some medical interventions such as labour augmentation after spontaneous onset of labour, artificial rupture of membranes outside of labour induction, and pharmacological use of pain relief, including epidurals.

Normal birth has been similarly defined by the Royal College of Obstetricians and Gynaecologists (RCOG) in Britain.[2] The RCOG, however, places no restrictions on gestational age or fetal presentation. Induction of labour (regardless of gestational age) and use of epidural anesthesia are excluded from the category of normal deliveries. While comprehensive, the SOCG and RCOG concepts of normal birth cannot measure the very thing that is of primary concern – the increased use of medical intervention, particularly in low-risk populations. This is because the use of medical interventions, such as assisted vaginal delivery or caesarean section, automatically excludes a woman from the category of normal birth. Therefore, the designation of "normal birth" is given in retrospect.

For the purposes of this analysis on "normal birth", BCPHP has identified a category of pregnant women with the following criteria:

- Spontaneous onset of labour
- Term delivery (37+0 to 41+6 weeks' gestation)
- Singleton pregnancy
- Baby is in vertex presentation
- No previous history of caesarean delivery

While it is understood that such a definition will result in the inclusion of some women with underlying medical issues as well as some with problems of pregnancy, such as preeclampsia or diabetes, exclusion of women who were induced implies that, if present, these conditions were mild or moderate.

Reviewing birth outcomes among "normal birth" women by parity provides information on the likelihood of such women encountering intervention during labour for some reason. Such an approach can illuminate practice variance across the province.

In 2007/2008, **53.2%** of all women delivering in British Columbia were normal at the onset of labour using the BCPHP definition described above (n=23,016). Of these women, **76.4%** had a spontaneous vaginal delivery, leaving almost one quarter (**23.7%**) who had either an assisted vaginal delivery or a caesarean section. Table 1.1.0 shows that women of parity ≥1 were considerably more likely to have a spontaneous vaginal delivery compared to nulliparous women (**92.6%** compared to **60.2%**). Assisted vaginal deliveries (involving the use of forceps and/or vacuum extraction) were more common among nulliparous women (**19.9%**) than women of parity ≥1 (**4.8%**). As well, nulliparous women were significantly more likely to experience caesarean section deliveries (**19.9%**) in comparison to women of parity ≥1 (**2.6%**).

**Table 1.1.0 Method of delivery by parity for "normal birth" women, British Columbia, 2007/2008**

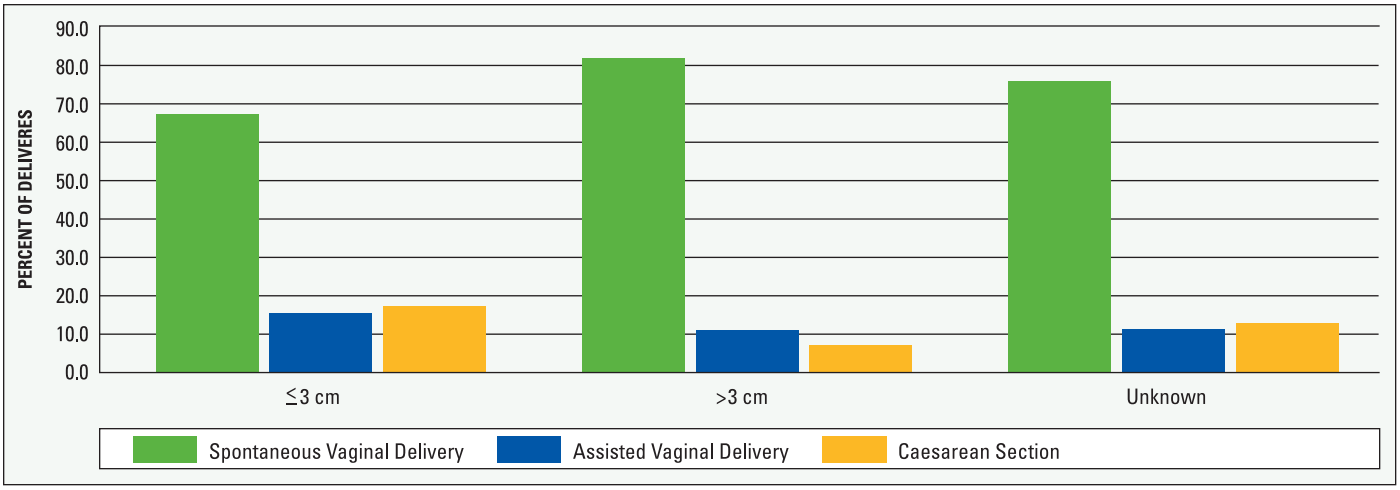
| | Delivery Method | | | | | | |
|---|---|---|---|---|---|---|---|
| | Spontaneous Vaginal | | Assisted Vaginal | | Caesarean Section | | |
| Parity | # | % | # | % | # | % | Total Deliveries |
| Nulliparous | 6,934 | 60.2 | 2,291 | 19.9 | 2,295 | 19.9 | 11,520 |
| Parity ≥1 | 10,643 | 92.6 | 554 | 4.8 | 299 | 2.6 | 11,496 |
| Total | 17,577 | 76.4 | 2,845 | 12.4 | 2,594 | 11.3 | 23,016 |

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
BCPHP "normal" at the onset of labour definition was used for this analysis.

Cervical dilation on admission is a crude marker for likelihood of achieving a spontaneous vaginal delivery. Among women who presented later in labour (cervical dilation >3 centimetres on admission), **82%** achieved a spontaneous vaginal delivery, while among those with a cervical dilation of ≤ 3 centimetres on admission, **67.3%** went onto spontaneous vaginal delivery. Women who presented to hospital in more advanced labour are less likely to have a caesarean section than those who presented earlier in labour (**7.1%** versus **17.2%**, Figure 1.1.0).

Not surprisingly, duration of labour and mode of delivery were related (Table 1.1.1).

**Figure 1.1.0 Cervical dilation on admission by method of delivery for "normal birth" women, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
BCPHP "normal" at the onset of labour definition was used for this analysis.

**Table 1.1.1 Labour characteristics by method of delivery and parity for "normal birth" women, British Columbia, 2007/2008**

| | Delivery Method | | |
|---|---|---|---|
| | **Spontaneous Vaginal** | **Assisted Vaginal** | **Caesarean Section** |
| **Nulliparous** | | | |
| Average duration of first stage of labour (hours) | 8.9 | 11.0 | 12.6 |
| Average duration of second stage of labour (hours) | 1.3 | 2.4 | 3.9 |
| Percentage with labour augmentation | 50.9 | 68.2 | 70.1 |
| Percentage with external electronic fetal monitoring | 66.5 | 85.4 | 90.3 |
| **Parity ≥1** | | | |
| Average duration of first stage of labour (hours) | 5.2 | 6.9 | 8.5 |
| Average duration of second stage of labour (hours) | 0.3 | 1.0 | 3.3 |
| Percentage with labour augmentation | 48.1 | 58.5 | 57.5 |
| Percentage with external electronic fetal monitoring | 50.9 | 75.1 | 83.3 |

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
BCPHP "normal" at the onset of labour definition was used for this analysis.

The logic used to develop the care provider indicator does not fully describe the multiple types of care providers potentially involved in a women's delivery admission nor does it describe the care provider types seen during pregnancy for antenatal care (and thus does not necessarily reflect the influence of an antenatal care provider on a woman's preparation and counseling for labour and birth). Furthermore, the population served by the diverse groups of providers is disparate as some will self select by request and others will be assigned by referral on the basis of risk. As such, an algorithm[3] previously developed by the BCPHP which describes care provider type during delivery admission was used to account for the various care providers feasibly involved in a women's delivery admission, which may differ from the 'most responsible care provider' field and the 'care provider at delivery' field, both of which only describe one care provider type.

Using this algorithm, of the women defined as "normal birth" delivering in British Columbia in 2007/2008 with a registered midwife involved during their delivery admission, **84.3%** had a spontaneous vaginal delivery, while **9.0%** had a caesarean section (Table 1.1.2). With an obstetrician as care provider (without a family physician or midwife), these women had a spontaneous vaginal delivery rate of **68.3%** and a caesarean section rate of **15.6%**. (Table 1.1.2). It is important to note that the selection of a care provider in pregnancy is dependent on many factors, and there is a selection bias for women who choose certain care provider types.

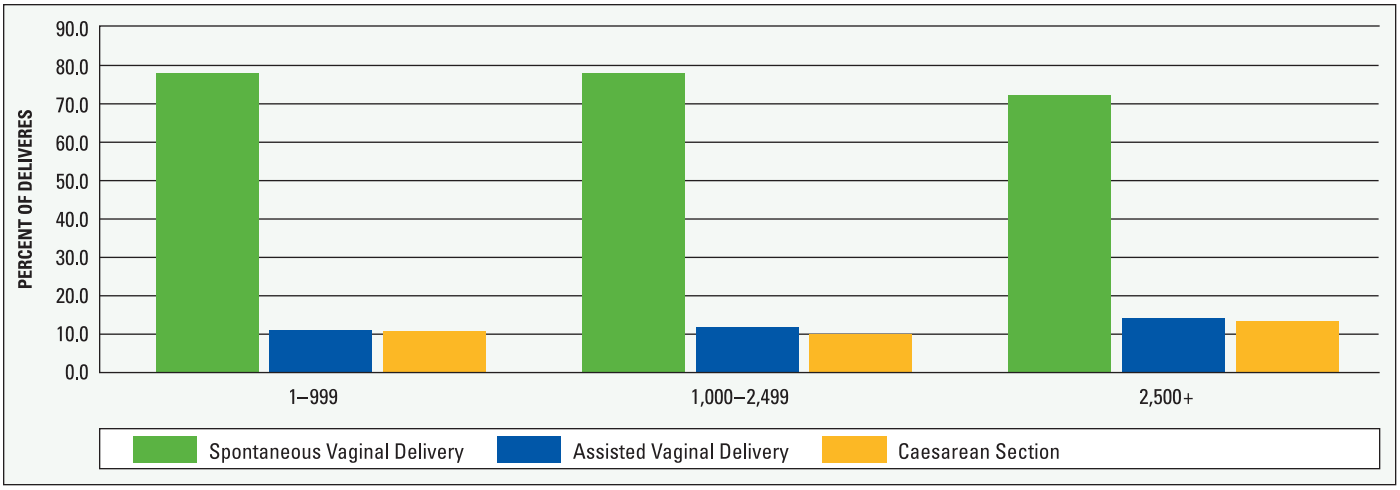
**Table 1.1.2 Method of delivery by care provider for "normal birth" women, British Columbia, 2007/2008**

| Care Provider | Delivery Method | | | | | | Total Deliveries |
|---|---|---|---|---|---|---|---|
| | Spontaneous Vaginal | | Assisted Vaginal | | Caesarean Section | | |
| | # | % | # | % | # | % | |
| Midwife | 2,251 | 84.3 | 180 | 6.7 | 239 | 9.0 | 2,670 |
| Family Physician/General Physician | 11,580 | 77.9 | 1,785 | 12.0 | 1,498 | 10.1 | 14,863 |
| Obstetrician/Gynecologist | 3,734 | 68.3 | 880 | 16.1 | 854 | 15.6 | 5,468 |

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
BCPHP "normal" at the onset of labour definition used in this analysis
Please refer to BCPHP Caesarean Section Task Force Report 2008 for a description of algorithm used to develop this indicator.

Figure 1.1.1 depicts rates of delivery methods according to hospital size for all women defined as "normal". Such women delivering in hospitals with between 1 and 999 births per year have similar delivery outcomes (i.e. method of delivery) as those women delivering in hospitals with between 1,000 and 2,499 births per year. Women delivering in a large hospital (2,500+ deliveries per year) are slightly more likely to have a birth with an intervention (assisted vaginal delivery or caesarean section) than those women delivering in smaller hospitals. However, since it is also more likely that women who experience complicated labour and delivery will be transferred to larger hospitals with more specialized care, this information must be interpreted with caution: the higher rates in larger hospitals may potentially be due to the transfer of women requiring assisted vaginal or caesarean delivery out of smaller hospitals, which would affect the rates in both settings.

**Figure 1.1.1 Method of delivery by hospital size for "normal birth" women, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
BCPHP "normal" at the onset of labour definition used in this analysis.

Table 1.1.3 shows neonatal outcomes by delivery method for all "normal birth" women in British Columbia in 2007/2008. In total, there were 23,004 live newborns born to these women. When compared to babies born via spontaneous vaginal delivery, babies born via caesarean section were more likely to require initial resuscitation (which includes use of oxygen, IPPV via mask/endotracheal tube, chest compressions, and/or drugs given in the first hour of life) (**11.71**% vs **22.35**%) and NICU admission (**2.45**% vs **7.76**%). As well, the percentage of small-for-gestational-age babies was slightly larger in the spontaneous vaginally delivered group of babies when compared to those babies delivered by caesarean section (**6.61**% vs. **5.94**%). Finally, **1.62**% of babies born via spontaneous vaginal delivery were macrosomic compared to **3.78**% of those born via caesarean section.

**Table 1.1.3 Neonatal outcomes by method of delivery for "normal birth" women, British Columbia, 2007/2008**

| | Delivery Method | | | | | | Total Deliveries | |
|---|---|---|---|---|---|---|---|---|
| | Spontaneous Vaginal | | Assisted Vaginal | | Caesarean Section | | | |
| Neonatal Outcomes | # | % | # | % | # | % | # | % |
| **All Newborns** | **17,577** | | **2,845** | | **2,594** | | **23,016** | |
| Stillbirths | 8 | | 1 | | 3 | | 12 | |
| **Live Newborns** | **17,569** | | **2,844** | | **2,591** | | **23,004** | |
| 5 minute Apgar <7 | 157 | 0.89 | 46 | 1.62 | 36 | 1.39 | 239 | 1.04 |
| Initial resuscitation | 2,058 | 11.71 | 502 | 17.65 | 579 | 22.35 | 3,139 | 13.65 |
| NICU admission | 431 | 2.45 | 147 | 5.17 | 201 | 7.76 | 779 | 3.39 |
| Small-for-gestational-age | 1,162 | 6.61 | 249 | 8.76 | 154 | 5.94 | 1,565 | 6.80 |
| Macrosomic (≥4,500 grams) | 285 | 1.62 | 37 | 1.30 | 98 | 3.78 | 420 | 1.83 |
| Perinatal death | 3 | 0.02 | 0 | 0.00 | 1 | 0.04 | 4 | 0.02 |

Source: BC Perinatal Database Registry
Notes: BCPHP "normal" at the onset of labour definition used in this analysis.
Initial resuscitation includes oxygen, intermittent positive pressure via mask/ endotracheal tube, chest compressions, and/or drugs given during the first hour of life.
NICU Admission = newborn was admitted to a Neonatal Intensive Care Unit (Level II and/or Level III)
Perinatal death = newborn was born alive and was discharged to 'death' during the newborn episode of care.

**Summary**

Use of medical interventions during labour and delivery have proven to benefit numerous mothers and infants, however, there can be an 'over-reliance' on these interventions. Due to the increasing concerns of rising intervention rates, an analysis of this 'low-risk' population was undertaken.

This high-level descriptive analysis showed that just over half of women delivering in British Columbia in 2007/2008 were 'normal' and healthy at the onset of labour and of these women, almost one-quarter had a birth that required some form of medical intervention, either through an assisted vaginal delivery or a caesarean section. It is to be expected that parity and age would significantly influence the outcome, but delineation of the other factors that differentiate which women will or will not safely achieve a vaginal delivery requires further analysis.

As this was a cross-sectional descriptive analysis, no cause and effect can be implied. For example, it cannot be stated from this study that women who seek care from certain types of providers have distinctly different attitudes about normal birth or that choosing a certain type of care provider will ensure a normal birth, or that an action or intervention used in delivery promotes or detracts from the outcome of normal birth.

This type of study does, nevertheless, direct attention to the need to support women in promoting 'normal' childbirth. It highlights that the "normal" population is not a homogenous group; there are differences between those who deliver via spontaneous vaginal delivery and those requiring intervention. Further analysis of these differences are required, including an analysis of factors that affect a woman's decision of when to seek care during labour; level of and ability to cope with pain, labour progression; distance to travel to seek care; family and/or care provider support; and other circumstances surrounding the initiation and course of labour. It is also important to note that delivering via caesarean section does not imply sub-optimal care and it is an inaccurate assumption that all "normal" women will inevitably end labour with a spontaneous vaginal delivery. Finally, the "normal" population only comprises approximately half of the entire delivering population, and many women who are excluded may potentially deliver via spontaneous vaginal delivery with little or no adverse outcome.

The increasing use of medical intervention in low-risk pregnancies emphasizes the importance of promoting normal childbirth during the antenatal period. The natural process of childbirth should be encouraged and supported through discussion and education such that all pregnant women and their families are able to make informed choices regarding the birthing process.[1] However, the most important outcome with any birth is a healthy mother and neonate.

## SECTION TWO

# Maternal Determinants of Health


*Optimizing Neonatal, Maternal and Fetal Health*

Maternal determinants of health refer to a number of factors relating to the mother that may influence maternal, fetal, and infant health outcomes. This encompasses a range of factors including behavioural/lifestyle choices; socio-demographic factors; health services utilization and access; and medical/health concerns.

Mothers may have control over some of these factors, such as substance use during pregnancy while some variables are entirely outside of their control, such as access to health services. As well, there are other health determinants, such as pre-pregnancy weight, where the distinction is less clear: while mothers can take actions to address these determinants by reducing or preventing their effects, there are also aspects that are outside of their control (for instance, weight control may depend on a number of issues including access to nutritious food, genetics, and underlying health issues that may be beyond an individual's ability to address). Thus, an analysis of maternal determinants of health must acknowledge that health outcomes do not depend entirely on individual behaviours, but are also influenced by complex socio-demographic factors.

In this section, a number of indicators of maternal determinants of health are discussed. These include maternal age; pre-pregnancy body mass index; weight gain during pregnancy; access to prenatal care; substance use during pregnancy; and intimate partner violence.

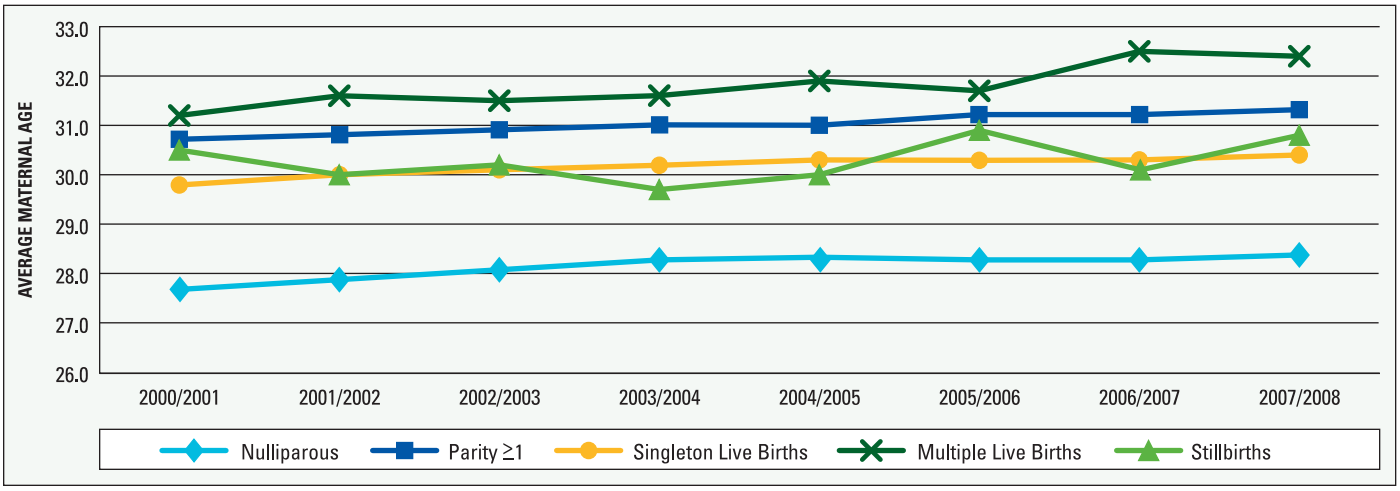
## 2.1 Maternal Age

Maternal age is defined as the age in years at time of delivery and is calculated using the mother's recorded date of birth and her delivery date. Mothers aged 35 and older are considered to be of advanced maternal age. Advanced maternal age is associated with a number of factors during pregnancy and labour, including chronic illnesses, placental problems, prolonged labour, and an increase in caesarean deliveries. However, older mothers are less likely to engage in behaviours such as smoking and generally have good access to prenatal care.[4]

Young maternal age has been associated with poor weight gain during pregnancy and anemia in mothers, as well as with low birth weight, prematurity, and increased mortality among infants. Younger mothers may also face socio-economic disadvantages, including low education and income levels, inadequate antenatal care, and may be more likely to smoke, drink, or use drugs during pregnancy.[4]

In BC, the average maternal age among mothers who have had at least one live birth in the past (parity ≥1) has been increasing slightly since 2000/2001, from **30.7** years of age to **31.3** years in 2007/2008. The average maternal age for first live birth (nulliparous) has been stable at **28.8** years for the last five years. The average maternal age for women having multiple (twins or greater) live births in BC has increased from **31.2** in 2000/2001 to **32.4** in 2007/2008 (Figure 2.1.0).

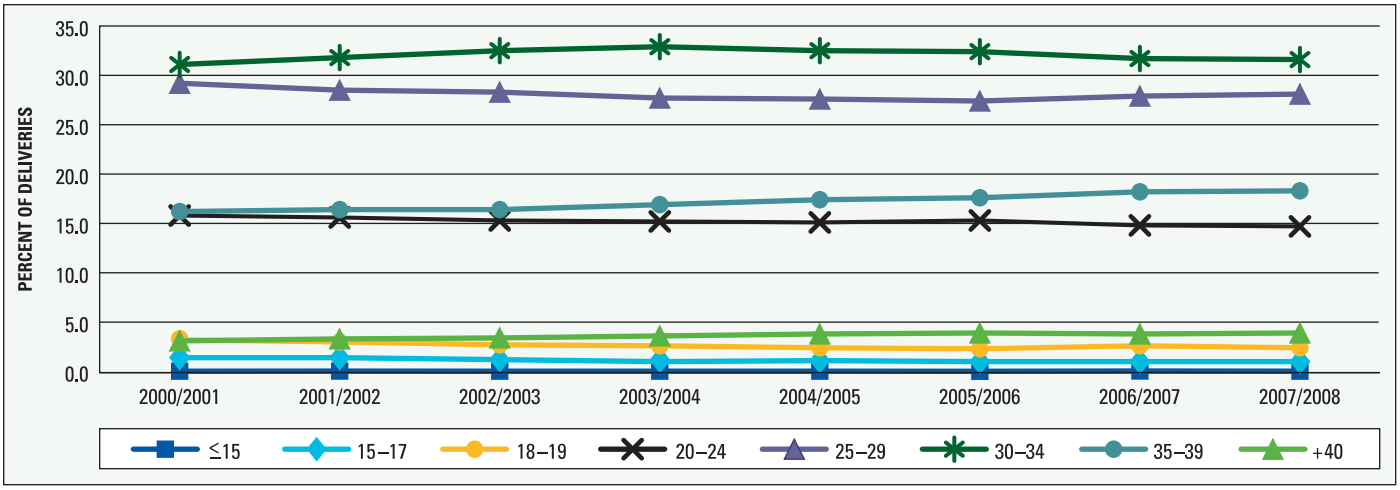
**Figure 2.1.0 Average maternal age (in years) by selected birth types, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
A mother with twins or greater resulting in at least one live birth was attributed to the 'live birth' category.
Late terminations have been excluded.

In 2007/2008, over half (**53.8%**) of live born deliveries in BC were to women age 30 and above, while only **18.1%** of live born deliveries in BC were to women under the age of 25 (Figure 2.1.1). From 2000/2001 to 2007/2008, the largest increase in live born deliveries was among women between the ages of 35 and 39 (Figure 2.1.1). In 2007/2008, **3.9%** of deliveries were to women age 40 and above, while **1.0%** were to women between the ages of 15 and 17.

**Figure 2.1.1 Proportion of women with live births by age group, British Columbia, 2000/2001 to 2007/2008**

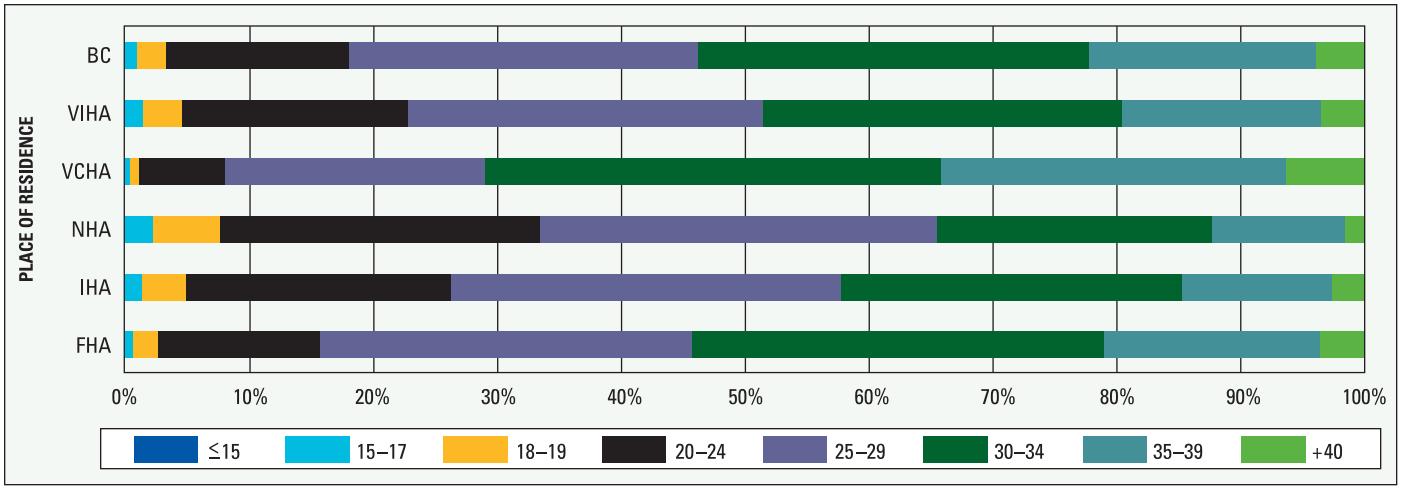



Source: BC Perinatal Database Registry
Notes: A mother with twins or greater resulting in at least one live birth was attributed to the 'live birth' category.
The numbers for age group ≤15 are between 10 and 19 each year. This equals 0.02% – 0.05% and does not register in the figure.
Only live births were included in this analysis.

In 2007/2008, of the women in British Columbia who delivered at age 40 and above, most lived in the Vancouver Coastal Health Authority (**37.8%**), while the fewest lived in the Northern Health Authority (**3.5%**) (data not tabulated).

The Northern Health Authority had the youngest mothers in 2007/2008, with **65.5%** of deliveries to women under the age of 30 (Figure 2.1.2), compared to the Vancouver Coastal Health Authority, where only **29.1%** of deliveries were to women under the age of 30.

**Figure 2.1.2 Proportion of women with live births by age group and resident Health Authority and British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.
The numbers for age group ≤15 are between 10 and 19 each year. This equals 0.02% – 0.05% and does not register in the figure.
Only live births were included in this analysis.

## 2.2 Pre-pregnancy Body Mass Index

Pre-pregnancy body mass index (BMI) is defined as the ratio of a woman's weight to height, as measured pre-pregnancy or up to 12 weeks gestation. It is calculated using the formula: BMI = weight (kg)/height(m)$^2$. BMI was calculated and grouped according to the classification scheme described in Table 2.2.0 below.

**Table 2.2.0 Health Risk Classification According to Body Mass Index (BMI)**

| Classification | BMI Category (kg/m$^2$) | Description |
|---|---|---|
| Underweight | < 18.5 | Increased risk |
| Normal Weight | 18.5 – 24.9 | Least risk |
| Overweight | 25.0 – 29.9 | Increased risk |
| Obese | ≥ 30.0 | High to extremely high risk |
| Unclassified | Not available | Unable to calculate body mass index |

Source: Health Canada, Canadian Guidelines for Body Weight Classification in Adults, Ottawa: Minister of Public Works and Government Services Canada; 2003.

An underweight pre-pregnancy classification is associated with various risks in pregnancy, including an increased risk of preterm birth, while being overweight is associated with other risks, such as increased risk of large-for-gestational-age babies.[5]

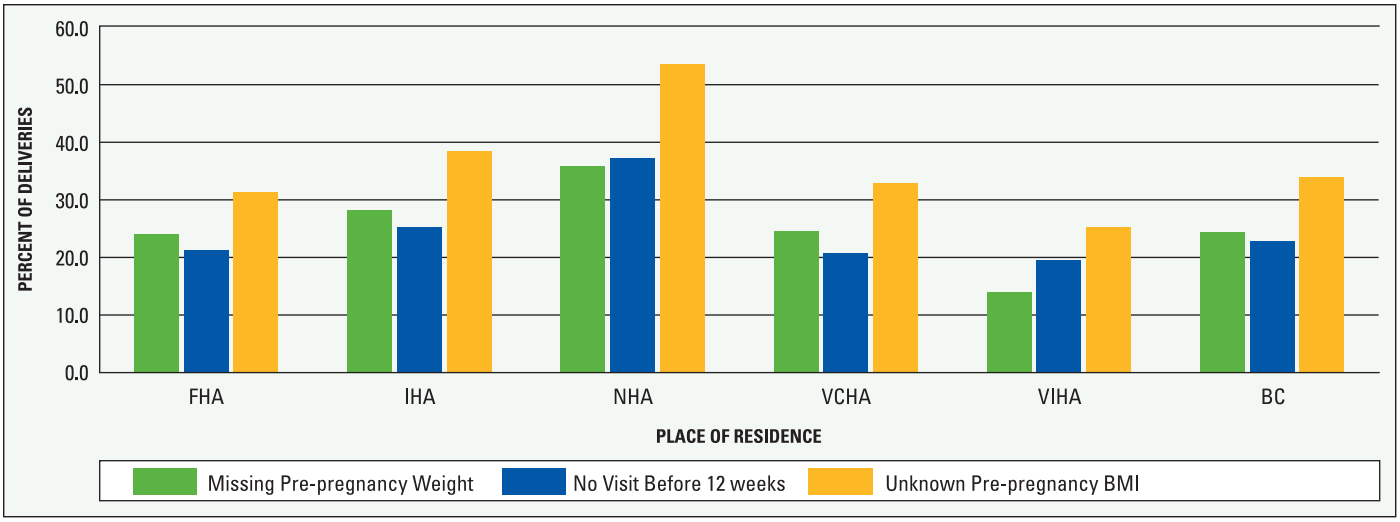
It should be noted that Health Canada does not recommend the use of this BMI classification system for children under the age of 18 years old. However, mothers under the age of 18 represented only **1%** of all mothers in BC. Thus although the BMI classification was not designed for use with teens, it was felt that including teen mothers in the analysis of pre-pregnancy weight would not adversely affect results.

In reviewing the information in this section, one important data limitation must be considered. For more than one-third of deliveries (**33.9%**) in 2007/2008 in British Columbia, pre-pregnancy body mass index could not be calculated (Figure 2.2.0) due to lack of recorded pre-pregnancy weight and/or height on the maternal record. Interpretations of information about pre-pregnancy body mass index and pre-pregnancy weight, including plans for preventative or risk reduction practices, should, therefore, take into consideration the fact that for many mothers in the province, this information was not available.

Unknown pre-pregnancy body mass index varies geographically, from a high of **53.5%** in the Northern Health Authority to a low of **25.3%** in the Vancouver Island Health Authority (Figure 2.2.0). Further analysis of missing pre-pregnancy BMI data showed that **24.4%** of total provincial records were missing pre-pregnancy weight, with a high of **35.8%** in the NHA and a low of **14.0%** in the VIHA (Figure 2.2.0).

As pre-pregnancy weight identifies weight before pregnancy or weight up to 12 weeks gestation, another analysis was conducted to determine what proportion of women did not have an antenatal visit before 12 weeks. While this does not preclude women from reporting their pre-pregnancy weight at any time during their pregnancy, the lack of a visit before 12 weeks' gestation may make it less likely that pre-pregnancy weight would be recorded. Figure 2.2.0 shows that unknown pre-pregnancy weight and lack of a visit before 12 weeks' gestation may be closely related. For example, in the NHA, where missing data on pre-pregnancy BMI and pre-pregnancy weight is the highest in the province, antenatal visits before 12 weeks' gestation are also a concern: **37.3%** of women in the NHA did not have a recorded antenatal visit before 12 weeks' gestation.

**Figure 2.2.0 Rates of unknown (unclassified) pre-pregnancy body mass index, unknown pre-pregnancy weight, and no antenatal visit before 12 weeks by resident Health Authority and British Columbia, 2007/2008**



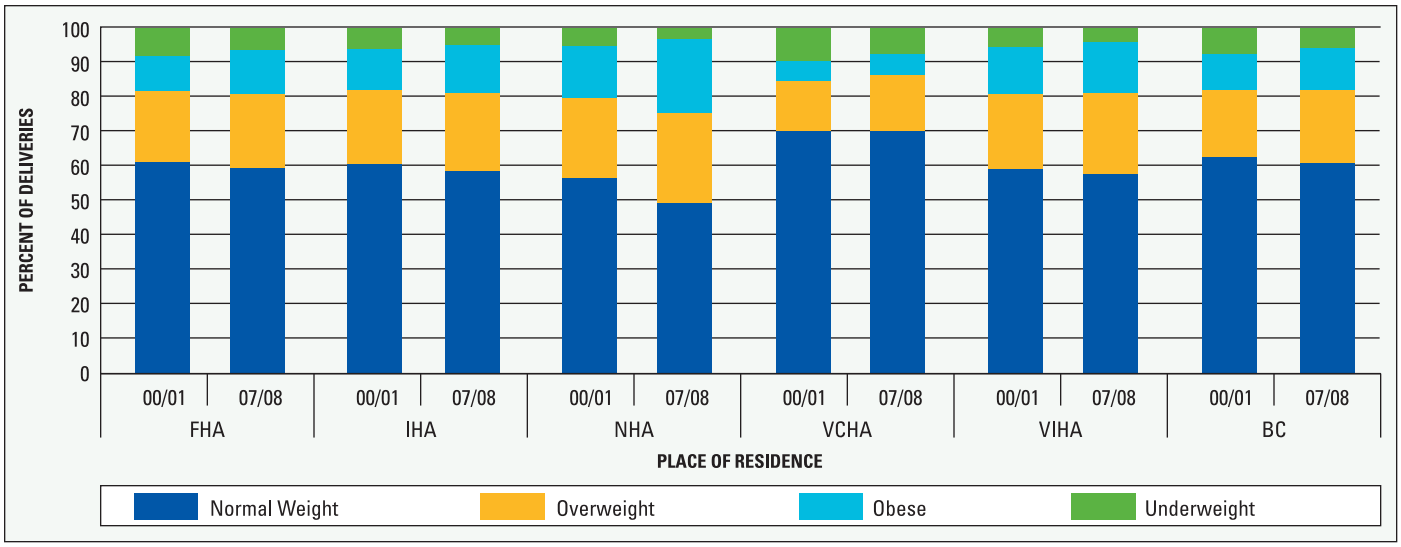

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.
Unknown (unclassified) refers to maternal records where either the pre-pregnancy weight and/or height information are missing.

Among those who do have a known pre-pregnancy body mass index (BMI), the obesity rate (BMI ≥ 30) has increased slightly, from **10.2%** in 2000/2001 to **12.2%** in 2007/2008 (Figure 2.2.1). Obesity rates (BMI ≥ 30) are lowest in the Vancouver Coastal Health Authority, where **6.0%** of mothers had a pre-pregnancy BMI of over 30.0 with very little change between 2000/2001 and 2007/2008 (**0.1%** increase, the smallest change among health authorities). The Northern Health Authority experienced the largest change over the seven year period (a **6.1%** increase in obesity (BMI ≥ 30) from 2000/2001 to 2007/2008). It should be noted, however, that known pre-pregnancy BMI is decreasing in the NHA, from **53.5%** known pre-pregnancy BMI in 2000/2001 to **46.5%** in 2007/2008 (data not tabulated).

As well, the NHA continues to have the lowest proportion of mothers who are normal weight pre-pregnancy (**49.3%** in 2007/2008) of all the health authorities; this region also has the highest proportion of mothers who are obese pre-pregnancy (**21.3%** in 2007/2008). However, as noted previously, the NHA has the highest proportion of unknown pre-pregnancy BMI, making it difficult to draw definitive conclusions. It may be that there is truly a greater proportion of women in the NHA who are obese pre-pregnancy, or it may be that care providers in this region are less likely to record pre-pregnancy weight among mothers who are of normal weight (and for whom, therefore, weight is not a significant risk to the pregnancy). Additionally, the NHA has the highest proportion of women with no recorded antenatal visit before 12 weeks, which may be influencing the documentation of pre-pregnancy weight, and therefore the calculation of pre-pregnancy BMI.

For BC as a whole, the increase in the proportion of mothers who are overweight or obese is matched by a decrease in the proportion of mothers who are of normal weight (declining from **62.9%** in 2000/2001 to **61.1%** in 2007/2008) and who are underweight (declining from **7.5%** to **5.7%** in the same time period). The greatest proportion of underweight mothers was found in the VCHA (**7.4%**), while the smallest proportion of underweight mothers was found in the NHA (**3.1%**).

**Figure 2.2.1 Pre-pregnancy body mass index by resident Health Authority and British Columbia, 2000/2001 and 2007/2008**

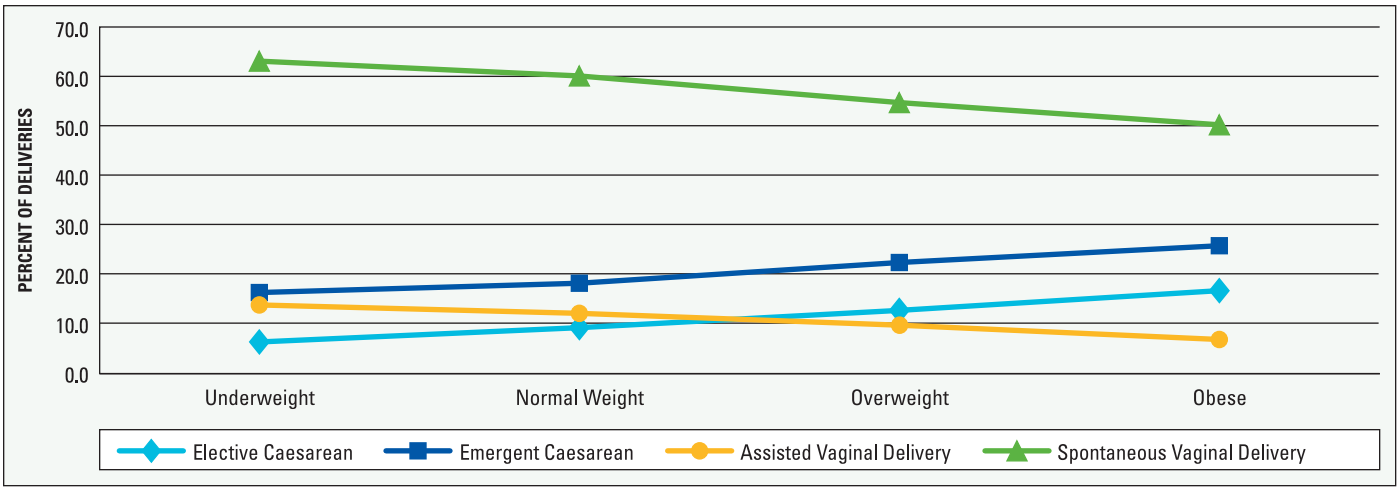



Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.
Only known BMI values were used in this analysis.

BCPHP data also shows that mothers who are obese pre-pregnancy have the highest rates of both elective caesarean section and emergent caesarean section (**16.8%** and **25.9%** in 2007/2008, respectively) (Figure 2.2.2).

The proportion of women who experience a spontaneous vaginal delivery decreases as pre-pregnancy weight increases. It is interesting to note that a smaller percentage of women who are of normal weight pre-pregnancy experience a spontaneous vaginal delivery compared to women who are underweight pre-pregnancy (**60.3%** compared to **63.3%**); however, the number of mothers who are underweight pre-pregnancy is also quite small, as seen in Figure 2.2.1.

**Figure 2.2.2 Type of delivery by maternal pre-pregnancy body mass index classification, British Columbia, 2007/2008**

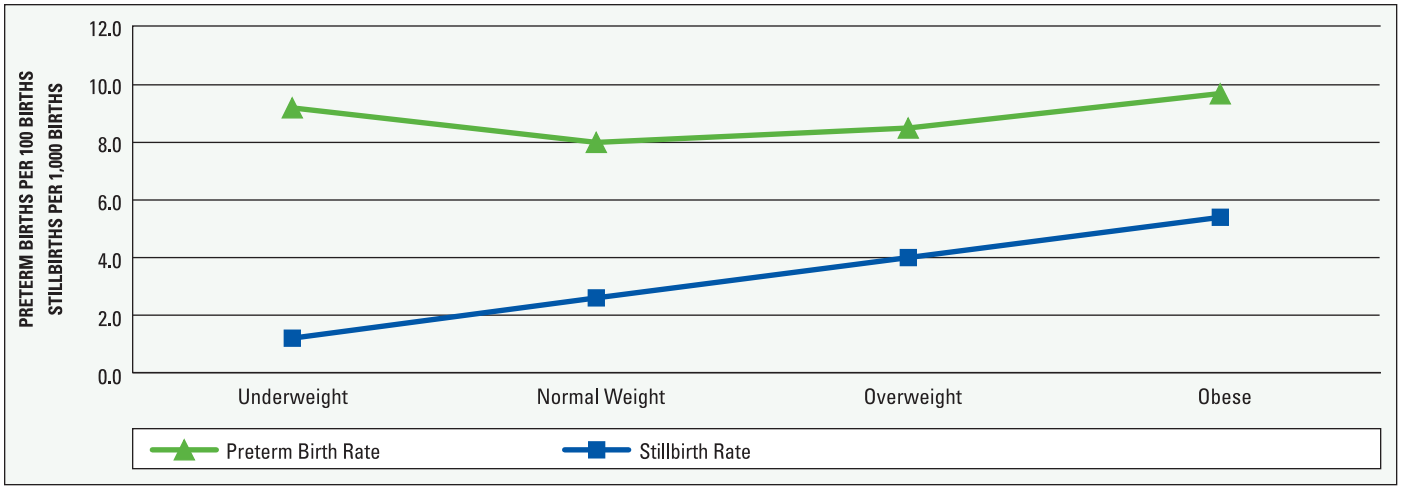



Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only known BMI values were used in this analysis.

Additionally, there was a clear relationship between pre-pregnancy weight and other indicators of maternal and infant health. For instance, the rate of both preterm births and stillbirths increases as pre-pregnancy weight increases (Figure 2.2.3). While the difference between preterm birth rates is relatively small (with the likelihood of experiencing a preterm birth being **1.2** times higher in women who are obese pre-pregnancy compared to women who are normal weight pre-pregnancy), the difference for stillbirths is more significant. Women who are obese pre-pregnancy are **2.9** times more likely to experience a stillbirth than women who are of normal pre-pregnancy weight.

Being underweight pre-pregnancy was also associated with an increased preterm rate; at **9.2** per 100 births it was nearly as high as the rate for women who were obese pre-pregnancy (**9.7** per 100 births).

**Figure 2.2.3 Preterm birth rates and stillbirth rates by maternal pre-pregnancy body mass index classification, British Columbia, 2007/2008**

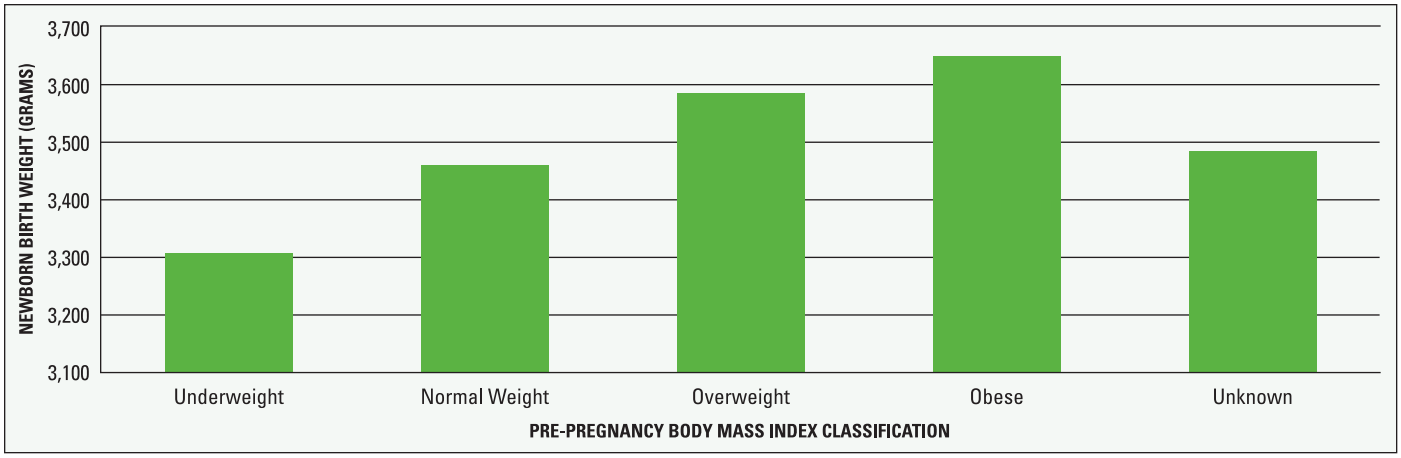



Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only known BMI values were used in this analysis.
Late terminations have been excluded.

Women for whom pre-pregnancy weight was unknown had the highest rate of stillbirths among all weight categories (**7.5** compared to **2.6** and **5.4** per 1,000 births for women of normal and obese pre-pregnancy weight, respectively) (data not tabulated). Given this fact, it is important to continue to improve the quality of data on pre-pregnancy weight that is collected, in order to determine whether or not weight is a factor that contributes to this higher rate of stillbirths.

Infant birth weight is also affected by maternal pre-pregnancy weight. The average birth weight for term singleton infants increases as maternal pre-pregnancy weight increases. Babies born to mothers who were underweight pre-pregnancy weigh an average of **3,307** grams. Babies born to mothers of normal weight pre-pregnancy weigh an average of **3,460** grams, and those born to mothers who were obese pre-pregnancy weigh an average of **3,649** grams (Figure 2.2.4).

**Figure 2.2.4 Mean birth weight for term singletons by maternal pre-pregnancy body mass index classification, British Columbia, 2007/2008**



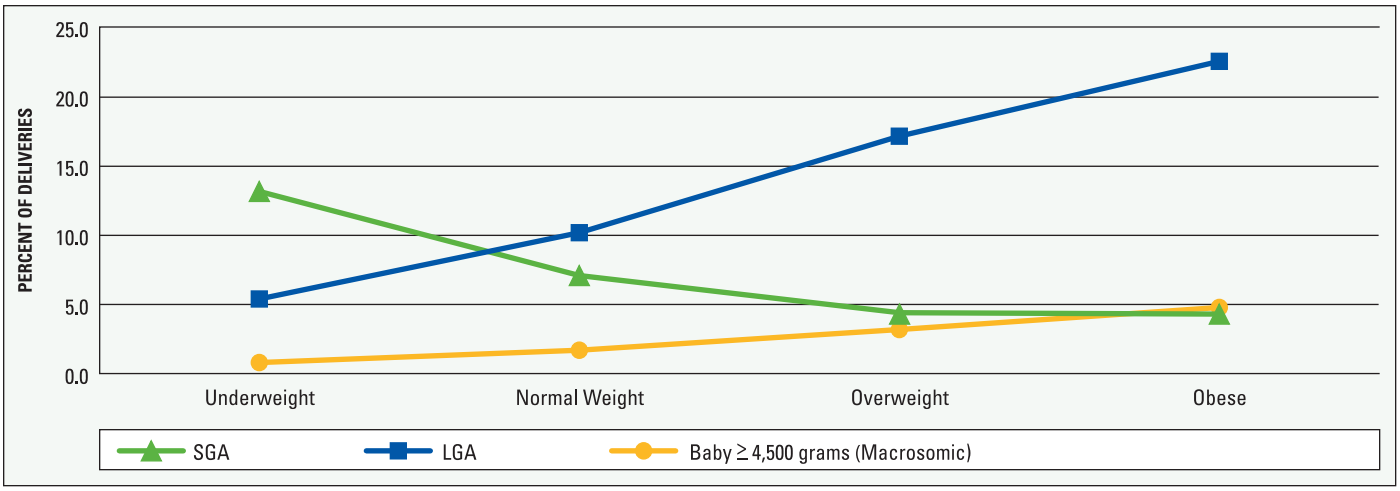

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only term singletons were included in this analysis.

Infants with a birth weight greater than the 90th percentile for gestational age are considered large-for-gestational-age. Infants with a birth weight of 4,500 grams or higher are considered to be macrosomic. Infants with a birth weight of less than the 10th percentile are considered small-for-gestational-age.

Figure 2.2.5 shows the extent to which maternal pre-pregnancy weight is associated with a number of indicators of infant birth weight in term singletons, including small-for-gestational age (SGA), large-for-gestational-age (LGA), and the proportion of babies who weigh 4,500 grams or more at birth.

Not surprisingly, the proportion of SGA infants is highest among mothers who were underweight pre-pregnancy, and declines as weight increases. Conversely, the proportion of LGA infants increases as weight increases, to a high of **22.5** per 100 births among mothers who were obese pre-pregnancy. A similar relationship is found between pre-pregnancy weight and high birth weight babies.

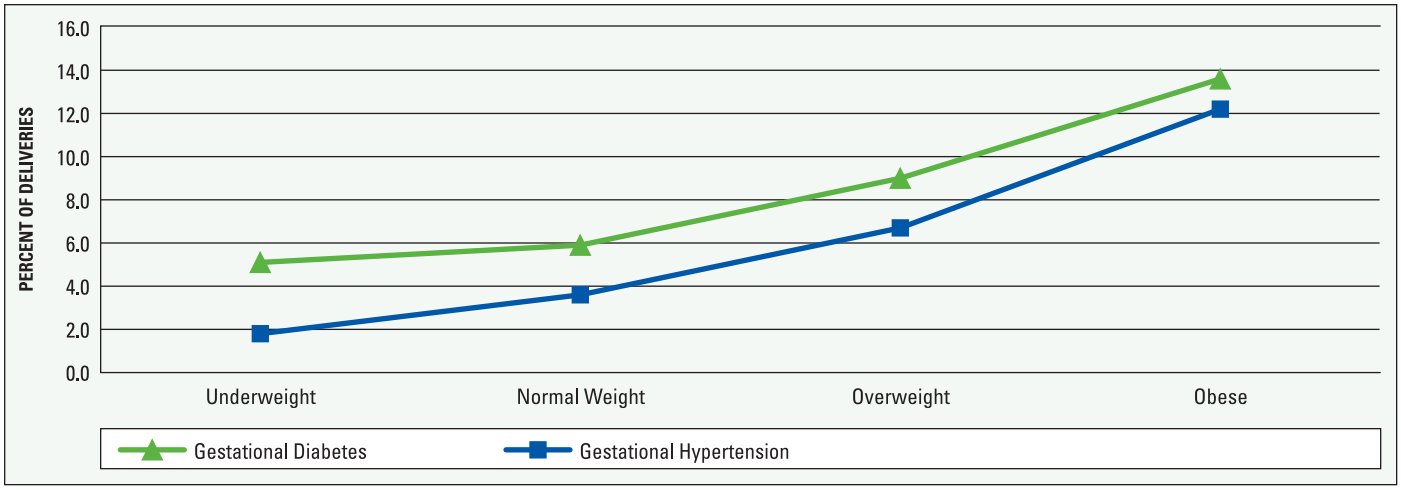
**Figure 2.2.5 Newborn birth weight categories by maternal pre-pregnancy body mass index classification, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only known BMI values were used in this analysis.
Only term singletons were included in this analysis.

Finally, the relationship between pre-pregnancy and specific maternal morbidities (diabetes and hypertension) during pregnancy was explored. Overall, the incidence of gestational diabetes was higher than the incidence of gestational hypertension, regardless of pre-pregnancy weight (Figure 2.2.6). However, incidence of both morbidities increased substantially as pre-pregnancy weight increased; incidence of gestational diabetes increased from **5.1** per 100 births among women who were underweight pre-pregnancy to **13.6** per 100 births among women who were obese, while for gestational hypertension, rates increased from **1.8** to **12.2** (2007/2008).

**Figure 2.2.6 Incidence of gestational diabetes and gestational hypertension by pre-pregnancy body mass index classification, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only known BMI values were used in this analysis.

## 2.3 Weight Gain in Pregnancy

Weight gain in pregnancy is defined as the difference in weight (in kg) between pre-pregnancy weight (or weight up to 12 weeks gestation) and maternal weight at the time of delivery. Accepted recommendations for weight gain in pregnancy arise from a report published by the Committee on Nutritional Status During Pregnancy and Lactation of the Institute of Medicine (IOM).[6] Recommendations for weight gain during pregnancy developed by the IOM and which are endorsed by Health Canada have been presented in Table 2.3.0.

**Table 2.3.0 Recommended total weight gain during pregnancy by pre-pregnancy BMI**

| Pre-pregnancy Body Mass Index Group | Recommended Total Weight Gain – lb (kg) |
|---|---|
| Underweight | 28–40 (12.7–18.1) |
| Normal Weight | 25–35 (11.3–15.9) |
| Overweight | 15–25 (6.8–11.3) |
| Obese | 11–20 (5.0–9.1) |

Source: Health Canada. Nutrition for a Healthy Pregnancy: National Guidelines for the Childbearing Years. Ottawa: Minister of Public Works and Government Services Canada; 1999.

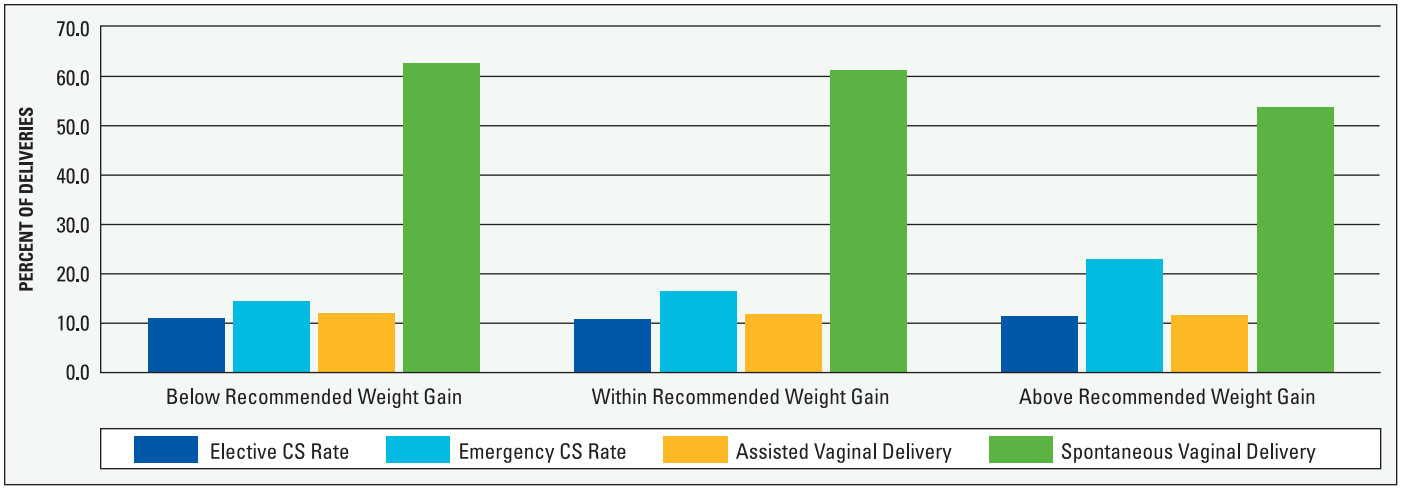
Pre-pregnancy BMI and weight gain during pregnancy are important predictors of fetal birth weight and well-being. A systematic review published in 2007[7] found strong evidence of an association between gestational weight gain and birth weight. This review also found strong evidence that above recommended weight gain is associated with greater risk of a large-for-gestational-age (LGA) infant and of macrosomia. Conversely, below recommended gestational weight gain is associated with a greater risk of a small-for-gestational-age (SGA) infant and of preterm birth. There is some evidence of an increased risk of caesarean delivery with above recommended weight gain as well as greater maternal weight retention later in life. Therefore, it appears that women whose weight gain is within the IOM's recommended range are more likely to deliver an infant with a normal birth weight. This is important, as infants with low and high birth weights have increased morbidity and mortality.

It is important to note, however, that there may be an inverse relationship between recommended weight gain and pre-pregnancy Body Mass Index (BMI). Over 40% of obese women who participated in the Danish National Birth Cohort study experienced lower than recommended weight gains, compared to less than 10% of women whose pre-pregnancy BMI classified them as either at or below normal weight.[8] These women are at increased risk of developing gestational diabetes because of their pre-pregnancy weight. However, a study of women in Newfoundland[9] concluded that low weight gains in women who were above the recommended weight pre-pregnancy were associated with a lower risk of negative outcomes, suggesting some of that risk may be mediated through control of weight gain during pregnancy.

Data from BC can be compared to the national average reported in the Canadian Maternity Experiences Survey[4] in 2006/2007. Among all BC mothers surveyed, the average weight gain reported during pregnancy was 16.1 kg (35.6 lbs). This is slightly higher than the Canadian average of 15.7 kg (34.6 lbs). Using BCPHP data, the average weight gain in pregnancy in 2007/2008 for all mothers was **15.1** kg. An analysis of weight gain by pre-pregnancy body mass index group showed that the average weight gain in pregnancy was **16.0** kg for underweight women, **15.6** kg for normal weight women, **15.0** kg for overweight women and **12.1** kg for obese women pre-pregnancy in 2007/2008 (data not tabulated). As well, it should be noted that approximately 10% of women in BC in 2007/2008 had missing data regarding weight gain in pregnancy.

Exploring British Columbia birth outcomes for term deliveries in 2007/2008 revealed that mothers who gain more than the recommended weight in pregnancy are more likely to experience an emergency caesarean delivery than those mothers whose weight gain is within the recommended limits (**22.9%** compared to **16.5%**; Figure 2.3.0). Mothers who gained less than the recommended weight were least likely to experience an emergency caesarean (**14.4%**).

**Figure 2.3.0 Mode of delivery by recommended total weight gain among term deliveries, British Columbia, 2007/2008**

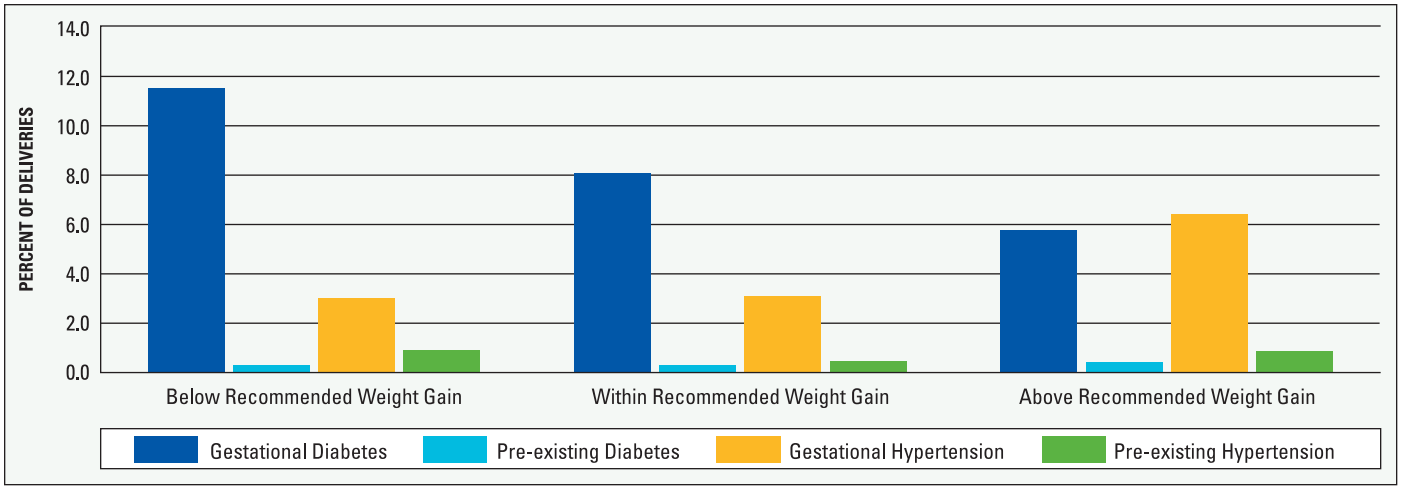



Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Refer to Table 2.3.0 for recommended weight gains.
Only term deliveries were included in this analysis.

In addition to affecting delivery, weight gain may affect maternal health outcomes, such as the development of maternal gestational illnesses like diabetes and hypertension (Figure 2.3.1). Interestingly, women who experience weight gain below recommendations were more likely to be diagnosed with gestational diabetes. Overall, **11.5%** of women with below the recommended weight gain developed gestational diabetes, compared to **8.1%** who were within the recommended weight gain and **5.8%** who were above the recommended weight gain.

The diagnosis of gestational hypertension appeared to rise with increased weight gain during pregnancy. A total of **3.0%** of women with below the recommended weight gain developed hypertension during pregnancy compared to **6.4%** of those who experienced above recommended weight gains. There was no difference found in rates of pre-existing diabetes and hypertension according to pregnancy weight gain.

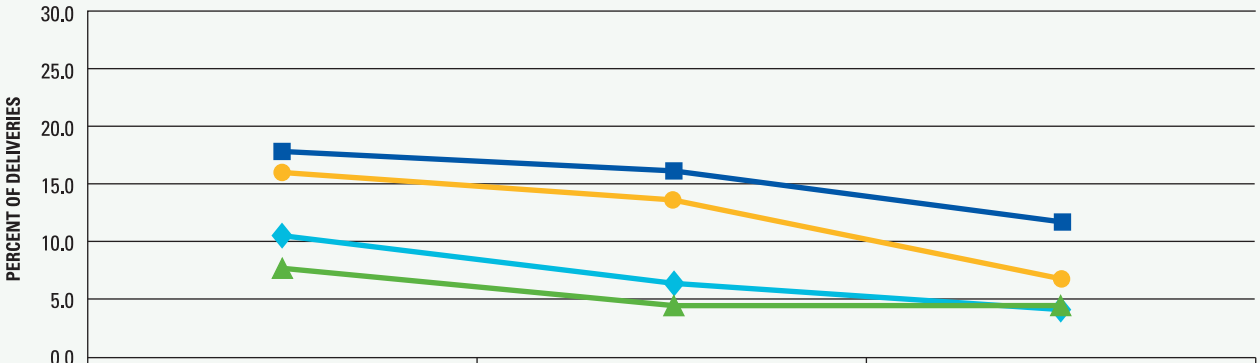
**Figure 2.3.1 Proportion of mothers with diabetes and hypertension by recommended total weight gain, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Refer to Table 2.3.0 for recommended weight gains.

The high proportion of women with below the recommended weight gain during pregnancy and who developed gestational diabetes was of concern, so further investigation was conducted. The proportion of women with gestational diabetes was recalculated by weight gain category, this time controlling for pre-pregnancy BMI (Figure 2.3.2).

**Figure 2.3.2 Proportion of mothers with gestational diabetes by recommended total weight gain and controlling for pre-pregnancy weight, British Columbia, 2007/2008**




| | Below Recommended Weight Gain | Within Recommended Weight Gain | Above Recommended Weight Gain |
|---|---|---|---|
| Normal | 10.4% | 6.7% | 4.1% |
| Obese | 17.8% | 17.0% | 12.0% |
| Overweight | 16.1% | 13.6% | 6.8% |
| Underweight | 8.2% | 4.7% | 4.4% |

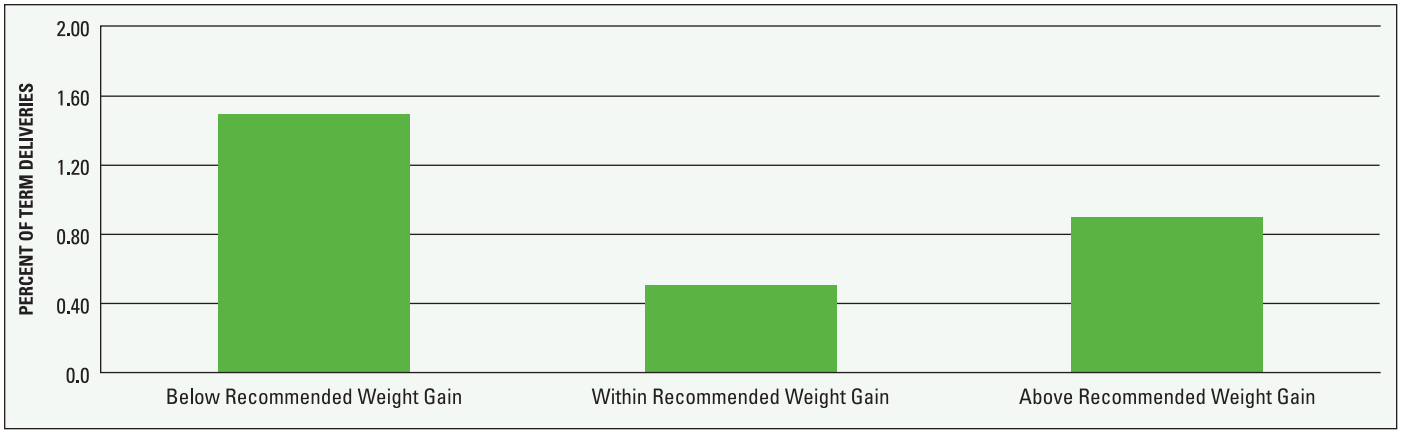
Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Refer to Table 2.3.0 for recommended weight gains.

However, the trend among women of normal weight or underweight pre-pregnancy and who gained below the recommended amount during pregnancy having higher rates of gestational diabetes overall remained unchanged (**10.4%** of normal weight women who gained below the recommended level had gestational diabetes compared to **4.1%** of normal weight women who gained above the recommended level). Women who were overweight or obese pre-pregnancy nevertheless had higher proportions of gestational diabetes regardless of weight gain during pregnancy.

In short, it is possible that part of this trend may have been due to the fact that women who are overweight or obese pre-pregnancy, even if they gain below the recommended amount during pregnancy, are still at increased risk for gestational diabetes.

Fetal health outcomes were also analyzed. An association between weight gain and stillbirth rates, for example, can be seen (Figure 2.3.3). Although the percentage of pregnancies resulting in a stillbirth is quite low regardless of weight gain, the proportion of stillbirths among women who gain below the recommended limit is **2.8** times higher than that of mothers whose weight gain is within the recommended limit.

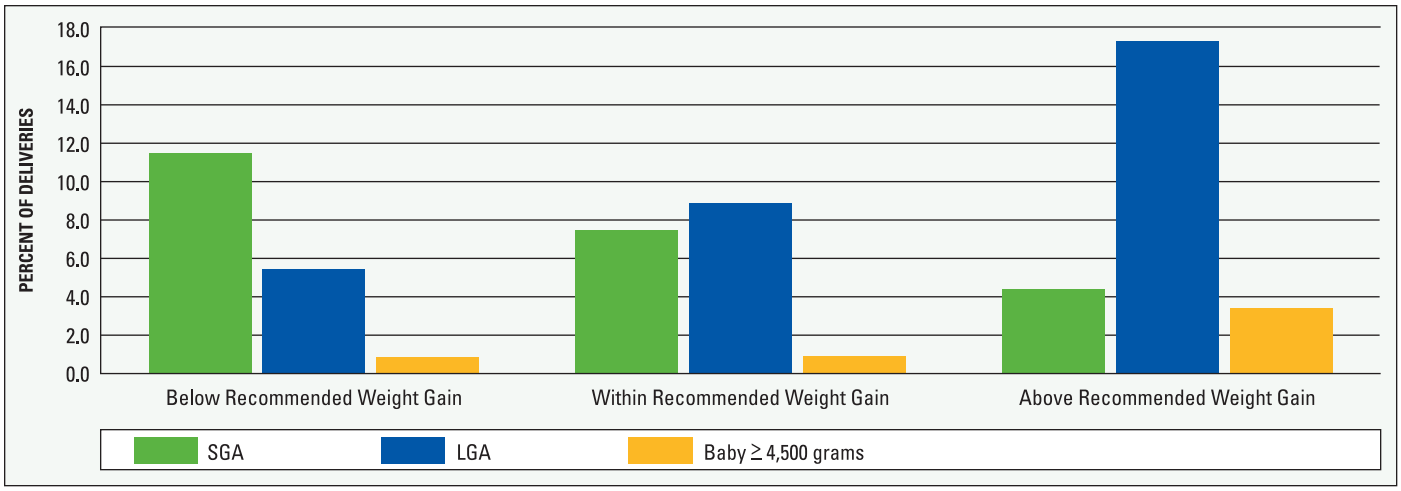
**Figure 2.3.3 Proportion of stillbirths by recommended total weight gain, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Refer to Table 2.3.0 for recommended weight gains.
Late terminations have been excluded.

Other fetal and infant health outcomes were also analyzed in the term singleton population. Figure 2.3.4 shows that the proportion of large-for-gestational-age infants is increased among mothers who experience above recommended weight gain (**17.3%**, compared to **8.9%** for women who are within the recommended weight gain), as is the proportion of babies who weigh 4,500 grams or more at birth (**3.4%**, compared to **0.9%**). Conversely, the proportion of small-for-gestational-age infants is higher among mothers who gained less than recommended (**11.5%**, compared to **7.5%**).

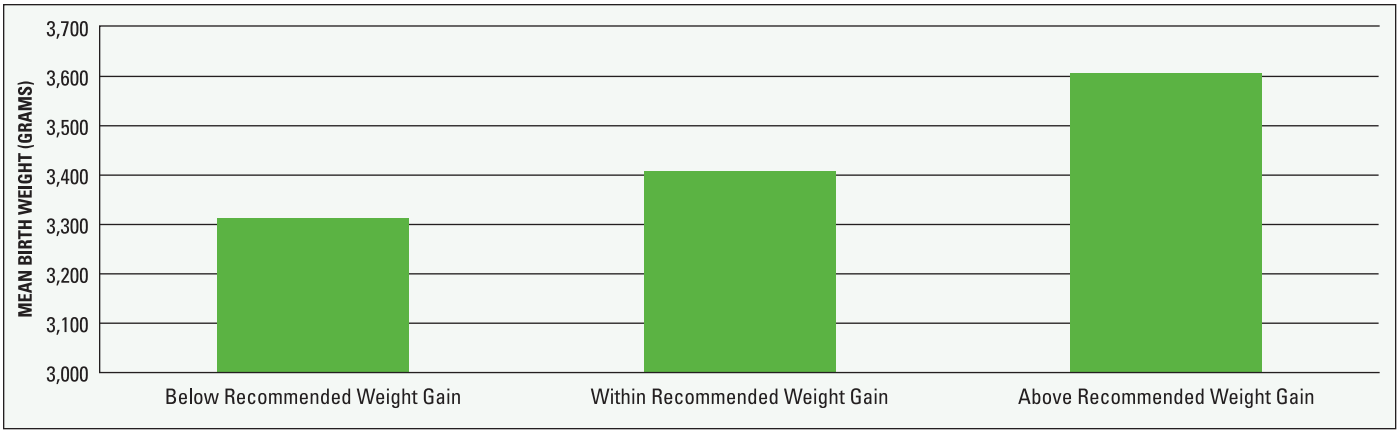
**Figure 2.3.4 Newborn birth weight categories for term singletons by recommended total weight gain for mothers, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Refer to Table 2.3.0 for recommended weight gains.
Only term singletons were included in this analysis.

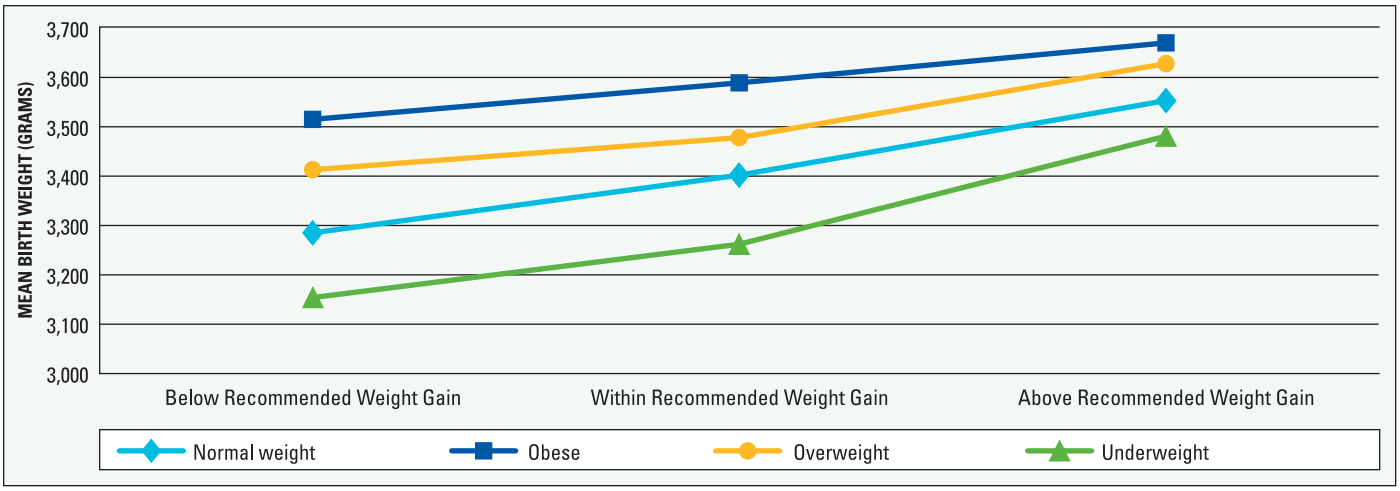
Figure 2.3.5 depicts a steady relationship between the increase in maternal weight gain and increased birth weight. However, when the mother's pre-pregnancy BMI is taken into consideration, as in Figure 2.3.6, a more complex relationship emerges. Babies born to women who were underweight pre-pregnancy experienced the largest gains in weight when their mothers gained more than the recommended amount during pregnancy. There was a mean difference of **326.7** grams between those who gained less than the recommended amount and those who gained more than the recommended amount. The weight gain was not as dramatic among babies born to women who were classified obese prior to pregnancy. Among obese women the mean difference in birth weight was only **154.5** grams between those who gained less than the recommended amount and those who gained more.

**Figure 2.3.5 Mean birth weight for term singletons by recommended total weight gain for mothers, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Refer to Table 2.3.0 for recommended weight gains.
Only term singletons were included in this analysis.

**Figure 2.3.6 Mean birth weight for term singletons by maternal pre-pregnancy BMI and recommended total weight gain, British Columbia, 2007/2008**



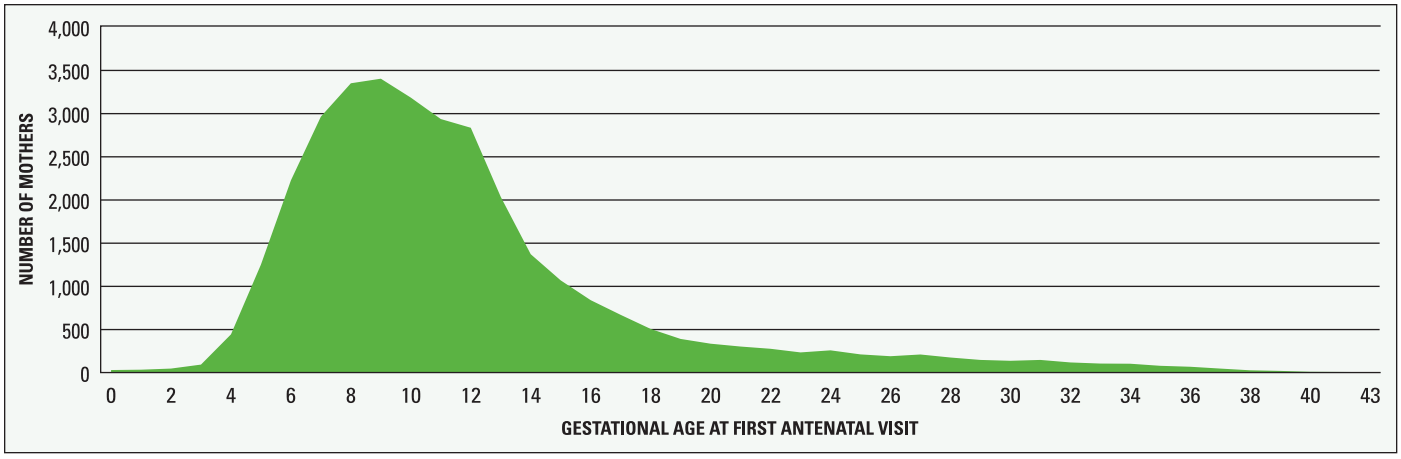

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Refer to Table 2.3.0 for recommended weight gains.
Only term singletons were included in this analysis.

## 2.4 Access to Prenatal Care

Prenatal care is most effective if initiated early, because this allows for the early management of risk factors (for example, smoking during pregnancy) as well as early detection of health issues such as gestational diabetes.[5] The Public Health Agency of Canada recommends that women initiate prenatal care as early as possible, preferably within the first trimester (defined as 14 weeks of gestation or earlier). However, some women may not know that they are pregnant until as late as 20 weeks' gestation. Thus, in this report, the proportion of women who initiated care prior to 20 weeks' gestation is examined as an indicator of early access to care.

As seen in Figure 2.4.0 the majority of women (**68%**) initiated care prior to 20 weeks' gestation. A total of **7%** of women in BC initiated care after 20 weeks' gestation, with only **2%** initiating care after 30 weeks.

**Figure 2.4.0 Gestational age at first antenatal visit, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

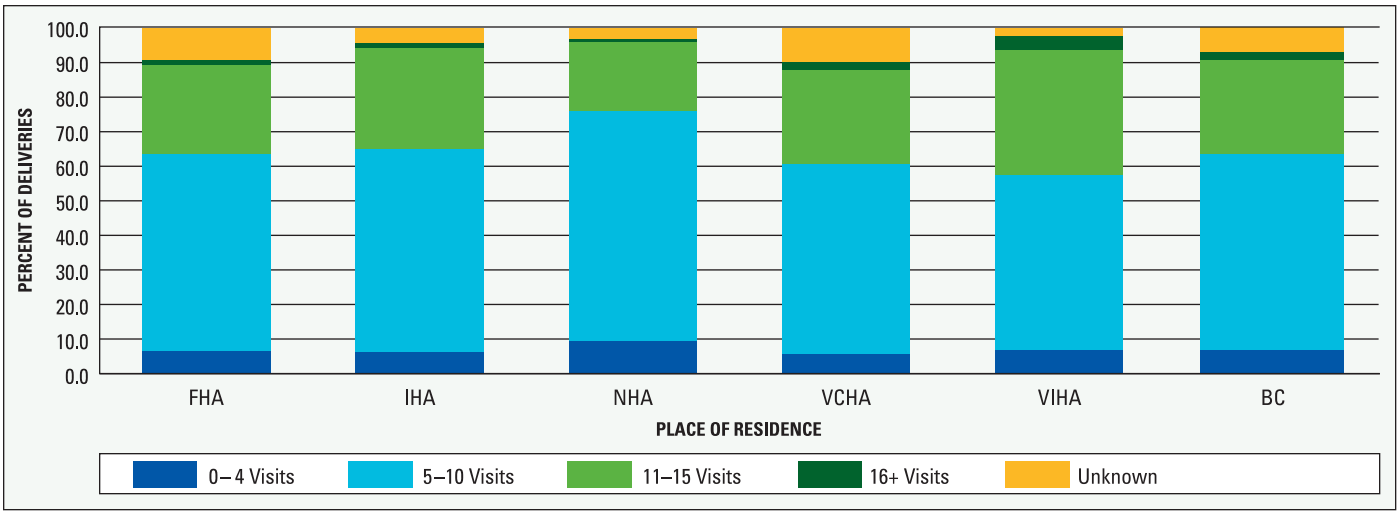
It should be noted that the gestational age of the fetus at the first prenatal care visit could not be calculated for **25%** of women due to missing information. There may be a number of reasons why information on the initiation of prenatal care is missing. One possibility is that antenatal information may not always be transferred from one care provider to another when a mother's care is transferred (for instance, in cases where the initial care provider does not offer intrapartum care). Without the consistent transfer of antenatal information from early pregnancy, it is difficult to ascertain accurately when the first prenatal visit occurred.

In addition to examining when prenatal care is initiated, it is also important to examine the number of prenatal visits. This provides an indication of the adequacy of care throughout the pregnancy. There is some debate with regard to the appropriate number of prenatal visits for both normal and high risk pregnancies. The Society of Obstetrician and Gynaecologists of Canada recommends visits every four to six weeks in early pregnancy, every two to three weeks after 30 weeks' gestation, and every one to two weeks after 36 weeks' gestation. The Public Health Agency of Canada has determined that inadequate prenatal care is indicated by four or fewer visits to a healthcare provider during the pregnancy.[4]

Nationally, for Canadian women the average number of prenatal care visits is 12.9, according to the Maternity Experiences Survey.[4] In comparison, **57%** of women in BC had only 5 to 10 prenatal care visits, with an additional **27%** having between 11 and 15 visits, and **7.7%** had four or fewer visits.

The number of prenatal care visits for women in BC varied by region (Figure 2.4.1). In particular, women in the Northern Health Authority had fewer visits overall than women in other regions (**76%** had 10 or fewer visits and **9%** had only 0-4 visits), while women in the Vancouver Island Health Authority had more visits than women in other regions (**40.4%** had 11 or more visits and **4%** had more than 16 visits).

**Figure 2.4.1 Proportion of antenatal visits by resident Health Authority and British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.

As noted previously, if a patient is transferred to another care provider in pregnancy, including a transfer to another place of residence, the initial antenatal record might not be submitted to the hospital. Thus visits to a previous care provider may not be counted. As well, care provider practices influence these numbers, such that the number of prenatal visits a mother receives may not only reflect her initiation of care, but also her care provider's standards for adequate care.

## 2.5 Substance Use in Pregnancy

Substance use in pregnancy, whether smoking, alcohol or drugs, has been related to a number of significant negative health outcomes for both mother and baby, including intrauterine growth restriction (IUGR) or lower birth weight, increased risk of preterm birth, placental complications, stillbirth and sudden infant death syndrome, in addition to ongoing issues which affect the child in the years that follow. More information is also emerging about the specific dangers of exposure to second-hand smoke among pregnant women. These dangers are similar to those experienced by women who smoke, and may, in fact, be compounded as women who smoke are more likely to be also exposed to second-hand smoke.[5]

Although the BCPHP currently does not report information on second-hand smoke in pregnancy, the Maternity Experiences Survey reported that in 2006/2007, 19.7% of women in British Columbia who participated in the survey reported living with a smoker during their pregnancy. This was the lowest proportion in Canada, followed closely by Quebec at 20.0%, and was lower than the national average at 23.4%.[4] Beginning with discharges in 2008/2009, the BCPHP will have the capability to report on second-hand smoke exposure as part of its regular reporting.

One of the greatest challenges in exploring issues in substance use generally is that they are most often not isolated. Substance use has been correlated with lower income, lower levels of education, poor or no prenatal care, poor nutrition, and, in the case of drug use in particular, exposure to multiple substances, including smoking, alcohol, and other drugs.[4]

Substance use in pregnancy includes smoking and the identification of alcohol and drug use as risk factors. These risk factors are documented on the Antenatal Form of the maternal record. Smoking of cannabis has been included with drug use, as smoking is restricted to tobacco products only. As well, it is important to acknowledge that figures presented may be under-reported due to a desire to appear socially acceptable, an unawareness of the health implications of certain behaviours, or to a fear of repercussion related to the illegal nature of particular drugs. Additionally, although research has shown that frequency and duration of substance use/abuse are important considerations in assessing the effects of substance use on fetal and infant health,[4] the method by which these figures were reported does not differentiate frequency or duration.

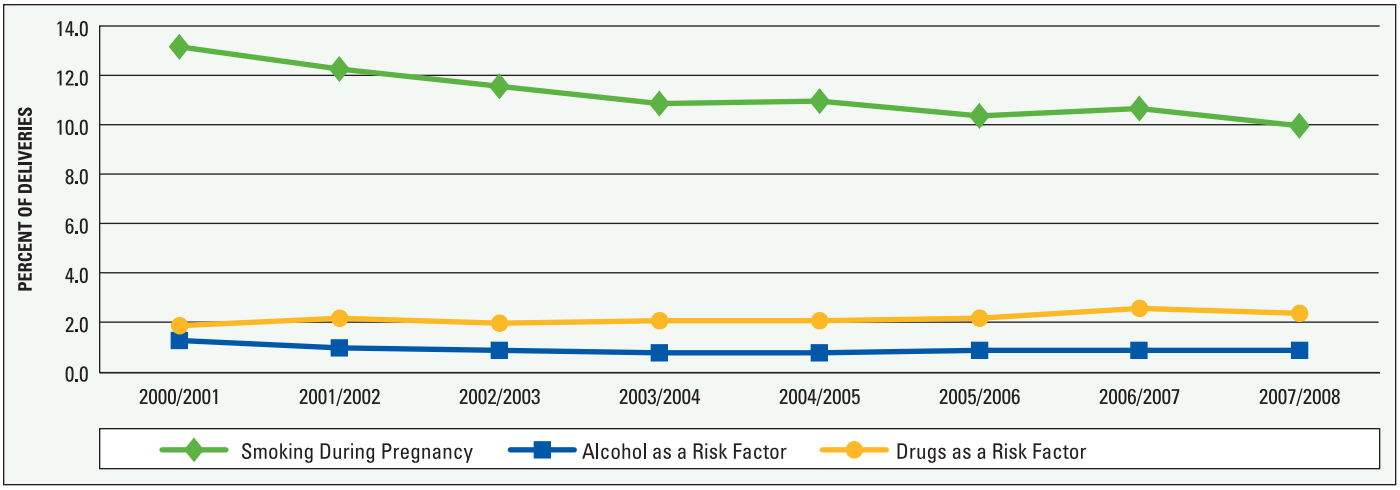
In Figure 2.5.0, the proportion of deliveries where it was identified that the mother had smoked cigarettes during pregnancy shows a steady decrease from **13.2%** in 2000/2001 to **10.0%** in 2007/2008. This proportion was comparable to rates found in the 2006/2007 Canadian Maternal Experiences Survey where 10.5% of Canadian women reported smoking either daily or occasionally while pregnant.[4]

The proportions of deliveries in which alcohol use and drug use were identified as risk factors were considerably lower, but unlike smoking these rates have remained relatively stable over time. In 2000/2001, the number of women for whom alcohol was identified as a risk factor was **1.3%**, falling to **0.9%** in 2007/2008. The number of deliveries in which alcohol was indicated as a risk factor was far lower than the percentage of women who reported consuming alcohol while pregnant on the Canadian Maternal Experiences Survey.[4] This survey found that 10.5% of women reported consuming alcohol during the course of their pregnancies and 62.4% indicated they had consumed alcohol in the three months prior to becoming pregnant.[4]

The proportion of deliveries in which the use of drugs was identified as a risk factor increased from **1.9%** in 2000/2001 to **2.4%** in 2007/2008. As mentioned above, drug use in pregnancy may be particularly challenging to identify as a result of under-reporting due to the illegal nature of the

activity. The Canadian Maternal Experiences Survey identified that 1.0% of women reported drug use following confirmed pregnancy.[4] It is interesting to note that drug use was identified as a risk factor more frequently than alcohol use. One possible explanation is that alcohol use, being more socially acceptable, is not flagged as problematic by care providers or women as frequently. That is, because the use of alcohol is accepted for women before they are pregnant, care providers may opt to informally discuss the importance of abstaining from alcohol during pregnancy without documenting the alcohol use on the maternal record.

**Figure 2.5.0 Substance use in pregnancy, British Columbia, 2000/2001 to 2007/2008**

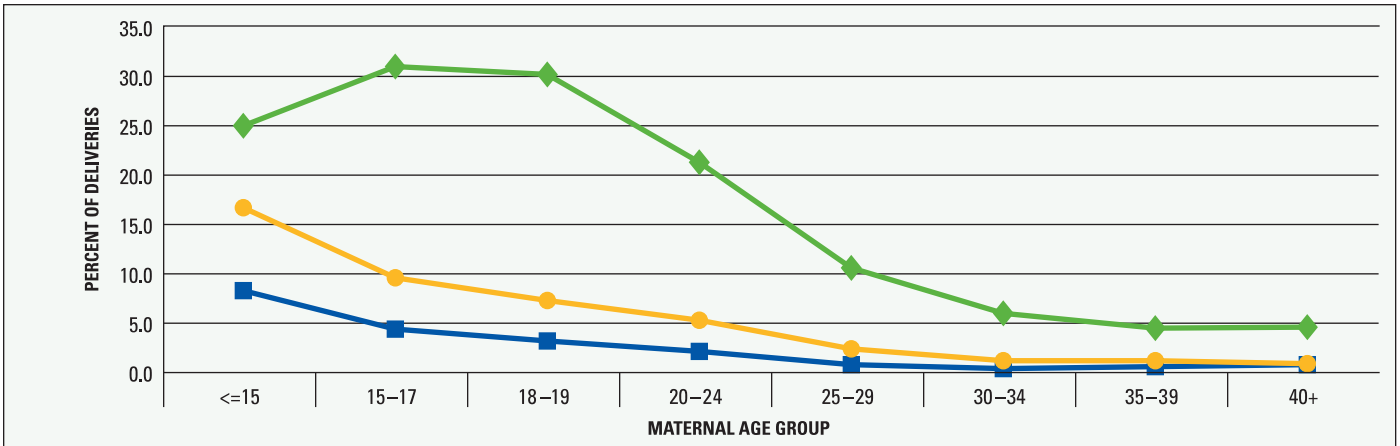



Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

There is a decrease in substance use when examined by maternal age (Figure 2.5.1). In 2007/2008, drug and alcohol use as risk factors were highest among young mothers under 15 years of age (risk of drug use was identified in **16.7%** of women, while alcohol use was identified in **8.3%**). Drug use was identified more often than alcohol use in all age categories, however, the gap declined with age. Among mothers age 40 and over, the use of drugs and alcohol as risk factors was relatively even at **0.9%** and **0.8%**, respectively.

Smoking peaked among mothers aged 15 to 17, in which nearly one third (**31.0%**) were identified as smokers. Similarly, **30.2%** of those aged 18 and 19 were smoking during pregnancy. Smoking during pregnancy decreases considerably with age to a low of **4.5%** among mothers 35 to 39 years of age. This information was lower than figures reported in the Canadian Maternal Experiences Survey which reported 54.7% of mothers aged 15 to 19 and 6.7% of women aged 35 to 29 smoking either daily or occasionally during the last three months of pregnancy.[4]

**Figure 2.5.1 Smoking, alcohol and drug use during pregnancy as risk factors by maternal age group, British Columbia, 2007/2008**

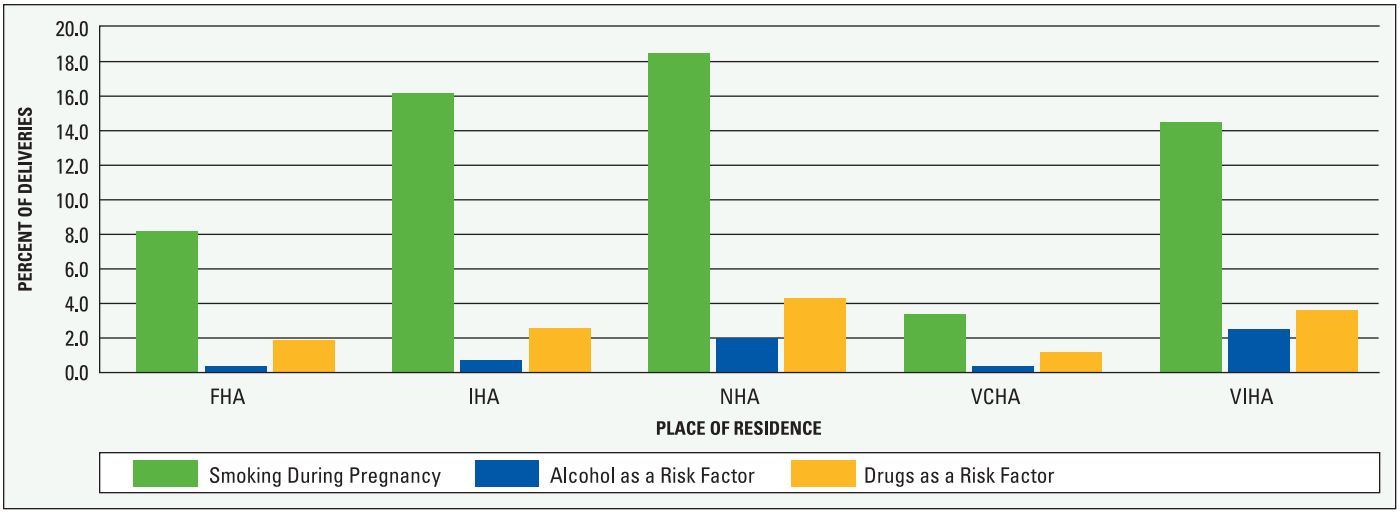



| | <=15 | 15–17 | 18–19 | 20–24 | 25–29 | 30–34 | 35–39 | 40+ |
|---|---|---|---|---|---|---|---|---|
| Smoking | 25.0 | 31.0 | 30.2 | 21.3 | 10.6 | 6.0 | 4.5 | 4.6 |
| Alcohol | 8.3 | 4.4 | 3.2 | 2.1 | 0.8 | 0.4 | 0.6 | 0.8 |
| Drugs | 16.7 | 9.6 | 7.3 | 5.3 | 2.4 | 1.2 | 1.2 | 0.9 |

Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

There was considerable variation in substance use by resident Health Authority in 2007/2008 (Figure 2.5.2). The proportion identified as smokers and for whom drugs were identified as a risk factor was highest among residents of the Northern Health Authority with **18.5%** and **4.3%** respectively (the Northern Health Authority also had the highest proportion of young mothers, with **65.5%** of deliveries to women under the age of 30 in 2007/2008). Alcohol use was identified as a risk factor most frequently in the Vancouver Island Health Authority at **2.5%**. The lowest reported rates of substance use were found in the Vancouver Coastal Health Authority. In this region, smoking, drug use and alcohol use were identified as risk factors in **3.4%**, **1.2%** and **0.4%** of mothers, respectively.

**Figure 2.5.2 Substance use in pregnancy by resident Health Authority, 2007/2008**



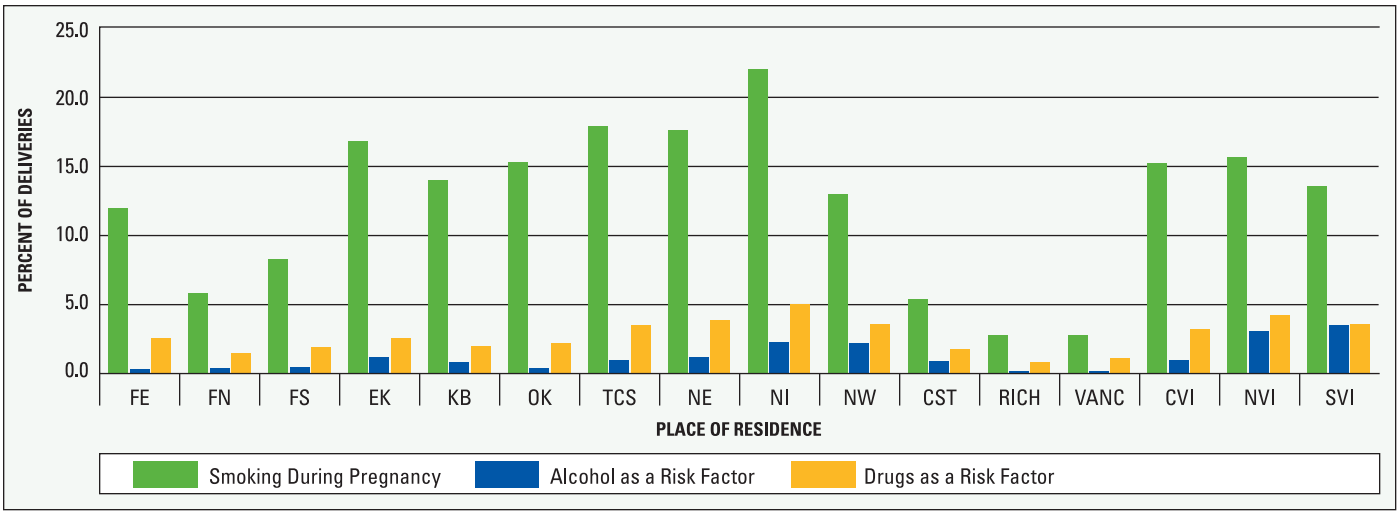

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.

A closer look at differences in substance use by resident Health Service Delivery Area (HSDA) revealed that there were also differences within Health Authorities (Figure 2.5.3). The proportion of women who were identified as smokers during the current pregnancy was highest in the Northern Interior in 2007/2008 (**22.0%**). However, rates were also high in Thompson-Cariboo-Shuswap (**17.9%**), East Kootenay (**16.8%**), Northeast (**17.6%**), as well as Central (**15.2%**) and North Vancouver Island (**15.7%**).

Alcohol use as a risk factor in pregnancy was identified most frequently in the South Vancouver Island HSDA at **3.5%**, whereas the lowest rates were found in Richmond and Vancouver where alcohol was identified as a risk factor for only **0.2%** of mothers.

Drug use was most often identified as a risk factor in the Northern Interior where **5.0%** of mothers were identified. Second to this was the North Vancouver Island HSDA at **4.2%**. The lowest was Richmond at **0.8%**.

**Figure 2.5.3 Substance use in pregnancy by resident Health Service Delivery Area (HSDA), 2007/2008**

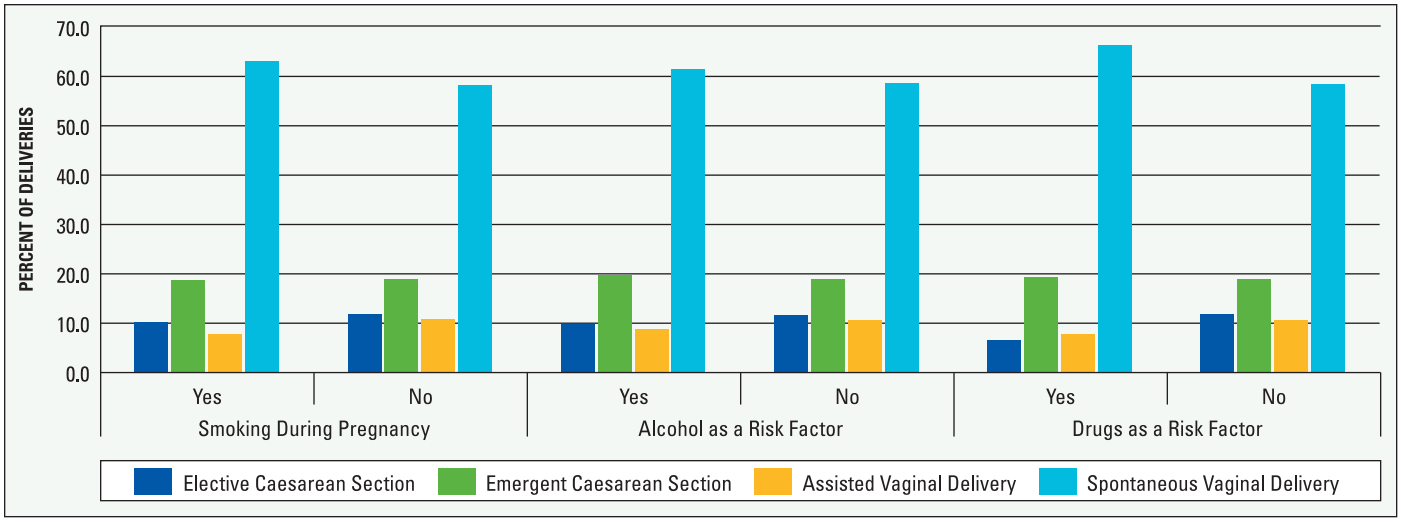



Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Service Delivery Areas.

Comparing method of delivery by substance use categories revealed that mothers identified in one of the three substance use categories were less likely to deliver via elective c-section or with an assisted vaginal delivery (Figure 2.5.4). Rates of emergent c-sections were slightly higher for mothers where either drugs or alcohol were identified as risk factors. When parity was taken into account, however, rates of emergent caesarean sections were slightly higher for mothers of parity ≥1, where smoking or drugs were identified as risk factors (data not tabulated).

In the context of spontaneous vaginal deliveries, women experiencing risks related to substance use may be less likely to have a planned intervention. When parity is taken into account, women who have given birth previously are more likely than nulliparous women to experience a spontaneous vaginal delivery once in labour (data not tabulated). These findings may point to differences in underlying maternal age as well as prenatal care. Adequate prenatal care may identify situations requiring intervention, whereas those who have not accessed prenatal care throughout pregnancy may be more likely to be faced with an emergent situation upon labour and delivery.

**Figure 2.5.4 Delivery type by substance use categories, British Columbia, 2007/2008**

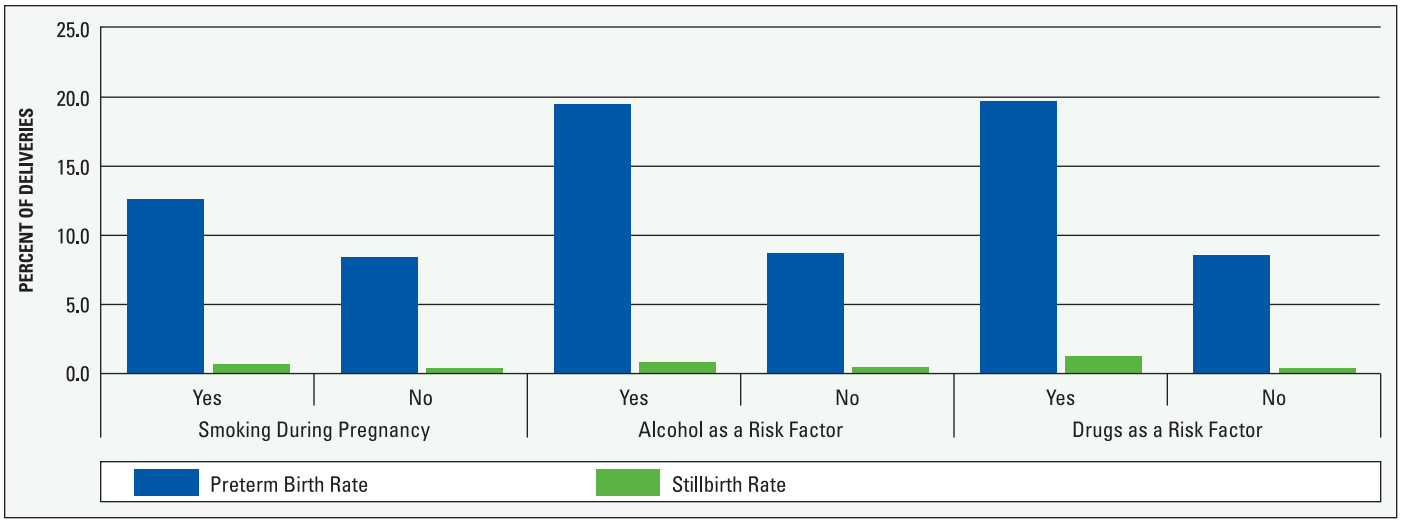



Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

Considerable differences were observed in the preterm birth rate and stillbirth rate of mothers identified in one of the substance use categories compared to non-identified mothers (Figure 2.5.5). Mothers who were identified as smokers had a preterm birth rate of **12.6%**. Among mothers not identified as smokers the preterm birth rate was **8.4%**. Stillbirths occurred at a rate of **0.7%** among smokers and **0.4%** among non-smokers.

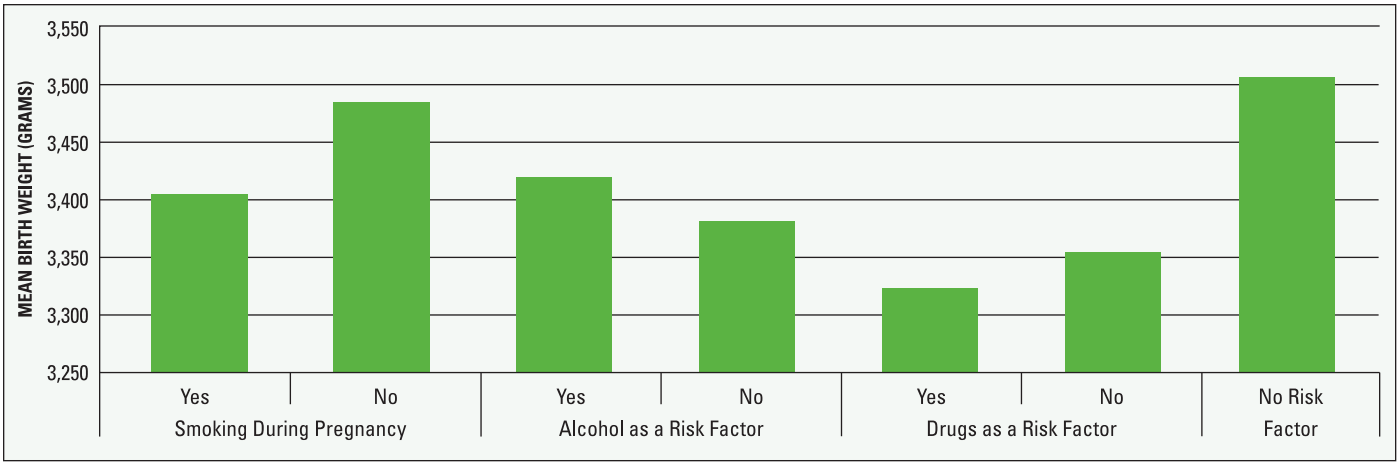
The preterm birth rate among mothers for whom alcohol was identified as a risk factor was higher at **19.5%**; the stillbirth rate among this group was **0.8%**. Where drug use was identified, the preterm birth rate was **19.7%** and the stillbirth rate was **1.3%**.

**Figure 2.5.5 Birth type by substance use categories, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Late terminations have been excluded.

**Figure 2.5.6 Mean birth weight for term singletons by substance use categories, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only term singletons were included in this analysis.

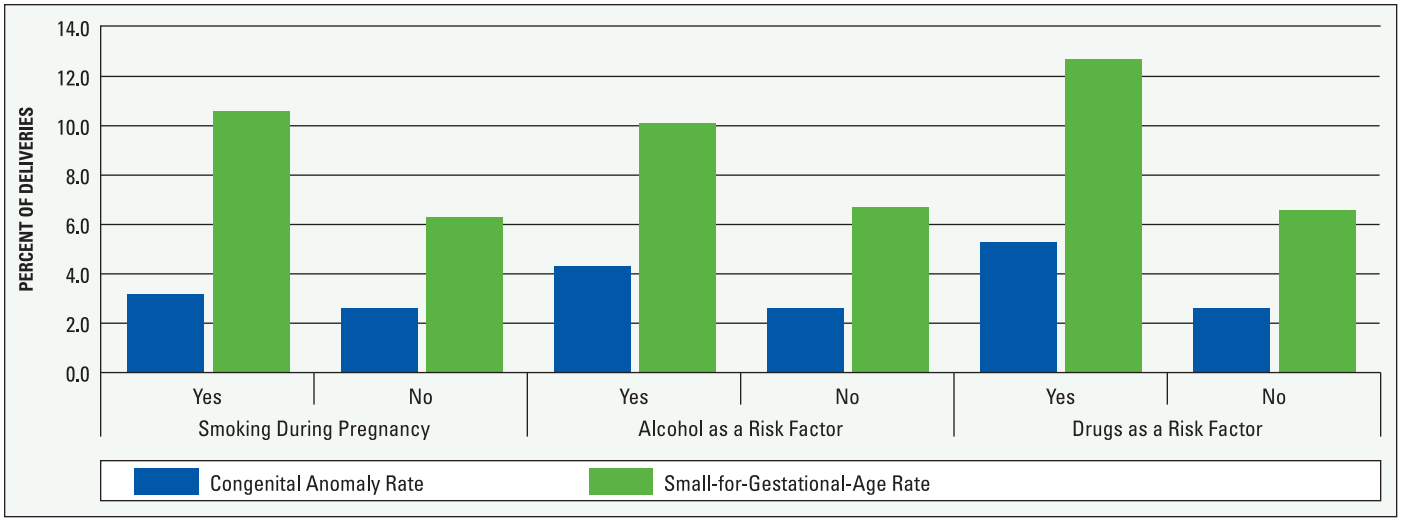
The mean term birth weight for singleton births among women identified as smokers was **3,405** grams, as seen in Figure 2.5.6. Among mothers for whom alcohol use was identified as a risk factor, the mean birth weight was **3,420** grams and among mothers for whom drug use was identified, the mean birth weight was **3,323** grams.

Figure 2.5.7 shows that mothers identified in each of the substance use categories were more likely than those who were not identified to have babies with congenital anomalies and to have babies small-for-gestational-age (SGA).

Among mothers who were identified as smokers, the congenital anomaly rate was **3.2%** compared to a rate of **2.6%** for non-smokers. Similarly, **10.6%** of mothers identified as smokers had babies that were small-for-gestational-age compared to **6.3%** of non-smokers.

Mothers for whom alcohol and drugs were identified as risk factors were more likely to give birth to babies with congenital anomalies (**4.3%** alcohol as a risk factor, and **5.3%** drug use as a risk factor). Additionally, similar patterns were seen in terms of those who gave birth to babies who were small-for-gestational-age (**10.1%** alcohol as a risk factor, and **12.7%** for drug use as a risk factor).

**Figure 2.5.7 Rates of congenital anomalies and small-for-gestational-age by substance use categories, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

Multiple studies have pointed to relationships between substance use and significant conditions, including preterm birth, stillbirth, congenital anomalies and babies who are small-for-gestational-age.[10] However, when analyzing substance use in pregnancy, it is important to consider other social and environmental factors that may have an effect, such as low levels of maternal education, multiple substance use or exposure from other sources, low access to prenatal care and poor nutrition.[4]

## 2.6 Intimate Partner Violence During Pregnancy

Recent research has highlighted the role of social determinants of perinatal health that have not previously been reported. Of particular concern is the incidence of intimate partner violence. One research study reports that the incidence of physical violence during pregnancy is associated with a two-fold increase in risk of perinatal death as well as higher incidence of low birth weight infants and preterm births.[11] As well, physical abuse during pregnancy is often targeted at the mother's abdomen,[12] and injuries in this area have been associated with spontaneous abortion, fetal death, placental abruption, preterm labour and delivery, and fetal injuries such as fractures and intracranial hemorrhage.[13]

As well, physical violence has also been linked to unintended pregnancies, inadequate prenatal care, increased used of tobacco, alcohol and illicit drugs, high levels of stress, and low levels of social support. Clearly, the experience of violence has an impact on maternal and fetal/infant health that cuts across medical and social boundaries.

In the Maternity Experiences Survey, which relied on self-reported data, a slightly higher proportion of BC women reported experiencing physical abuse from a partner within two years of being surveyed compared to the national average (11.3% compared to 10.9%).[4] Among these, 40% reported that abuse occurred during pregnancy, compared to 31% of Canadians overall.[4]

Increased frequency of violence is associated with increased risk of poor health outcomes. Routine assessment accompanied by safety planning has been shown to reduce assaults and threats of violence during pregnancy, thus reducing the health risks to both mother and child. However, many women are afraid to disclose violence. As well, care providers may not be aware of the importance of screening pregnant women for abuse. They may also be uncomfortable or worried that asking questions will be perceived as an invasion of privacy. Thus it is difficult to consistently collect information on intimate partner violence.

In the BC Antenatal Form (Part 1) Rev. 2007/06/05, "IPV" refers to intimate partner violence. Although this data is currently not part of regular reporting, the BCPHP considers intimate partner violence a priority for future publications.

## SECTION THREE

# Labour and Birth Processes


*Optimizing Neonatal, Maternal and Fetal Health*

The emphasis in this chapter is on health services provided during labour and delivery. These include labour induction, fetal surveillance, pain management, assisted vaginal deliveries, episiotomies and treated lacerations, caesarean sections, caesarean birth morbidity and vaginal births after caesarean.

Additionally, this chapter reports on the primary care provider during delivery. In Canada, as in many other countries, there is a shortage of maternity care providers, as well as geographical inequalities in accessing maternity care providers. While midwifery service is expanding, the number of registered midwives is not sufficient to fill the gap left by fewer obstetricians and family physicians engaged in maternal care. BC is one of eight provinces or territories where midwifery is legislated and where care provided by a midwife is publicly funded.[14]

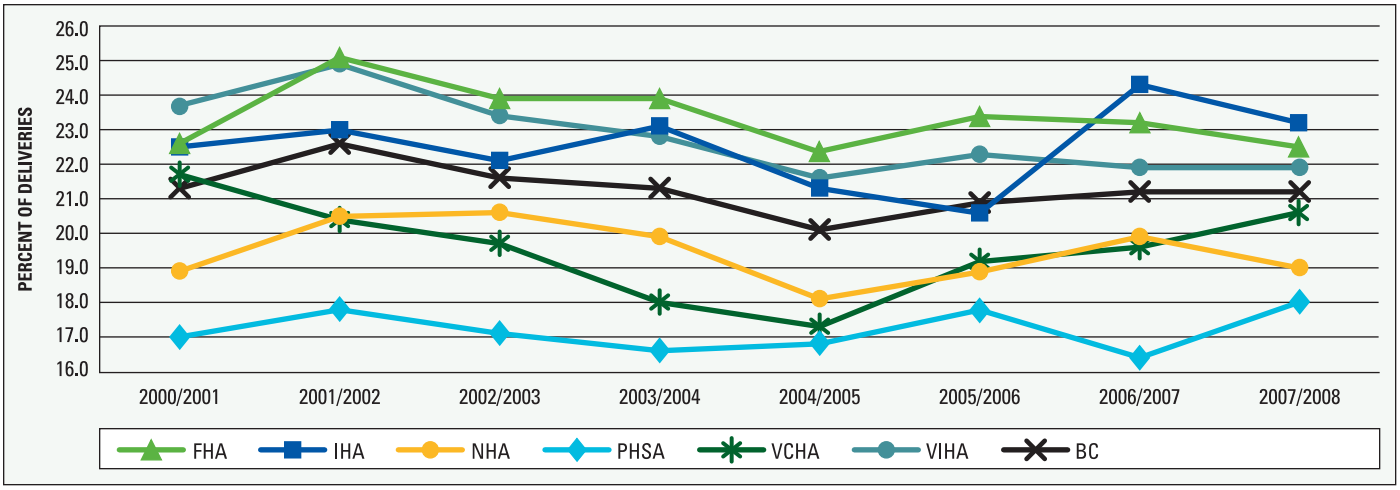
This chapter includes an examination of the Robson Classification for Caesarean sections[15] (see Section 3.8). Developed in 2001 by Michael Robson, an obstetrician from the United Kingdom, the 10-group classification system is intended to help specify caesarean rates among different subgroups of pregnant women. This, in turn, allows for a more detailed understanding of how labour and delivery circumstances are affecting caesarean rates. More information on the context of caesarean rates is provided in the section on classification, as well as in Section 3.6, which describes caesarean rates in BC.

## 3.1 Labour Induction

Labour induction rates refer to the use of medical or surgical means of initiating labour and are separate from labour augmentation rates, as augmentation may occur after the spontaneous onset of labour. Labour induction is practiced in situations such as post date pregnancy, premature rupture of membranes, or other maternal and fetal indications where the risk of continuing the pregnancy outweighs the risk of inducing labour to facilitate birth.

Overall, the rate of induction remained consistent during the period from 2000/2001 to 2007/2008 with **21.2%** of all pregnant women in British Columbia having labour induced in 2007/2008 (Figure 3.1.0). The provincial average over the eight year period was **21.3%**. This was slightly higher in the FHA with an average of **23.3%** over the same time period; ranging from a high of **25.1%** in 2001/2002 to a low of **22.1%** in 2004/2005. The lowest rates were seen in the PHSA with an average of **17.2%**. The second lowest rates were attributable to the NHA with an average of **19.5%** and the VCHA with an average of **19.6%**. The VCHA, however, displayed more annual variation ranging from a high of **21.7%** in 2000/2001 to a low of **17.3%** in 2004/2005. While rates of labour induction have remained fairly stable over the last eight fiscal years, rates of elective caesarean section have slowly increased (Figure 3.6.2).

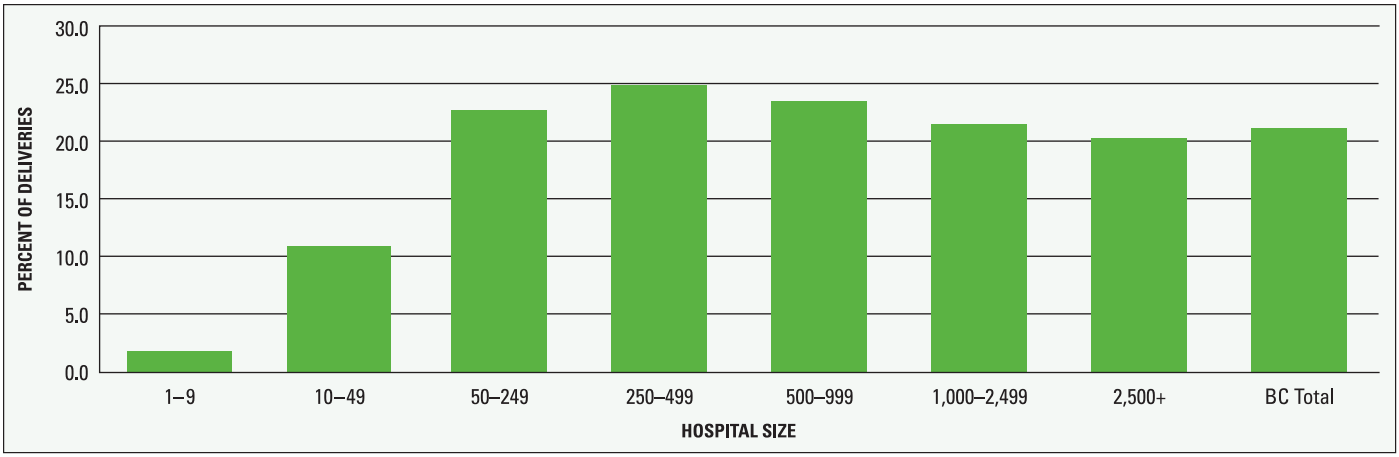
**Figure 3.1.0 Rate of labour induction by delivery Health Authority and British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.
PHSA refers to BC Women's Hospital patients only.

Exploring rate of induction by hospital size for 2007/2008 showed that the highest induction rates occurred at hospitals with between 250 and 499 births per year (Figure 3.1.1). Among these facilities, one quarter (**25.0**%) of labours involved an induction. Overall, **76.0**% of all births took place at hospitals with 1,000 or more births per year. Among these hospitals the rate of induction was slightly lower at **21.0**%, compared to a rate of **23.5**% among hospitals with less than 1,000 births per year.

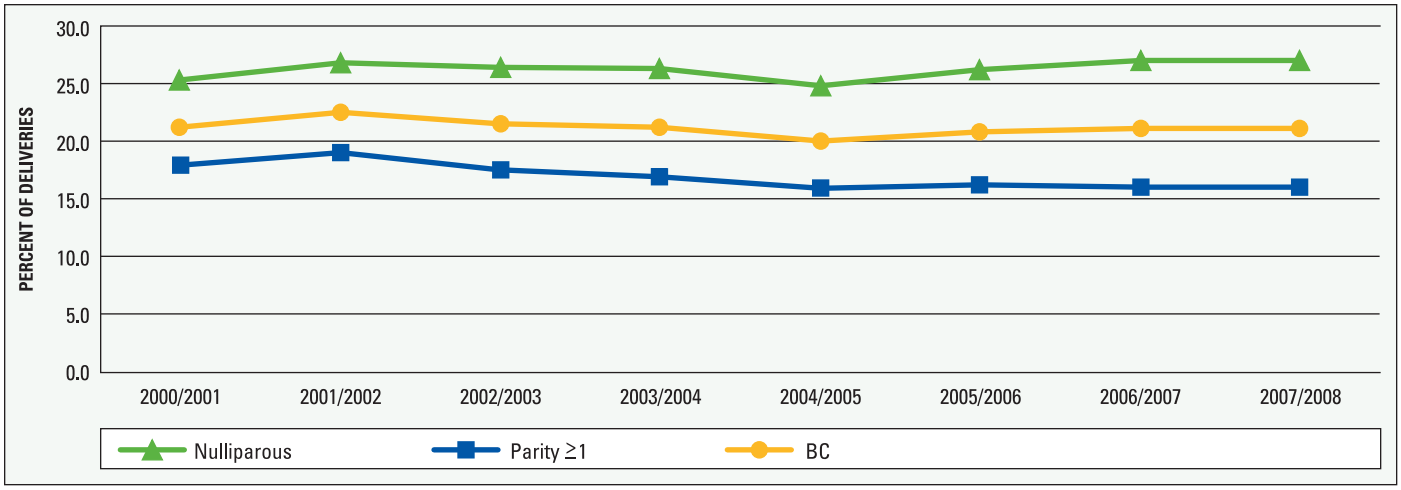
**Figure 3.1.1 Rate of labour induction by hospital size, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

Labour induction rates for women having their first babies were consistently higher than women of parity ≥1 in each of the eight years studied (Figure 3.1.2). Furthermore, while the rate among nulliparous women increased from **25.4%** in 2000/2001 to **27.1%** in 2007/2008, the rate for women of parity ≥1 has shown an overall decrease from **18.0%** in 2000/2001 to **16.1%** in 2007/2008. The result is a widening gap between nulliparous and women of parity ≥1 from a difference of **7.3%** in 2000/2001 to a difference of **11.0%** in 2007/2008.

**Figure 3.1.2 Rate of labour induction by parity, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

Examining the primary indication for labour induction among nulliparous women revealed that **35.8%** of all such inductions were conducted as a result of post date pregnancy in 2007/2008 (Table 3.1.0). This was followed by **27.4%** due to premature rupture of membranes (PROM). Generally the proportion of labour inductions attributed to each of the primary indications has remained consistent over the past eight years, with some slight variation. The exception to this is premature rupture of membranes (PROM) which has increased consistently from **22.1%** in 2000/2001 to **27.4%** in 2007/2008. Although not as consistent, inductions as a result of fetal compromise also increased from **7.1%** in 2000/2001 to **8.4%** in 2007/2008.

**Table 3.1.0 Rate of primary indication for induction of labour by parity for women with induced labour, British Columbia, 2000/2001 to 2007/2008**

| | Fiscal Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2000/2001 | 2001/2002 | 2002/2003 | 2003/2004 | 2004/2005 | 2005/2006 | 2006/2007 | 2007/2008 |
| **Nulliparous** | | | | | | | | |
| Fetal Compromise | 7.1 | 7.0 | 7.2 | 6.4 | 7.6 | 8.1 | 8.1 | 8.4 |
| Maternal Condition | 24.4 | 23.3 | 25.5 | 23.6 | 24.0 | 24.8 | 23.0 | 21.8 |
| Other | 5.6 | 7.6 | 9.5 | 7.1 | 5.1 | 4.8 | 4.3 | 5.3 |
| Post Dates | 40.2 | 39.4 | 35.9 | 37.0 | 36.8 | 35.8 | 37.3 | 35.8 |
| PROM | 22.1 | 22.1 | 21.3 | 24.9 | 25.6 | 25.7 | 26.1 | 27.4 |
| **Parity ≥1** | | | | | | | | |
| Fetal Compromise | 7.0 | 7.1 | 7.0 | 7.3 | 8.3 | 7.7 | 7.3 | 8.5 |
| Maternal Condition | 25.1 | 25.3 | 26.4 | 26.2 | 26.7 | 26.5 | 25.9 | 23.9 |
| Other | 12.7 | 13.2 | 16.0 | 14.0 | 10.7 | 11.7 | 10.8 | 10.8 |
| Post Dates | 36.7 | 37.7 | 33.7 | 32.8 | 33.4 | 32.7 | 32.9 | 32.7 |
| PROM | 17.2 | 15.3 | 15.7 | 17.5 | 19.0 | 19.6 | 20.8 | 21.1 |

Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

Among women who had given birth previously, being post date was still the most frequent reason for labour induction (Table 3.1.0). The percentage attributed to this reason, however, was lower than for nulliparous women at **32.7%** in 2007/2008. The second most common reason among women of parity ≥ 1 in the same year was maternal condition, which represented **23.9%** of all such inductions. Similar to nulliparous women above, both premature rupture of membranes and fetal compromise have increased in proportion over the past eight years for women of parity ≥ 1. Premature rupture of membranes as an indication for labour induction for women of parity ≥ 1 increased from **17.2%** in 2000/2001 to **21.1%** in 2007/2008, while fetal compromise as an indication increased from **7.0%** in 2000/2001 to **8.5%** in 2007/2008.

In each of the past eight years the most common method of labour induction (medical or surgical) among nulliparous women was prostaglandin (Table 3.1.1). Its use, however, has been steadily declining in recent years from a high of **52.1%** of all inductions in 2001/2002 to a current low of **37.5%** in 2007/2008. The use of oxytocin and combined methods of induction have risen in the same period to **28.5%** and **28.4%** of labour inductions among nulliparous women in 2007/2008, respectively. The exclusive use of artificial rupture of membranes (ARM) as a means to induce labour occurred in only **3.8%** of all inductions among nulliparous women in 2007/2008.

**Table 3.1.1 Method of induction by parity for women with induced labour, British Columbia, 2000/2001 to 2007/2008**

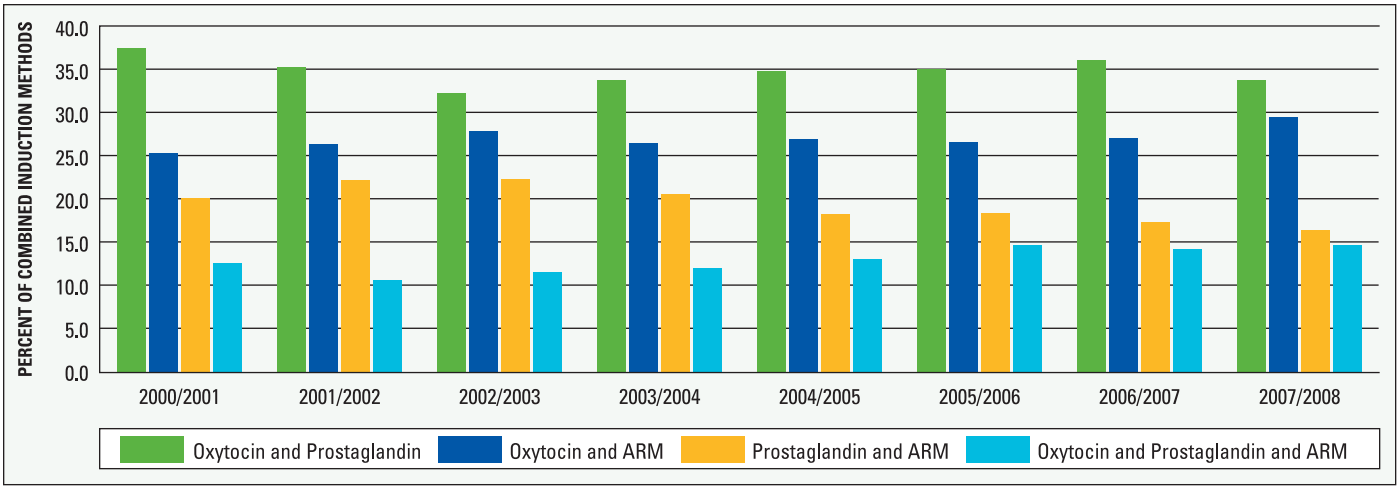
| | Fiscal Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2000/2001 | 2001/2002 | 2002/2003 | 2003/2004 | 2004/2005 | 2005/2006 | 2006/2007 | 2007/2008 |
| **Nulliparous** | | | | | | | | |
| Combined Method | 24.9 | 24.4 | 25.5 | 25.8 | 26.3 | 29.4 | 28.0 | 28.4 |
| ARM | 3.0 | 3.7 | 4.5 | 3.8 | 3.4 | 3.0 | 3.5 | 3.8 |
| Other | 1.9 | 1.3 | 1.5 | 1.5 | 1.4 | 1.0 | 1.8 | 1.8 |
| Oxytocin | 20.6 | 18.6 | 19.6 | 22.0 | 22.8 | 25.7 | 27.1 | 28.5 |
| Prostaglandin | 49.6 | 52.1 | 48.9 | 46.8 | 46.0 | 40.8 | 39.6 | 37.5 |
| **Parity ≥1** | | | | | | | | |
| Combined Method | 22.1 | 22.4 | 22.5 | 22.6 | 23.9 | 23.4 | 24.2 | 25.1 |
| ARM | 7.9 | 8.8 | 9.6 | 10.3 | 9.4 | 8.8 | 9.6 | 10.0 |
| Other | 1.9 | 1.2 | 1.9 | 1.4 | 1.1 | 1.5 | 2.0 | 2.1 |
| Oxytocin | 21.6 | 19.6 | 20.7 | 22.2 | 23.6 | 26.2 | 27.3 | 29.8 |
| Prostaglandin | 46.5 | 48.0 | 45.4 | 43.4 | 42.1 | 40.2 | 36.9 | 37.7 |

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Combined Method – use of more than one method of labour induction.
Other – use of a method of labour induction not listed.

Prostaglandin was again the most commonly used method of labour induction among women of parity ≥1, with its exclusive use declining in a pattern similar to that of nulliparous women (Table 3.1.1). The use of prostaglandin among women who had given birth previously ranged from a high of **48.0%** in 2001/2002 to a low of **36.9%** in 2006/2007. The use of combined methods of labour induction was less common among women of parity ≥1 compared to those giving birth for the first time. In 2007/2008, just over one quarter (**25.1%**) of women of parity ≥1 were induced in labour using a combination of methods. The use of oxytocin was slightly more common among this group with a steady increase in use over the past seven years from a low of **19.6%** in 2001/2002 to a current high of **29.8%** in 2007/2008. A total of **10.0%** of labour inductions among women of parity ≥1 involved the exclusive use of artificial rupture of membranes in 2007/2008.

Among all women whose labour involved a combination of methods of induction, the most common throughout each of the previous eight years was the use of oxytocin and prostaglandin (Figure 3.1.3). This pairing accounted for just over one third (**33.9%**) of all combined method inductions in 2007/2008. This was followed by the use of oxytocin and artificial rupture of membranes, used in **29.6%** of all combined method inductions in 2007/2008 and prostaglandin and artificial rupture of membranes, used in **16.5%** in the same year. In 2007/2008, a total of **14.7%** of all labours involving combined methods utilized all three of these techniques (oxytocin, prostaglandin, and ARM). Together these four combinations of methods accounted for **94.6%** of all combined method inductions for 2007/2008.

**Figure 3.1.3 Combined Induction methods for British Columbia, 2000/2001 to 2007/2008**

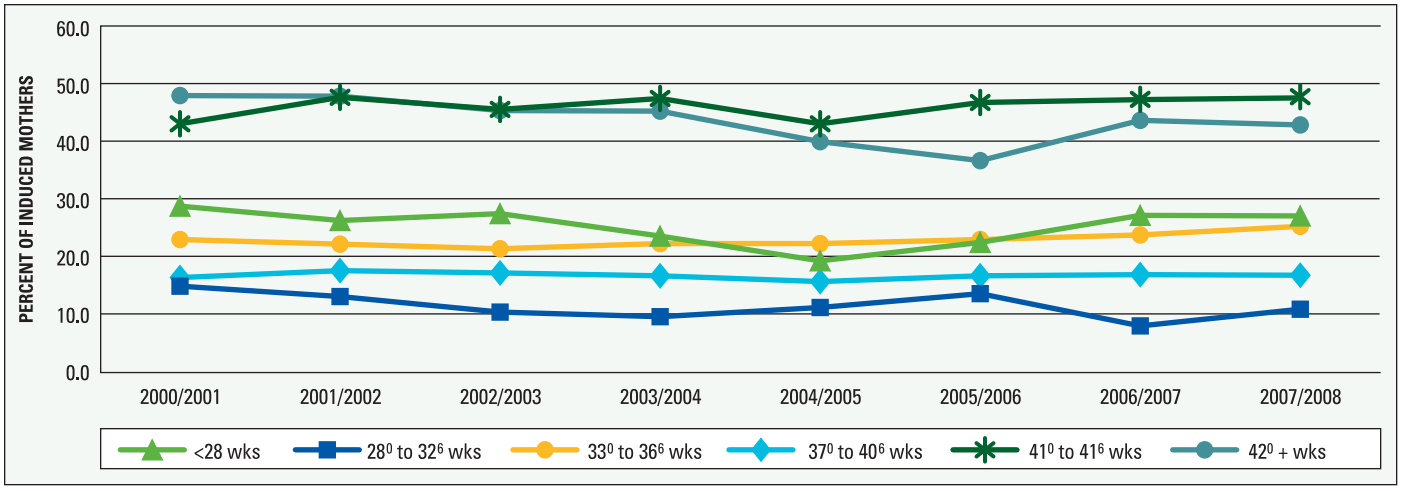



Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

Considering the total labour inductions in 2007/2008, nearly two thirds (**62.8%**) were performed on women between 37 and 40 weeks gestation, while over one quarter (**27.1%**) were for women who were post date at 41 weeks or more. Combined, these two categories indicate that **89.9%** of all inductions were performed on women whose pregnancies had reached full term.

There was some annual variation in labour induction rates at various gestational ages (Figure 3.1.4). For the past five years, women who gave birth at 41 weeks gestation had the highest labour induction rates with **47.7%** of women in this group induced in 2007/2008. Among women who gave birth at 42 weeks or more **43.0%** were induced in 2007/2008. However, this gestational age group represented only **1.3%** of the total births for this year. There has been a steady year over year increase over the past six years in the induction rate among women between 33 and 36 weeks gestation, rising to **25.4%** of all inductions for 2007/2008. The induction rate for other gestational age categories remained relatively consistent. A similar analysis on preterm births in BC found that the increase of preterm birth in this gestational age group was the result of either induced labour or caesarean section before labour.[16]

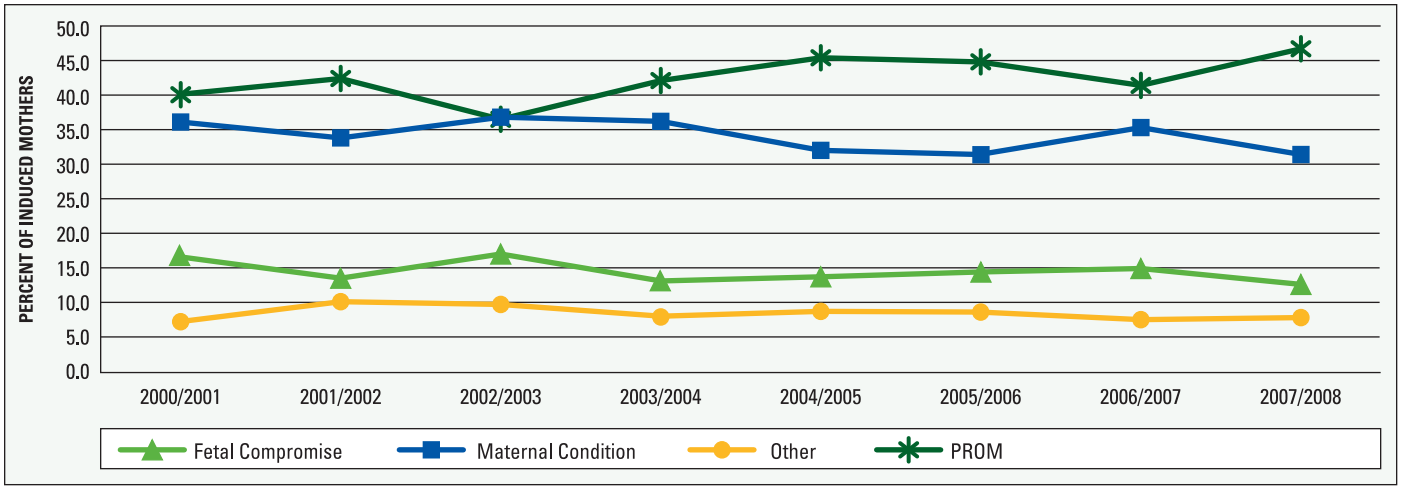
**Figure 3.1.4 Rate of labour induction by gestational age, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
All induced deliveries were included in this analysis, including stillbirths.
Late terminations have been excluded.

To explore the increase in inductions among births at 33 to 36 weeks' gestation, the primary indication for labour induction was analyzed (Figure 3.1.5). In 2007/2008, **7.2%** of all births were among women at 33 to 36 weeks gestation, with an induction rate of **25.4%** among this gestational age group. Exploring the specific conditions showed that premature rupture of membranes was the most common reason cited for induction in seven of the past eight years (**46.7%** of inductions in this gestational age group in 2007/2008). Over the past eight years, an average of **34.1%** of inductions among this gestational age group were for reasons related to maternal condition, while an average of **14.5%** of inductions were related to fetal compromise.

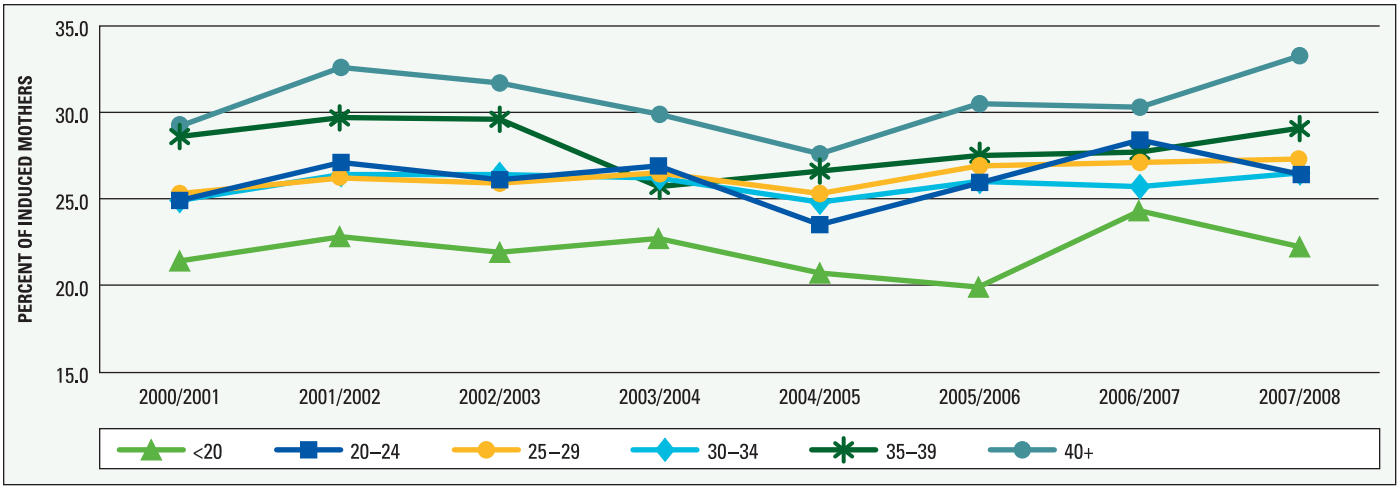
**Figure 3.1.5 Labour induction at gestational age (33-36) by indication for induction, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1

Maternal age is an important consideration in labour induction rates as well. Among women who were giving birth for the first time, labour induction rates were highest in each of the past eight years for women who were 40 years or older at the time of the delivery (Figure 3.1.6). In 2007/2008, one third (**33.7%**) of women in this age group had labour induced, with an average of **30.7%** induced during the period from 2000/2001 to 2007/2008. This occurred in a context where in 2007/2008, women giving birth for the first time in this age group represented only **2.4%** of all first time mothers, up from **1.8%** in 2000/2001. Among first time mothers between the ages of 35 and 39 there was a **29.3%** induction rate in 2007/2008, which has risen steadily from a low of **25.8%** in 2003/2004. There was very little difference in the induction rates seen among nulliparous women in the age groups between 20 and 34 years of age; however, induction rates among first time mothers under 20 were consistently lower across each of the past eight years. In 2007/2008, the induction rate was **22.3%** among mothers in the youngest age group. The percent of all births to nulliparous women in this age range has been steadily decreasing from **8.8%** in 2000/2001 to **6.3%** in 2007/2008.

**Figure 3.1.6 Labour induction by maternal age for nulliparous women, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
All induced deliveries were included in this analysis.

The 2008 Canadian Perinatal Health Report (CPHR)[5] indicates that induction rates have been increasing in Canada over the last several years, including increases in preterm inductions. Across the country, 23.7% of deliveries were induced in 2004/2005. In comparison, BCPHP data for the same year show an induction rate of **20.1%**, though the CPHR suggests a BC rate that is slightly lower at 16.9%. The CPHR distinguishes between medical and surgical inductions; surgical inductions rates are generally quite a bit lower. The Canadian average in 2004/2005 for surgical inductions was 8.4%. Surgical induction rates in BC were the lowest in the country at 3.6%. Medical inductions among Canadian women accounted for 19.1% of deliveries in 2004/2005; in BC this rate was around 15.6%. Differences in rates between provincial and national sources may be due to slight differences in the way that inductions are identified in the data.

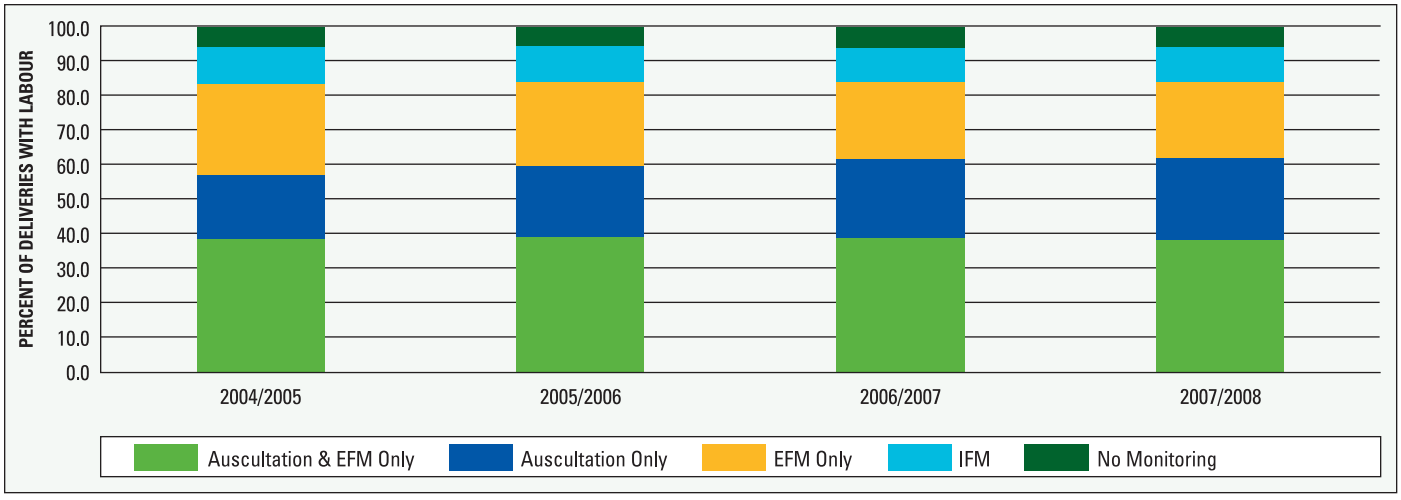
## 3.2 Fetal Surveillance

Fetal surveillance, which allows care providers to monitor fetal heart rates during labour and delivery, can be accomplished through the use of a number of means, including intermittent auscultation (using stethoscopes, fetoscopes, Dopplers), and electronic fetal monitoring. In their Joint Policy Statement on Normal Childbirth (2008), the Society of Obstetricians and Gynaecologists of Canada emphasize their position that, although the technology is available,[1] continuous electronic fetal monitoring should not be used for women with no risk factors. While evidence has shown that intermittent auscultation can be beneficial, continuous electronic fetal monitoring has been associated with an increase in interventions, such as assisted vaginal deliveries, caesarean deliveries, and the use of anesthesia.[4]

Data on fetal surveillance during labour using intermittent auscultation (e.g. Doppler), external fetal monitoring (EFM), and internal fetal monitoring (IFM) is reported in this section; however, BCPHP data does not describe whether IFM and EFM in labour was intermittent or continuous. A change in scope of collection of this data element, beginning with 2004/2005 data precludes a comparison with older data.

An exploration of fetal surveillance for the period between 2004/2005 and 2007/2008 shows slight changes in approach over time (Figure 3.2.0). Fetal surveillance using a combination of intermittent auscultation and electronic fetal monitoring was most prevalent across all four years and remained relatively stable with approximately one third (**38.4%** in 2007/2008) of labours monitored using these methods. In 2004/2005, **26.4%** of labours included monitoring with electronic fetal monitoring only, but by 2007/2008, this number had fallen to **22.0%**. Conversely, the percentage in which auscultation methods alone were used increased from **18.6%** in 2004/2005 to **23.7%** in 2007/2008.

**Figure 3.2.0 Fetal surveillance during labour, British Columbia, 2004/2005 to 2007/2008**

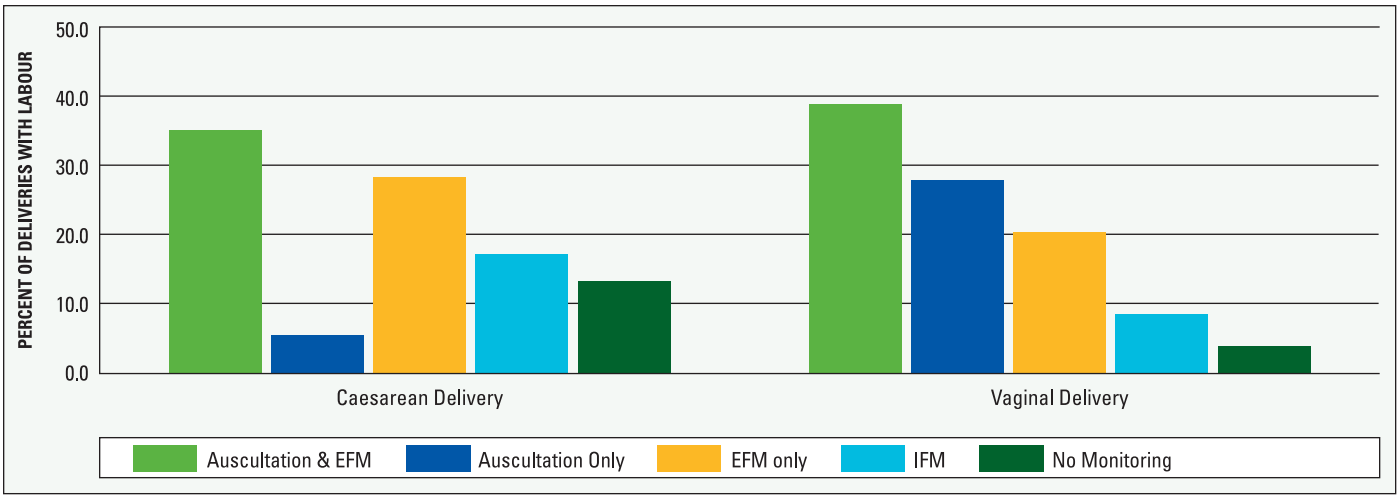



Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
IFM = internal fetal monitoring can include external fetal monitoring, intermittent auscultation and internal fetal monitoring.

One of the concerns related to fetal surveillance is that electronic fetal monitoring (of any method) may be associated with increase in interventions, such as caesarean sections and assisted vaginal delivery.[1] Thus, surveillance methods were cross-tabulated with type of delivery for 2007/2008 (Figure 3.2.1). While no distinction can be made between intermittent and continuous electronic monitoring from this data, rates of fetal surveillance did vary according to method of delivery. For example, **5.6%** of women having a caesarean section during labour had intermittent auscultation only compared to **28.0%** of women having a vaginal delivery. However, IFM (including intermittent auscultation, external fetal monitoring, and internal fetal monitoring) was more prevalent in women having a caesarean section during labour compared to women having a vaginal delivery (**17.3%** vs. **8.6%**).

It is worth noting that **13.4%** of women having a caesarean section during labour had no monitoring, compared to **3.9%** of women delivering vaginally. This figure may be due, however, to lack of documentation on the mother's record rather than the fact that these women received no fetal surveillance whatsoever, as a routine part of the caesarean procedure.

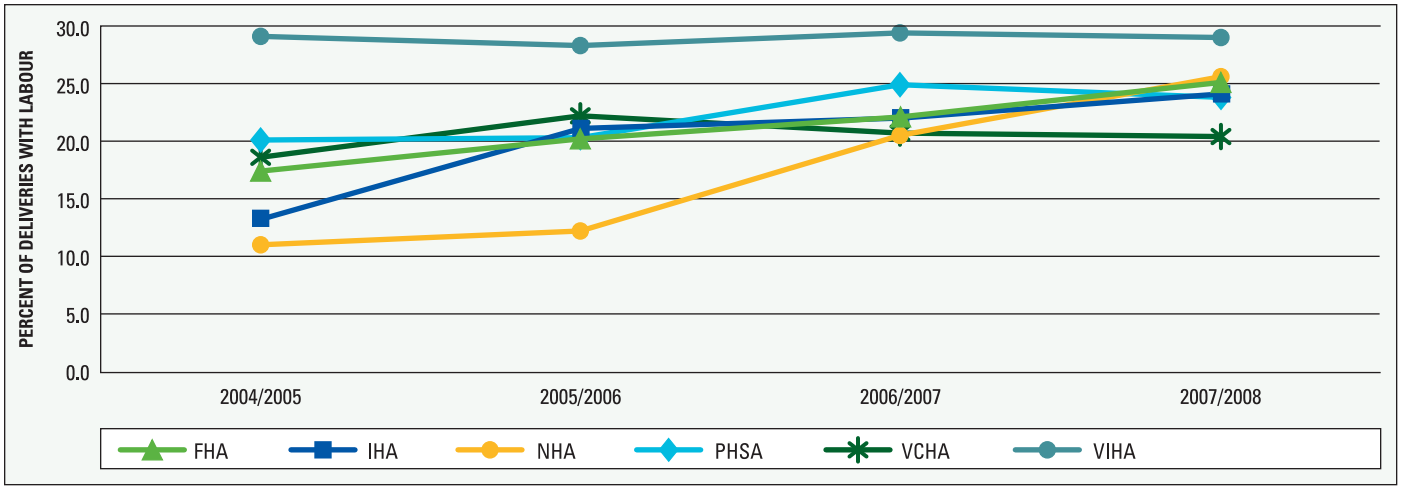
**Figure 3.2.1 Fetal surveillance during labour by type of delivery, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
IFM = internal fetal monitoring can include external fetal monitoring, intermittent auscultation and internal fetal monitoring.

A closer look at the use of auscultation only by delivery Health Authority revealed that while the rates remained relatively stable across the period from 2004/2005 for VIHA, there were noteworthy changes in many of the other Health Authorities (Figure 3.2.2). In 2004/2005, **29.1%** of women in VIHA were monitored with auscultation methods only, with this number, in effect, unchanged at **29.0%** in 2007/2008. In all other Health Authorities this number increased, with the largest changes seen in the Northern Health Authority (NHA). In this region, the number of labours monitored with auscultation only methods increased **14.6%** from **11.0%** in 2004/2005 to **25.6%** in 2007/2008. Considerable changes were also seen in the Interior Health Authority (IHA) which increased **3.8%** from **13.3%** in 2004/2005 to **17.1%** in 2007/2008.

**Figure 3.2.2 Auscultation only during labour by delivery Health Authority, and British Columbia, 2004/2005 to 2007/2008**



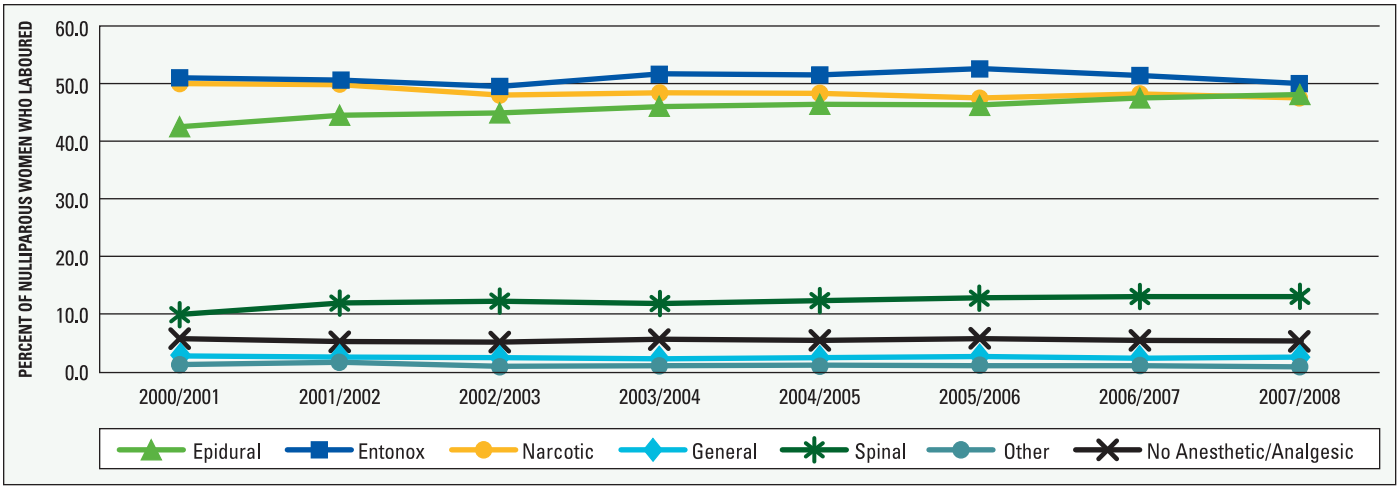

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.
PHSA refers to BC Women's Hospital patients only.

## 3.3 Anesthetic/Analgesic Use in Labour and Delivery

Anesthetic/analgesic use during labour and delivery is defined as administration during any stage of labour (first, second, or third stage) and is extracted from hospital records. In the BCPHP database, use of various types of anesthetic/analgesic can be determined; however the timing (i.e. stage of labour) of administration of anesthetic/analgesic cannot be differentiated. In the following analysis, only women with labour were included (i.e. women who had caesarean section with no labour were excluded).

There has been very little change in the use of anesthesia/analgesia during labour and delivery among nulliparous British Columbia women through the period from 2000/2001 to 2007/2008 (Figure 3.3.0). The anesthetics/analgesics most often used included Entonox, narcotics, and epidural anesthesia, with Entonox being used most frequently. Between 2000/2001 and 2007/2008 an average of **51.1%** of women used Entonox for pain relief. The use of epidural anesthesia has increased steadily from **42.5%** in 2000/2001 to **48.1%** in 2007/2008, whereas the use of narcotics has shown a small decrease from **50.0%** in 2000/2001 to **47.5%** in 2007/2008. Although used considerably less often, spinal anesthesia has increased from **9.9%** in 2000/2001 to **13.0%** in 2007/2008. The number of nulliparous women receiving no anesthetics/analgesics has remained relatively consistent with an average of **5.4%** over the past eight years.

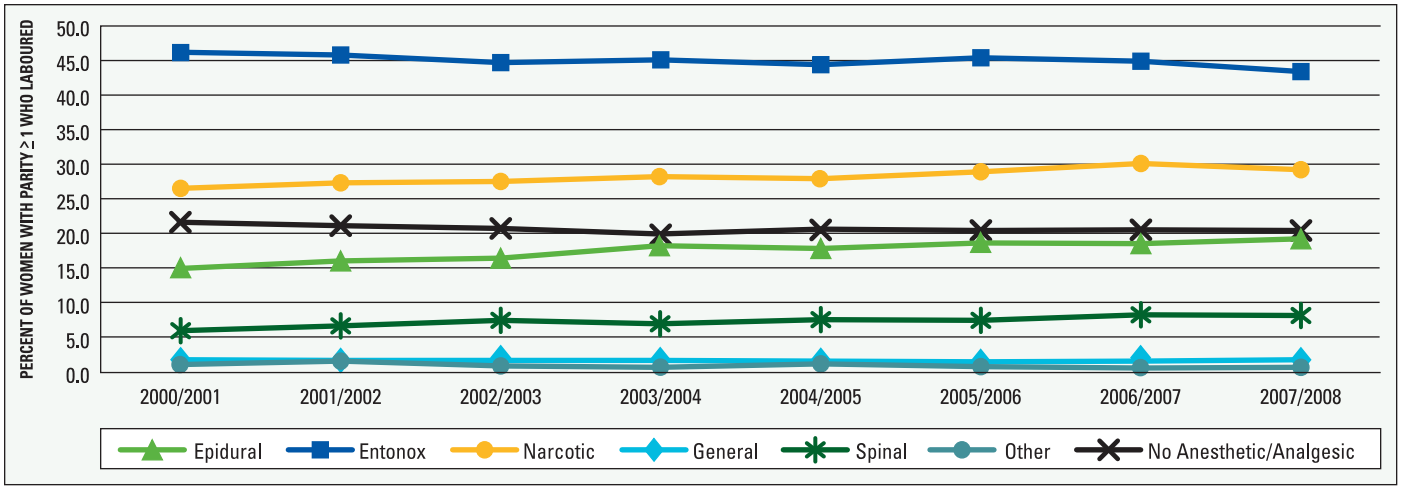
**Figure 3.3.0 Anesthesia/analgesia use in labour and delivery for nulliparous women, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Categories are not mutually exclusive as mothers may receive more than one type of anesthetic. Anesthetic/Analgesic use in labour is defined as administration during any stage of labour (first, second or third stage). The specific stage of labour cannot be determined.

The use of anesthetics and analgesics in labour was lower among women who had given birth previously compared to nulliparous women (Figure 3.3.1). Entonox remained the most commonly used among women with parity ≥ 1 with a slight decrease in use from **46.2%** in 2000/2001 to **43.4%** in 2007/2008. During the same time period narcotics were used on average by **28.2%** of women with parity ≥ 1, with a slight increase from **26.5%** in 2000/2001 to **29.2%** in 2007/2008. The use of epidural anesthesia was lower with an average over the same time period of **17.5%**. Again there was a small increase in its use from **14.9%** in 2000/2001 to **19.2**% in 2007/2008. On average, **20.6%** of women with parity ≥ 1 received no anesthesia/analgesia during labour, considerably higher than that recorded for nulliparous women. There has been very little change in this percentage over the past eight years.

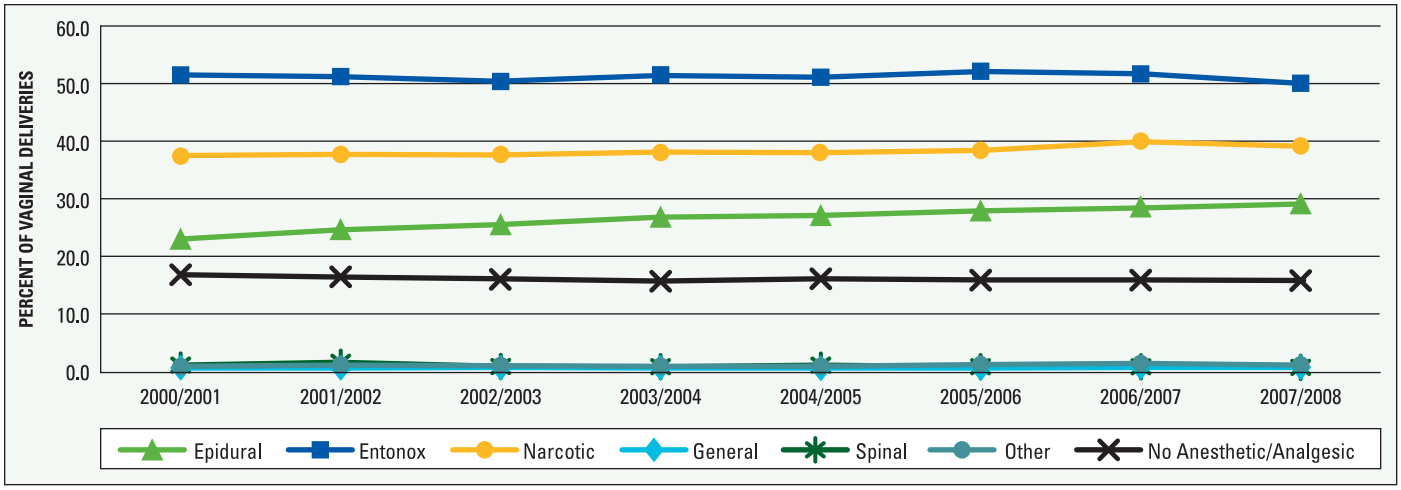
**Figure 3.3.1 Anesthesia/analgesia use in labour and delivery for parity ≥ 1, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Categories are not mutually exclusive as mothers may receive more than one type of anesthetic. Anesthetic/Analgesic use in labour is defined as administration during any stage of labour (first, second or third stage). The specific stage of labour cannot be determined.

Exploring anesthetic/analgesic use in labour for vaginal deliveries only revealed that Entonox was used for just over half of all labours (average **51.2%**), with its use remaining relatively consistent over the period from 2000/2001 to 2007/2008 (Figure 3.3.2). There has been a relatively steady increase in the use of narcotics as pain relief in labour from **37.5%** in 2000/2001 to **39.1%** in 2007/2008 and epidural anesthesia from **23.0%** in 2000/2001 to **29.1%** in 2007/2008. The use of all other methods combined (including general and spinal anesthetics) represented only **2.5%** of all vaginal deliveries in 2007/2008. Of women giving birth vaginally in 2007/2008, **15.8%** had no anesthesia/analgesia.

**Figure 3.3.2 Anesthesia/analgesia use in labour and delivery for vaginal deliveries, British Columbia, 2000/2001 to 2007/2008**

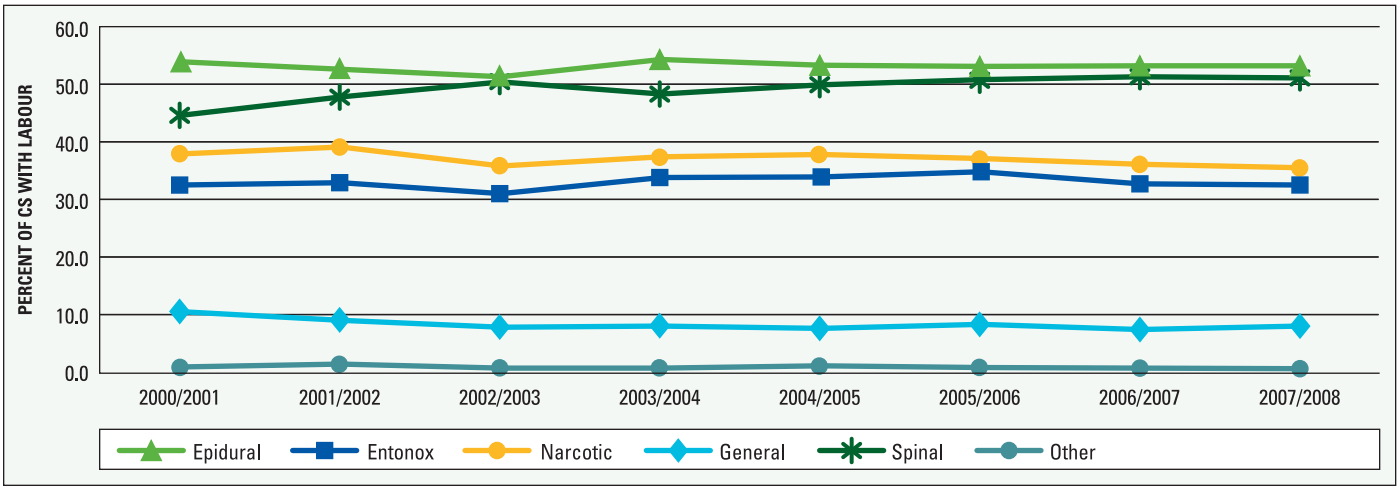



Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Categories are not mutually exclusive as mothers may receive more than one type of anesthetic. Anesthetic/Analgesic use in labour is defined as administration during any stage of labour (first, second or third stage). The specific stage of labour cannot be determined.

Among caesarean section deliveries, the patterns of anesthetic/analgesic use were considerably different (Figure 3.3.3). During the period from 2000/2001 to 2007/2008, an average of **53.1%** of caesarean section deliveries involved the use of epidural anesthetic; a percentage that did not change substantially. There has, however, been a steady increase in the use of spinal anesthetic during caesarean section from **44.6%** in 2007/2008 to **51.1%** in 2007/2008, which has, in effect, narrowed the gap between the administration of epidural and spinal anesthesia. For most elective caesarean sections, a spinal anesthetic is administered. However, if a woman in labour is given an epidural and continues on to an emergency caesarean section, the epidural will likely be enhanced for anesthesia during delivery or a combined spinal-epidural may be used. The use of narcotic pain relief in caesarean section births averaged **37.1%** in the period from 2000/2001 to 2007/2008 and ranged from a high of **39.1%** in 2001/2002 to a low of **35.5%** in 2007/2008. This was closely followed by the use of Entonox, which ranged from **31.0%** in 2002/2003 to **34.8%** in 2005/2006. In 2007/2008, **8.0%** of caesarean section deliveries involved general anesthetic.

The time at which analgesia/anaesthesia is administered for the purposes of pain relief in the first, second or third stage of labour cannot be ascertained from the BCPHP data. It is not possible, therefore, to differentiate between epidural use for the purpose of labour progress and that for delivery.

**Figure 3.3.3 Anesthesia/analgesia use in labour and delivery for caesarean deliveries, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Categories are not mutually exclusive as mothers may receive more than one type of anesthetic. Anesthetic/Analgesic use in labour is defined as administration during any stage of labour (first, second or third stage). The specific stage of labour cannot be determined.

The Maternity Experiences Survey[4] asked women both about medication-based pain management, such as the use of epidural anesthesia or medication, and about medication-free pain management. This latter category included such things as breathing techniques, position change, walking, massage, taking a bath or shower, and the use of a birthing ball.

In BC, 22.6% of women reported using medication-free techniques only, while 70.1% of women reported using medication-free techniques in combination with medication-based techniques. This was similar to the proportion of Canadian women overall (23.0% using medication-free techniques only and 68.9% using both). Overall, 78.2% of mothers in BC reported that they received enough information about medication-free pain management and potential side effects of pain medication and anesthesia, compared to a national average of 77.0%.[4]

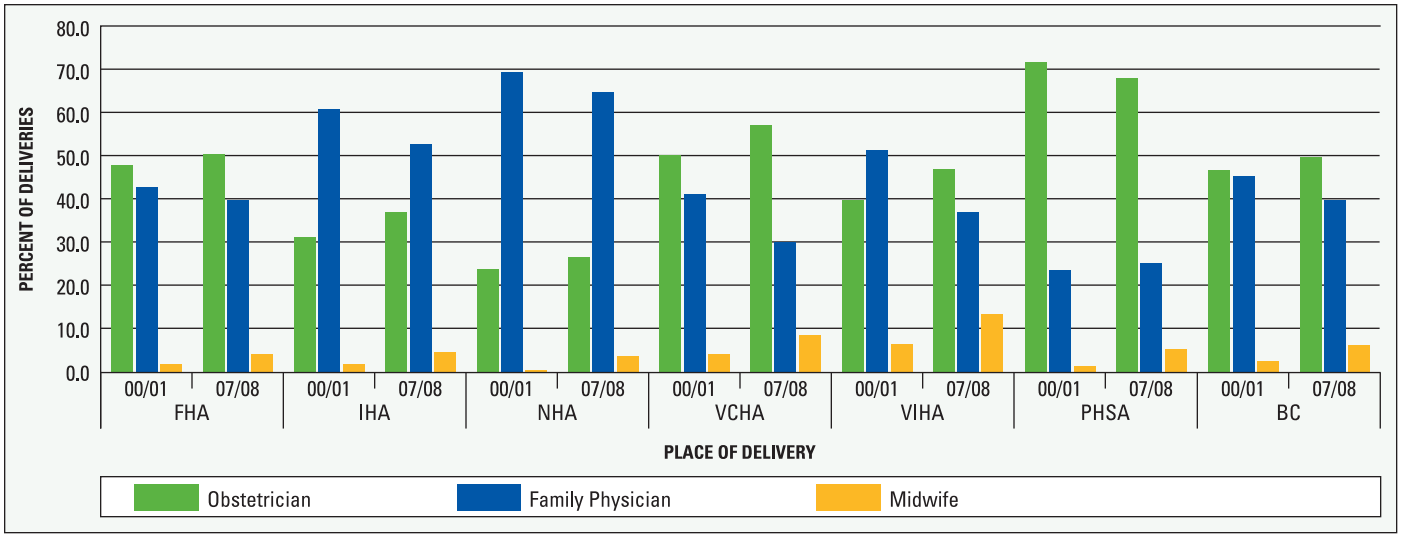
## 3.4 Delivery Care Provider

During the period from 2000/2001 to 2007/2008, the percentage of deliveries attended by British Columbia obstetricians increased **3.0%** from **46.9%** in 2000/2001 to just under one half (**49.9%**) in 2007/2008 (Figure 3.4.0). This has coincided with a decrease in births attended by family physicians. In 2000/2001, **45.4%** of births were attended by family physicians with this number falling to **39.9%** in 2007/2008. Although the proportion of deliveries attended by registered midwives continues to be far lower at **6.3%** in 2007/2008, this is a considerable increase from 2000/2001 where only **2.6%** of deliveries throughout the province were attended by registered midwives.

This pattern holds true to a greater or lesser extent in all regions of the province, with the exception of the Provincial Health Services Authority (PHSA). Among women who gave birth in the PHSA in 2000/2001, **71.8%** were attended by obstetricians. This proportion fell to **68.2%** in 2007/2008. There was an increase in the proportion of deliveries attended by both family physicians (up **1.5%**) and registered midwives (up **4.0%**) among women who gave birth in the PHSA during this eight year period.

The greatest changes over this period were observed in the Vancouver Island Health Authority (VIHA) and the Vancouver Coastal Health Authority (VCHA). In VIHA, the proportion of deliveries attended by family physicians fell by **14.4%** from 2000/2001 to 2007/2008, while the proportion attended by obstetricians and registered midwives increased by **7.3%** and **6.9%**, respectively. In VCHA the picture is similar with family physician attended deliveries falling by **11.1%** and deliveries attended by obstetricians and registered midwives increasing by **7.0%** and **4.5%**, respectively.

**Figure 3.4.0 Care Provider (Obstetrician/Family Physician/Midwife) by delivery Health Authority and British Columbia, 2000/2001 and 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.
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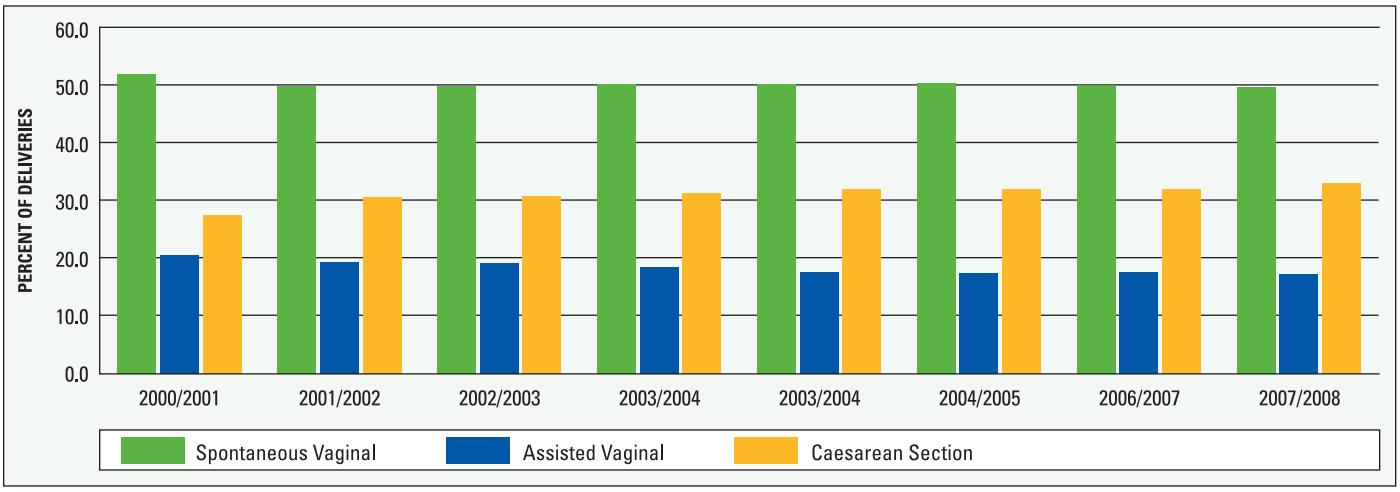
The care provider at delivery data element in the BCPHP database identifies the one care provider who is ultimately responsible for delivering the baby; it does not necessarily capture other care providers who may have provided care throughout a woman's pregnancy or during labour and birth. For example, a woman may see a family physician for antenatal care, be admitted to hospital in labour under the care of a family physician and then have an obstetrician perform a caesarean section to deliver her baby. In this scenario, 'obstetrician' would be selected as care provider in the BCPHP database. Recent findings from the Maternity Experiences Survey[4] showed that BC women had the same care provider throughout her pregnancy and at birth 58.5% of the time (self-reported data). As well, this Survey showed that the majority of Canadian women surveyed (88%) felt it was important to have continuity of care throughout pregnancy and birth.[4]

## 3.5 Assisted Vaginal Delivery

Assisted vaginal deliveries are those in which vacuum and/or forceps are used to assist in the delivery of the baby when spontaneous vaginal delivery has not progressed adequately.

Among nulliparous women, there has been a slight decline in the percent of spontaneous vaginal births through the period from 2000/2001 to 2007/2008 (Figure 3.5.0). In 2000/2001, **52.0%** of births among this group were spontaneous vaginal births falling to **49.7%** in 2007/2008; a decrease of **2.3%**. During this same period, however, the percent of instrument assisted vaginal deliveries (using vacuum and/or forceps) also decreased from **20.5%** in 2000/2001 to **17.3%** in 2007/2008. Both of these decreases were countered by a change in the percent of caesarean section births among first time mothers, which increased from **27.5%** in 2000/2001 to **33.0%** in 2007/2008.

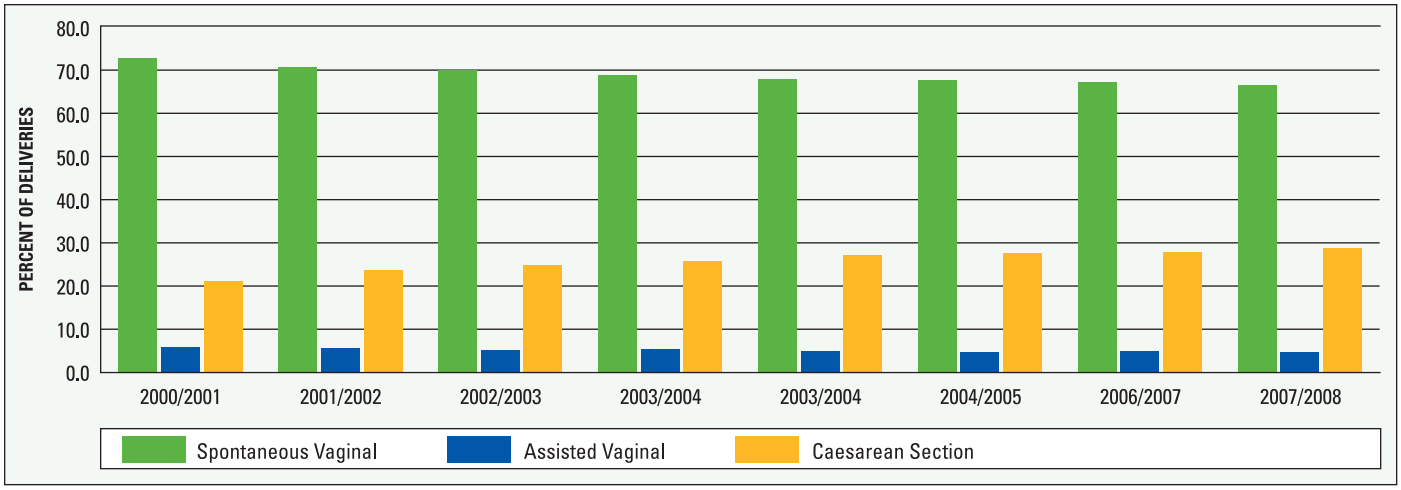
**Figure 3.5.0 Method of delivery for nulliparous women, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

Compared to nulliparous women, women who have given birth previously are considerably more likely to have a spontaneous vaginal delivery. However, there has also been a decrease in the percent of spontaneous vaginal births among women of parity ≥1, and this decline has been considerably sharper than that seen among nulliparous women (Figure 3.5.1). In 2000/2001, **72.9%** of all births to women of parity ≥1 were spontaneous vaginal deliveries, but by 2007/2008 this number had steadily decreased year over year to **66.5%**, a difference of **6.4%**. The number of instrumental assisted deliveries among women of parity ≥1 also decreased from **5.8%** in 2000/2001 to **4.8%** in 2007/2008, while the number of caesarean section deliveries increased **7.5%** from **21.2%** in 2000/2001 to **28.7%** in 2007/2008.

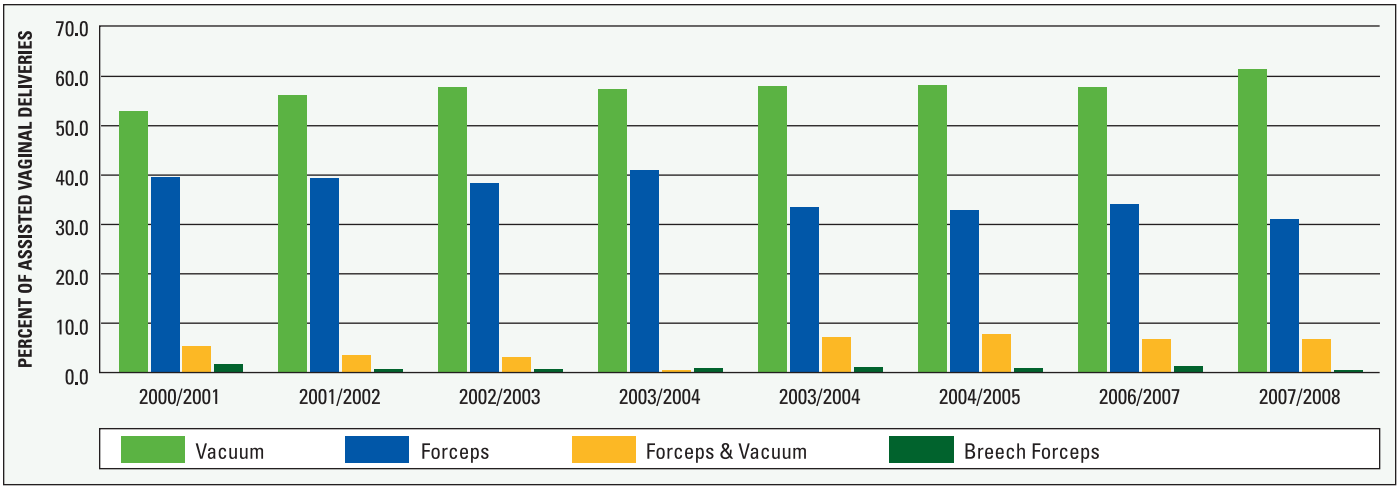
**Figure 3.5.1 Method of delivery for parity ≥1, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

In 2007/2008, among nulliparous women who had an assisted vaginal birth, the vacuum was the most commonly used instrument with **61.5%** of assisted vaginal deliveries employing this technique (Figure 3.5.2). This is an increase of **8.6%** over 2000/2001 when **52.9%** of assisted vaginal deliveries involved the exclusive use of the vacuum. The increase in the use of the vacuum matched a decrease in the use of forceps. Forceps assisted deliveries accounted for **39.6%** of all assisted vaginal deliveries in 2000/2001, falling **8.6%** to **31.0%** in 2007/2008. In 2007/2008, a total of **6.8%** of assisted vaginal deliveries among nulliparous women involved the use of both vacuum and forceps, while only **0.6%** involved a forceps breech delivery.

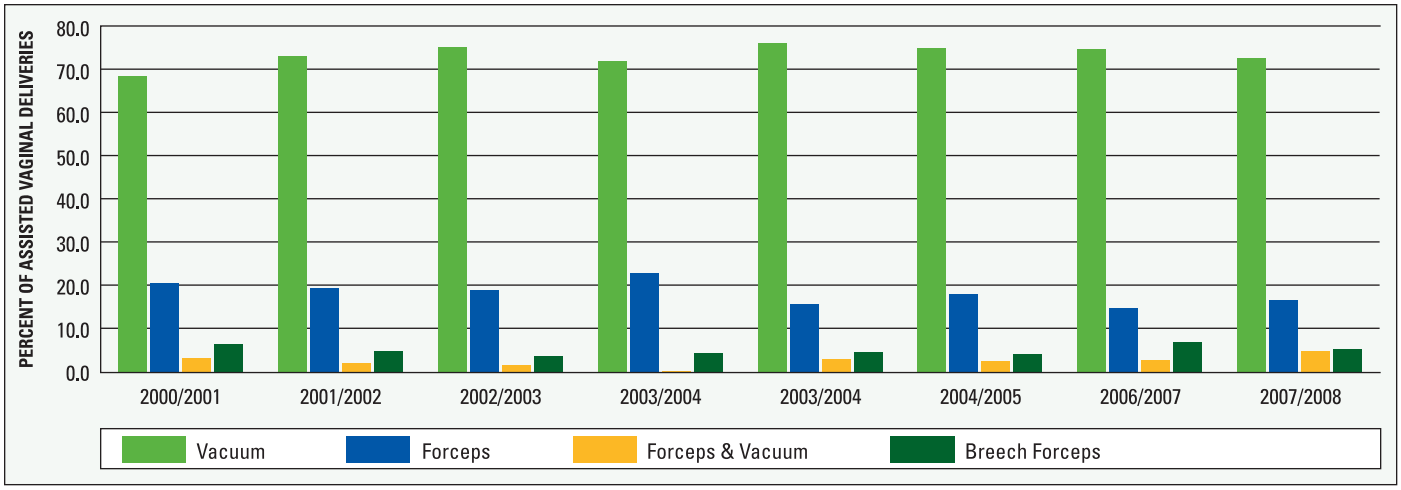
**Figure 3.5.2 Instrumentation rates among nulliparous women having assisted vaginal delivery, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

Among women who have given birth previously, the patterns in instrument usage were similar, although the changes have been more moderate and the proportions vary (Figure 3.5.3). Again the increase in the use of the vacuum is matched with a decrease in the use of forceps. In 2007/2008, **72.8%** of assisted vaginal deliveries among women of parity ≥ 1 used the vacuum, an increase of **4.1%** from 2000/2001 when **68.7%** employed this technique. The highest percentage of vacuum use, however, occurred in 2004/2005 when **76.4%** of all assisted deliveries among women of parity ≥ 1 involved the vacuum. The use of forceps has decreased by a commensurate amount from **20.8%** in 2000/2001 to **16.7%** in 2007/2008. The highest percentage in the past eight years occurred in 2003/2004, when forceps use represented **23.0%** of all instrument assisted vaginal deliveries. In 2007/2008, among women of parity ≥ 1, the use of a combination of the vacuum and forceps occurred in **4.9%** of instrument assisted vaginal deliveries, whereas the percent of breech forceps deliveries was slightly higher at **5.5%**.

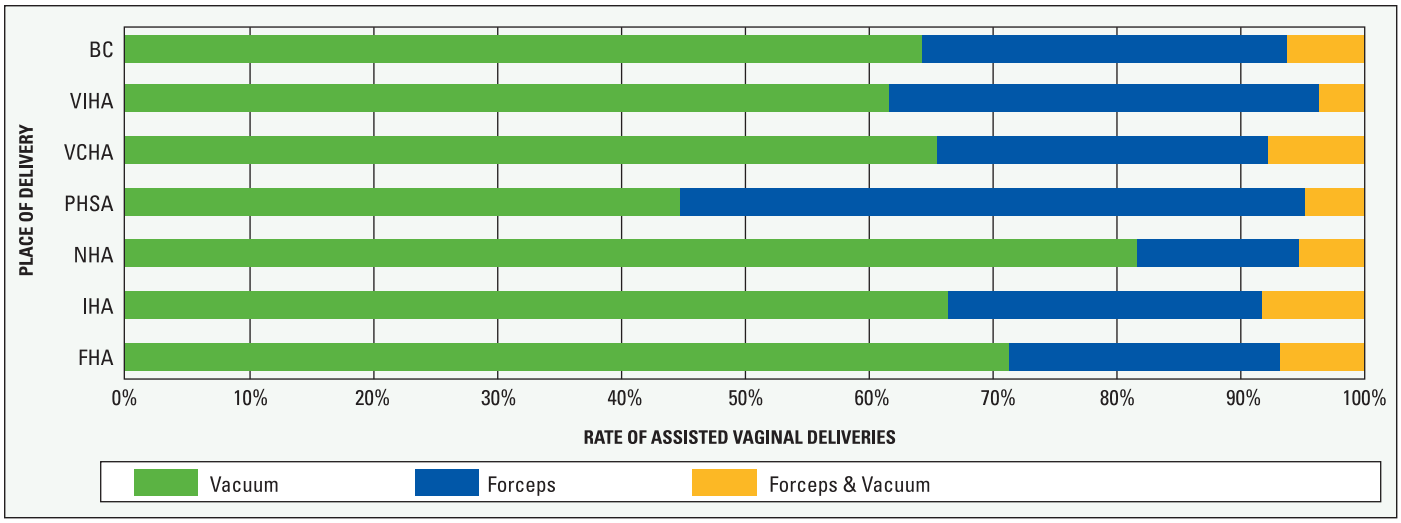
**Figure 3.5.3 Instrumentation rates among women with parity ≥1 having assisted vaginal delivery, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

Exploring the percentage of instrument assisted vaginal deliveries across each of the British Columbia Health Authorities for 2007/2008 revealed some differences (Figure 3.5.4). The vacuum was the most commonly used method in all Health Authorities with the exception of PHSA, and ranged from a high of **81.6%** in NHA to a low of **61.6%** in VIHA with a provincial rate of **64.3%**. In PHSA, this proportion was even lower at **44.8%**, while the percent of assisted vaginal deliveries using forceps in the same year was **50.3%**. Across the province, **29.4%** of instrument assisted vaginal deliveries were with forceps exclusively. With the exception of PHSA, this ranged from a high of **34.7%** in VIHA to a low of **13.1%** in NHA. IHA had the highest rate of assisted vaginal deliveries in which the vacuum and forceps were used in combination at **8.4%**, with VIHA lowest at **3.7%**. Across the province this rate was **6.4%**.

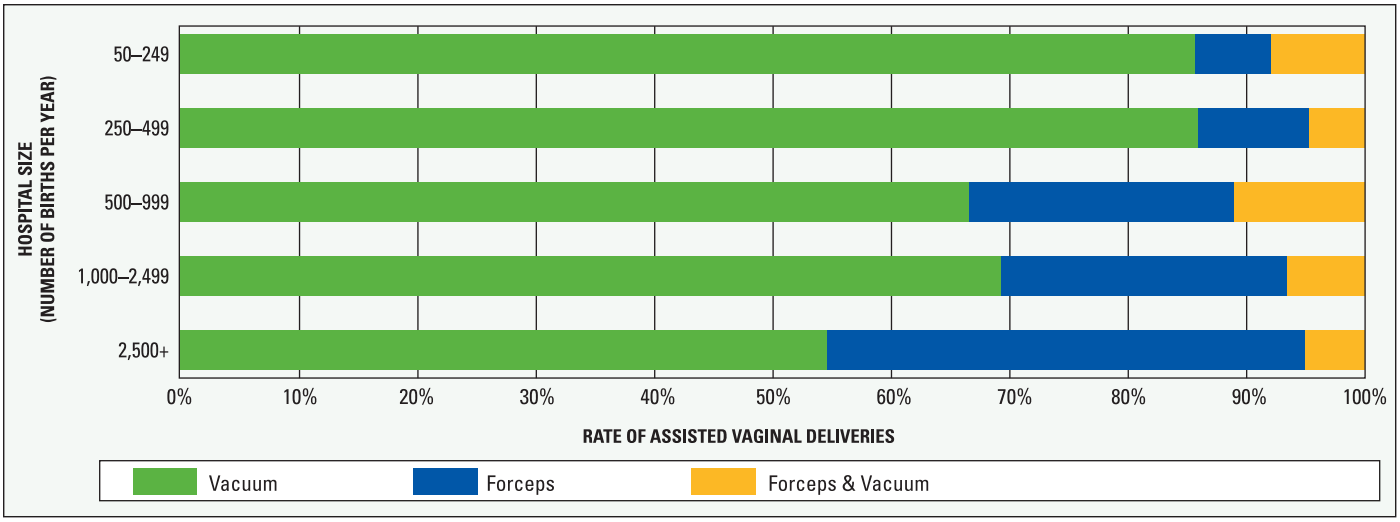
**Figure 3.5.4 Instrumentation type by delivery Health Authority and British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.
PHSA refers to BC Women's Hospital patients only.

In 2007/2008, exclusive forceps use accounted for a total of **40.3%** of all assisted vaginal deliveries in hospitals with 2,500 births or more (Figure 3.5.5). This is considerably higher than smaller facilities; only **6.4%** of assisted vaginal deliveries in hospitals with 50 to 249 births involved the exclusive use of forceps. In hospitals with 250 to 499 births, this number climbed to **9.3%**, whereas in hospitals with 500 to 999 births **22.3%** involved the exclusive use of forceps. Even in larger hospitals with between 1,000 and 2,499 births in 2007/2008 this number was nearly half that of the largest hospitals at **24.1%**. The inverse was found of vacuum usage with larger hospitals less likely to use the vacuum in assisted vaginal deliveries. The lowest rates were found in the largest hospitals with **54.6%** of assisted vaginal deliveries in hospitals with 2,500 or more births in 2007/2008 using a vacuum, compared to **85.9%** of hospitals with 250 to 499 births. In Figure 3.5.5, hospitals with less than 50 births in 2007/2008 have been removed due to small sample sizes.

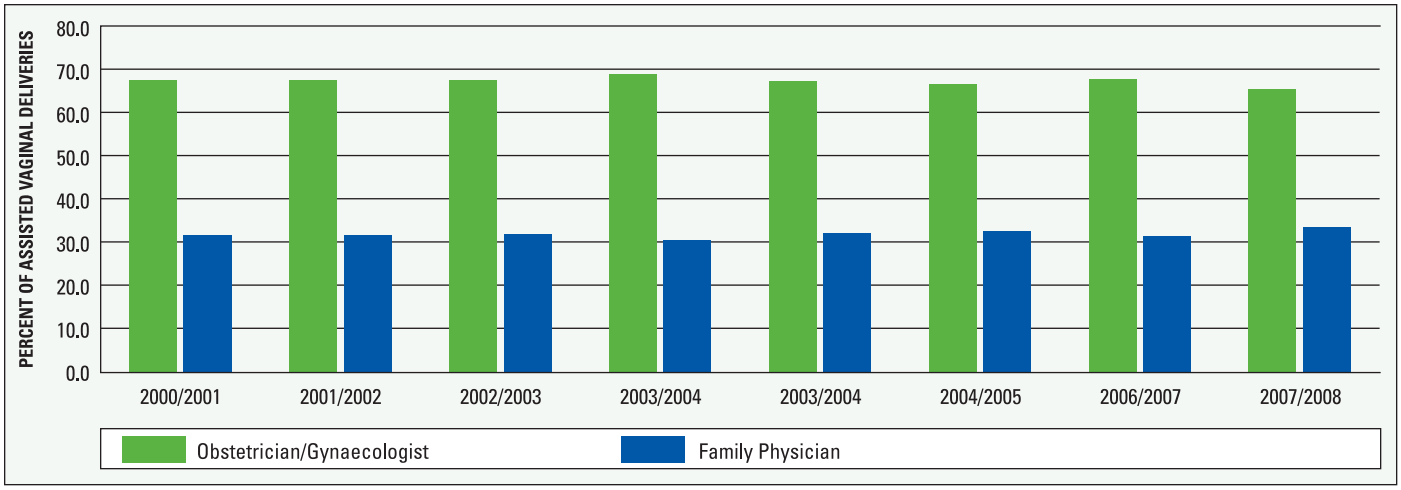
**Figure 3.5.5 Instrumentation type by method of delivery and hospital size, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

Throughout the eight year period from 2000/2001 to 2007/2008, an average of **67.5%** of all assisted vaginal deliveries involved an obstetrician, while family physicians were the care provider at delivery for an average of **32.1%**. There was very little annual change in the proportions, with obstetrician care varying from a high of **69.1%** in 2003/2004 to a low of **65.7%** in 2007/2008. Other care providers represented only **0.5%** of all assisted vaginal deliveries in 2007/2008. Because the sample size was so small for other care providers, these numbers have been excluded from Figure 3.5.6.

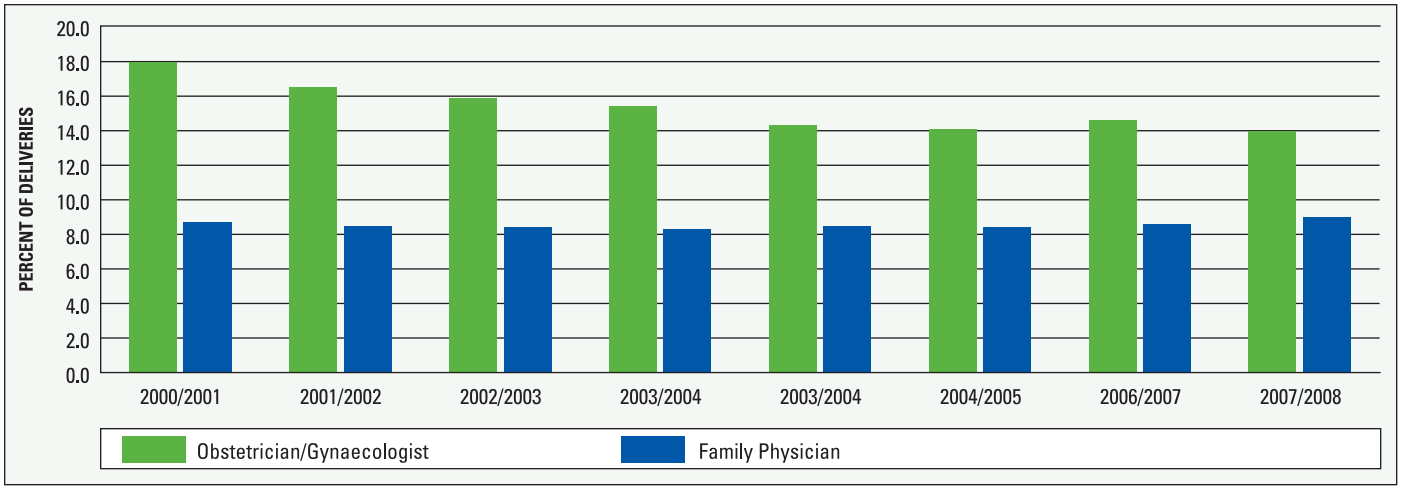
**Figure 3.5.6 Care provider at delivery for assisted vaginal deliveries, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

The rates of assisted vaginal deliveries (as a proportion of all deliveries) by care provider showed some changes over the past eight years (Figure 3.5.7). There has been a relatively steady decline in the rate of assisted vaginal deliveries among obstetricians ranging from a high of **18.0%** in 2000/2001 to a low of **14.0%** in 2007/2008. The rate of assisted vaginal deliveries for family physicians has shown far less variation with no clear pattern over the past eight years. The rate of assisted vaginal deliveries for family physicians ranged from a low of **8.3%** in 2003/2004 to a high of **9.0%** in 2007/2008. Among deliveries attended by other primary care providers, assisted vaginal delivery rates were only **0.5%** in 2007/2008. These rates are not shown in the figure below.

**Figure 3.5.7 Rate of assisted vaginal delivery by care provider, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

The 2008 Canadian Perinatal Health Report[5] identified a similar pattern of decreasing forceps use nationally, declining from 7.4% of all deliveries in 1995/1996 to 4.6% in 2004/2005. However, a corresponding increase in the use of vacuum extractions was not identified in the national data; rather, the use of vacuum instruments has remained fairly stable, increasing from a low of 9.4% in 1995/1996 to a high of 11.2% in 1998/1999, then decreasing to 10.3% in 2004/2005. However, the rate ratio of forceps to vacuum use has been increasing, from 1.3 in 1995/1996 to 2.2 in 2004/2005.

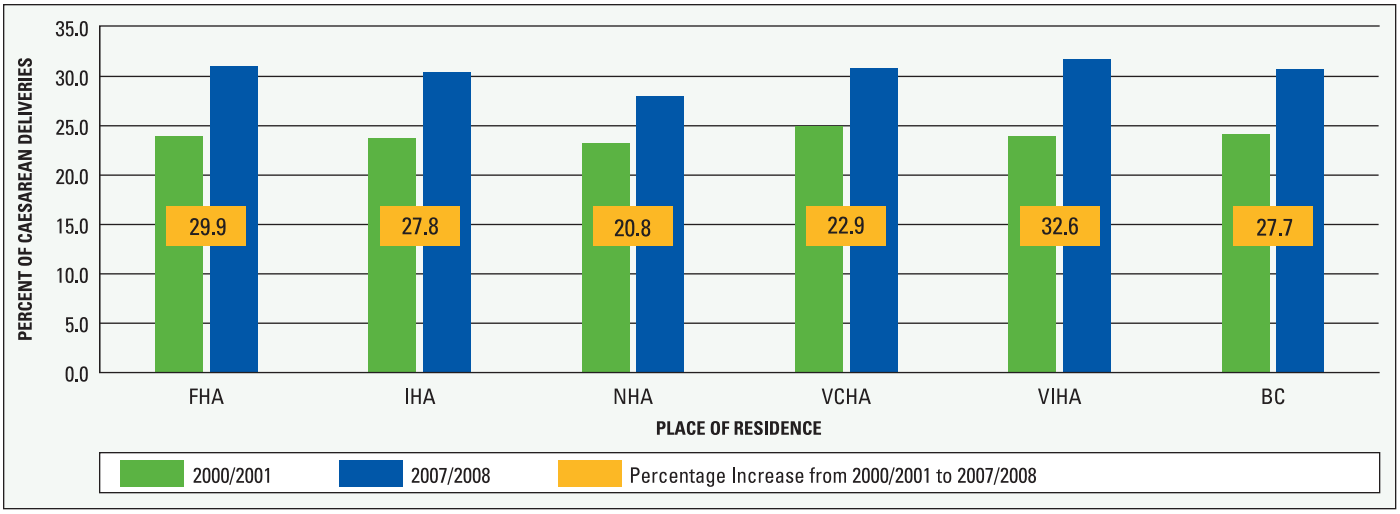
Overall, the rate of assisted vaginal delivery in Canada was 14.8% in 2004/2005. Using the same methodology, BCPHP data shows that this rate was slightly higher at **15.2%**.

## 3.6 Caesarean Delivery

Data on caesarean deliveries for nulliparous women compared to women who have given birth previously was briefly reported in the previous section (see Figures 3.5.0 and 3.5.1). This section focuses on caesarean deliveries and provides more detail into the patterns of caesarean sections in BC. Caesarean deliveries include both elective procedures (i.e., those pre-planned either at the request of the mother or on the recommendation of a health care provider) and emergent procedures (i.e., c-sections that were not a planned method of delivery, including emergency c-sections for mothers who entered into labour spontaneously or who encountered problems during induced labour).

The use of caesarean deliveries has increased in all regions of BC from 2000/2001 to 2007/2008 (see Figure 3.6.0). In 2000/2001, the highest rate of caesarean delivery was found in VCHA (**25.0%**); in 2007/2008, VIHA had the highest rate of caesarean delivery overall (**31.8%**). Indeed, VIHA saw the most growth in the use of caesarean sections, increasing **32.6%** over the eight year period. The least growth occurred in NHA, where rates increased **20.8%** from **23.2%** in 2000/2001 to **28.0%** in 2007/2008. In the last year of data, caesarean section rates were higher than 30% in all health authorities except NHA.

**Figure 3.6.0 Rate of caesarean delivery by resident Health Authority and British Columbia, 2000/2001 and 2007/2008**

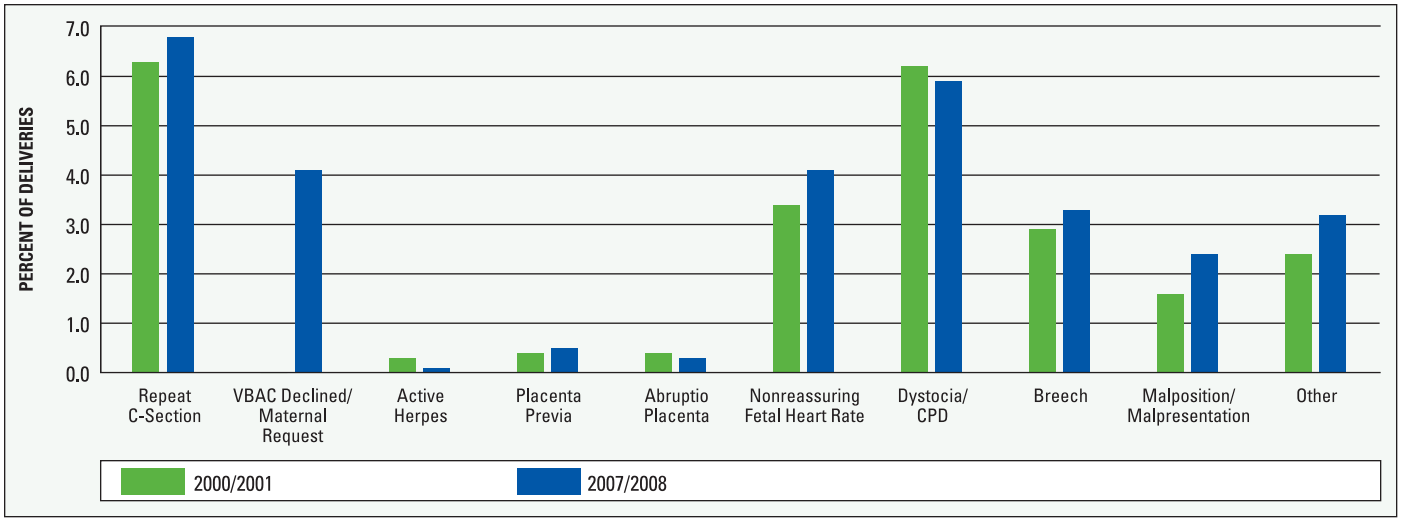



Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.

The indications for caesarean delivery are numerous, and examining how these have changed over time may help foster a better understanding of why caesarean rates continue to increase. The most common primary indications reported for caesarean sections in BC in 2000/2001 and 2007/2008 were repeat c-section (**6.3**; **6.8**), dystocia/CPD (**6.2**; **5.9**), and non-reassuring fetal heart rate (**3.4**; **4.1**) (Figure 3.6.1). As of April 1, 2004 discharges, "maternal request/VBAC declined" was added to the BC Perinatal Database Registry to the list of primary indications for caesarean section. In 2007/2008, caesarean deliveries due to maternal request or due to a vaginal birth after previous caesarean birth was **4.1**% of all births.

Caesareans indicated for repeat c-section or for dystocia/CPD changed slightly over the eight year period (a percentage increase of **7.4**% and a decrease of **5.4**% respectively). However, there was considerable change in the primary indication for caesarean delivery over the eight year period where other indications were reported. Non-reassuring fetal heart rate, for instance, saw an increase of **21.7**% between 2000/2001 and 2007/2008. Malposition/malpresentation increased by **46.7**%, while caesarean deliveries indicated for active Herpes declined by **50.1**%. A large increase was also seen in caesarean deliveries for "other" reasons (**30.8**% rise between 2000/2001 and 2007/2008).

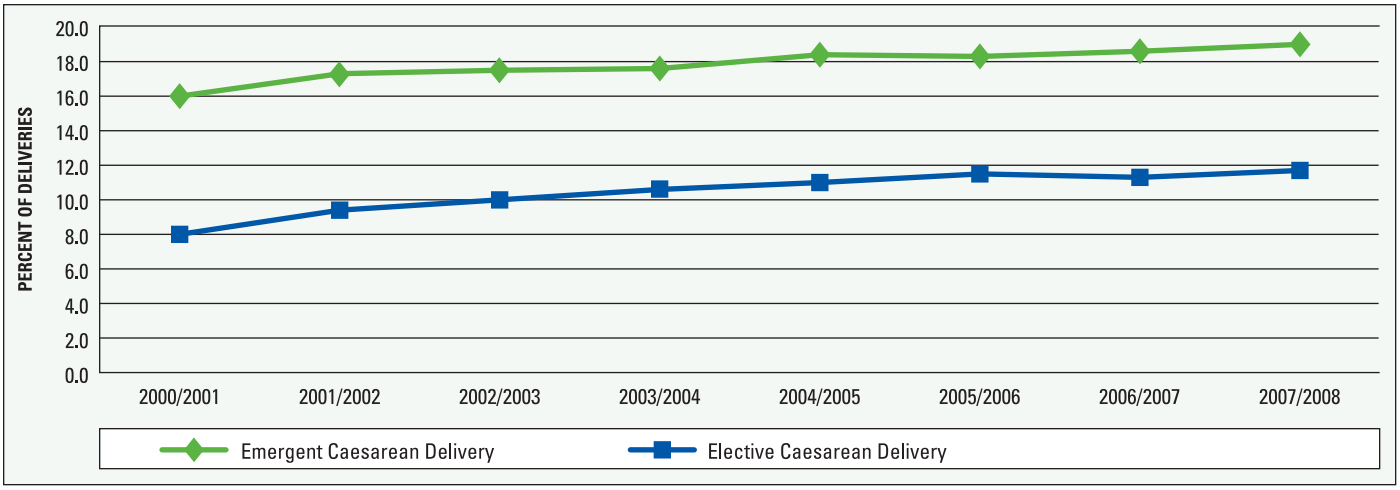
**Figure 3.6.1 Rate of primary indication for caesarean delivery, British Columbia, 2000/2001 and 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

Caesarean deliveries can also be classified as either elective or emergent, as mentioned previously. Emergent caesarean deliveries represent the larger proportion of the two groups (Figure 3.6.2). However, while both types of caesarean delivery are increasing, elective caesareans are increasing at a higher rate. Elective c-sections increased by **46.5**% from **8.0**% in 2000/2001 to **11.7**% in 2007/2008; in addition, emergent c-sections increased **18.4**% from **16.0**% to **19.0**% in the same time period.

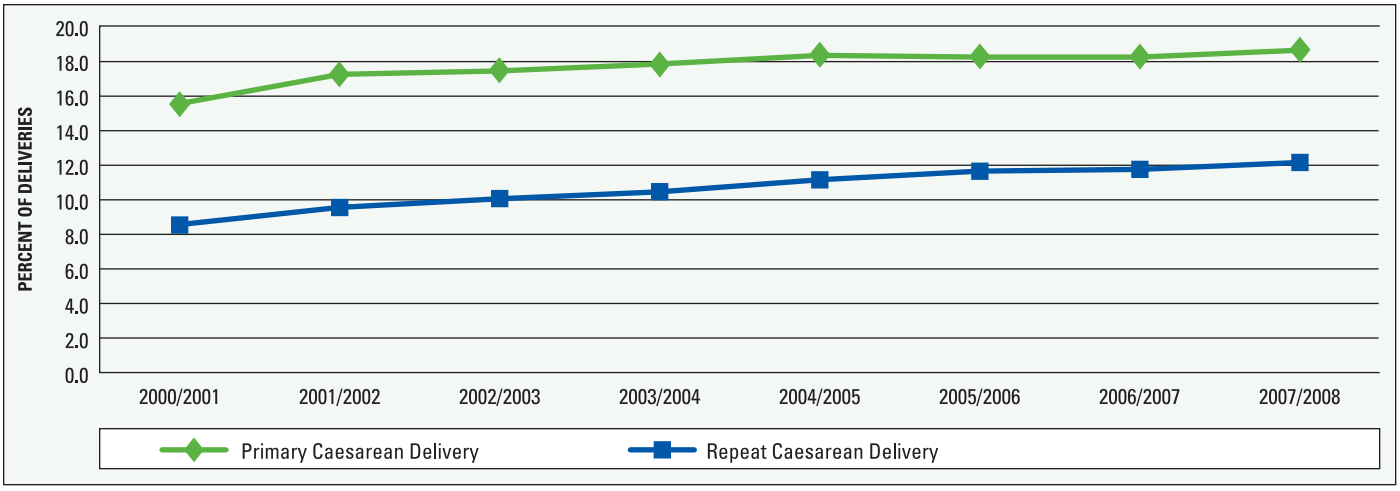
**Figure 3.6.2 Rate of emergent caesarean and elective caesarean delivery, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

Finally, caesarean rates can be examined according to whether the delivery was a first (primary) or subsequent (repeat) caesarean section. Rates of primary caesarean delivery were consistently higher than rates of repeat c-section (Figure 3.6.3). In 2007/ 2008, for instance, **18.6%** of all deliveries were primary caesarean sections, while only **12.1%** were repeat caesareans. However, repeat caesarean deliveries experienced greater growth between 2000/2001 and 2007/2008, increasing at a rate of **41.8%** compared to only **20.0%** for primary caesarean procedures.

**Figure 3.6.3 Rate of primary and repeat caesarean delivery, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

National caesarean rates were reported in the 2008 Canadian Perinatal Health Report.[5] In 2004/2005, the last year of data in the report, the caesarean rate for BC was almost the highest in the country at 29.9 per 100 deliveries, second only to Prince Edward Island at 33.4. The Canadian average was 25.6. Similar to trends identified in the BCPHP data, the Canadian study found that repeat caesarean rates were growing faster than primary rates.

The Maternity Experiences Survey asked women whether they had requested a caesarean delivery at some point during pregnancy, before labour began. It also asked whether a health care provider had recommended a c-section during that time. Just under one-tenth of women in BC (9.0%) reported requesting a caesarean delivery at some point during their pregnancy, compared to a national average of 8.1%. The difference between BC women and Canadian women on the whole was higher when women were asked whether a care provider had recommended a c-section: in BC, 18.1% of women had a care provider recommend a c-section during their pregnancy, while in Canada overall, only 15.8% of women reported such a recommendation. However, 89.5% of BC women reported that their planned caesarean delivery was for a medical reason, slightly more than the national average of 86.7%.[4]

## 3.7 Vaginal Birth After Caesarean

The Society of Obstetricians and Gynaecologists of Canada recommends that provided there are no contraindications, women who have had a previous caesarean delivery should be offered the opportunity to attempt a vaginal delivery in a subsequent pregnancy. Their recommendations for medical intervention in vaginal birth after caesarean (VBAC) deliveries, however, are slightly different from vaginal births in which mothers have had no previous c-section. For instance, continuous use of electronic fetal monitoring is recommended and certain restrictions on the use of pharmaceutical labour induction are indicated.[17]

In 2007/2008, there were **6,327** mothers delivering with at least one previous c-section (**14.5%** of total mothers in 2007/2008). Of the **6,327** mothers, close to one-quarter (n=**1,486**, **23.5%**) had a trial of labour (i.e. attempted a VBAC) and 3 (0.05%) who were unknown, leaving **76.5%** (n=**4,838**) who had no trial of labour.

The differences between those who had a trial of labour and those who did not can be seen in Table 3.7.0. In comparison to those who did not attempt VBAC, those who did attempt VBAC had lower rates of gestational diabetes and gestational hypertension, although women who attempted VBAC in 2007/2008 had higher rates of premature rupture of membranes, post-term pregnancy, and singleton births than those who did not attempt VBAC. Finally, women who had two or more prior caesarean sections were less likely to attempt VBAC.

**Table 3.7.0 Characteristics of women with at least one previous caesarean section who did and did not attempt VBAC in their current pregnancy, British Columbia, 2007/2008**

| | VBAC Attempted (trial of labour) (n=1,486) | | VBAC Not Attempted (no trial of labour) (n=4,838) | |
|---|---|---|---|---|
| | n | % | n | % |
| Singleton births | 1,480 | 99.6 | 4,742 | 98.0 |
| Gestational diabetes | 110 | 7.4 | 503 | 10.4 |
| Gestational hypertension | 30 | 2.0 | 156 | 3.2 |
| Post-term pregnancy | 158 | 10.6 | 95 | 2.0 |
| Term pregnancy | 1,180 | 79.4 | 4,200 | 86.8 |
| Premature rupture of membranes | 308 | 20.7 | 41 | 0.8 |
| Previous CS ≥ 2 | 27 | 1.8 | 1,027 | 21.2 |
| Vertex presentation at delivery | 1,416 | 95.3 | 3,906 | 80.7 |
| Vaginal delivery | 1,037 | 69.8 | n/a | n/a |

Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

One of the challenges associated with analysis of vaginal birth after caesarean is in the determination of a women's eligibility for a trial of labour. Using a database such as the BCPDR presents challenges in that, as a retrospective database, many of the distinct and subtle qualities that determine VBAC eligibility may not be easily identifiable in the data. For example, time between pregnancies (or time since last caesarean) and type of caesarean section scar cannot be determined in the BCPDR.

However, the BCPHP has previously described women who are 'eligible' for vaginal birth after caesarean (that is, who ideally should be encouraged to attempt a vaginal birth for a subsequent pregnancy) as having the following characteristics:

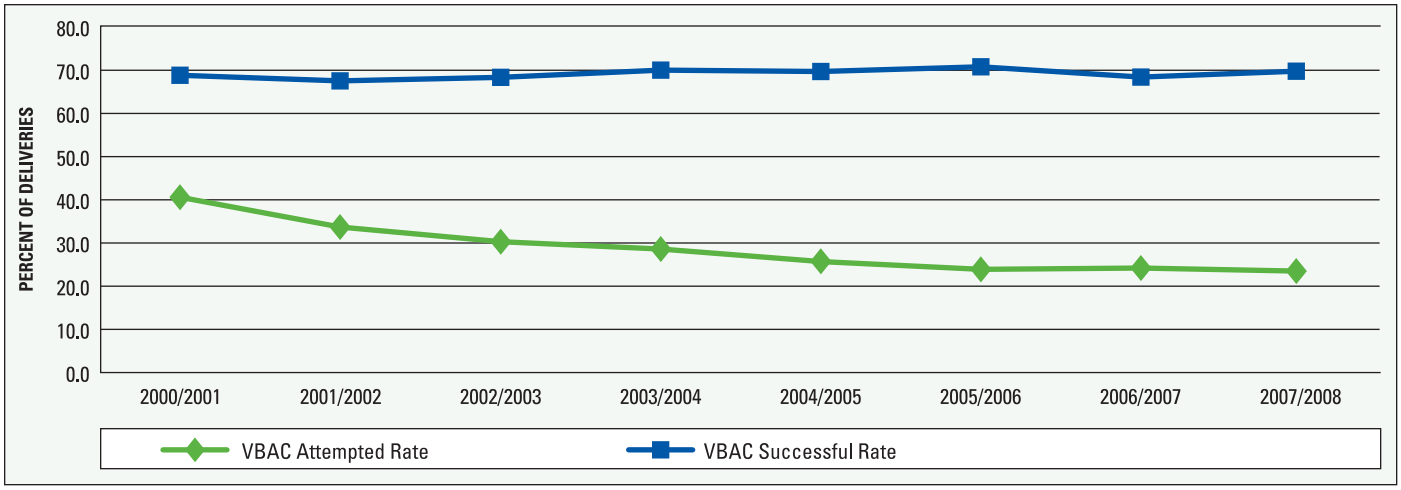
- Term pregnancy (≥ 37 weeks' gestation)
- Singleton pregnancy
- Cephalic presentation at delivery

It is important to understand that the term 'eligible' does not imply criteria that are being implemented by maternity care providers across BC in a deterministic way to decide how individual mothers should give birth. Rather, the criteria are meant to highlight the circumstances in which VBAC ought to be strongly supported. Furthermore, the description of VBAC eligibility as listed above is not meant to exclude other women who may be considered eligible for a trial of labour/attempt at VBAC by their care providers (e.g. certain cases of preterm pregnancy or multiple births among women who may otherwise be considered low-risk). Recent recommendations from the SOGC[18] have suggested revised criteria for VBAC eligibility that include subsets of the maternity population that may be excluded using the above-listed criteria. Although future analyses may incorporate revised VBAC eligibility criteria, for the purposes of the current report, the three indicators listed above have been used to identify a potentially low-risk population where VBAC may be supported.

Based on these criteria, some women with a previous c-section were not considered eligible for VBAC; namely, mothers with a previous caesarean who went into labour prematurely for a subsequent pregnancy, those who experienced multiple birth, or those whose baby had a non-cephalic presentation during delivery. Of the **6,327** delivering women in BC who had previously delivered via c-section in 2007/2008, **4,789** were considered eligible for VBAC (**75.7%**) using the above criteria. Of these, **27.0%** attempted VBAC, with a success rate of **70.8%**. Of the **1,538** who were considered non-eligible for a VBAC (**24.3%**), only 126 delivered vaginally (**8.2%**).

The rate of attempted VBAC has been declining over time (Figure 3.7.0). Between 2000/2001 and 2007/2008, the attempted VBAC rate for all mothers with a previous caesarean delivery in BC declined substantially (Figure 3.7.0), from just under half (**40.6%**) to less than one-quarter (**23.5%**) of mothers with a previous caesarean delivery. The rate of successful VBAC expressed as a percentage of all attempted VBAC, however, has remained relatively constant, increasing from **68.8%** of all attempted VBAC in 2000/2001 to **69.8%** in 2007/2008 and fluctuating between a low of **67.5%** and a high of **70.8%** in the intervening years.

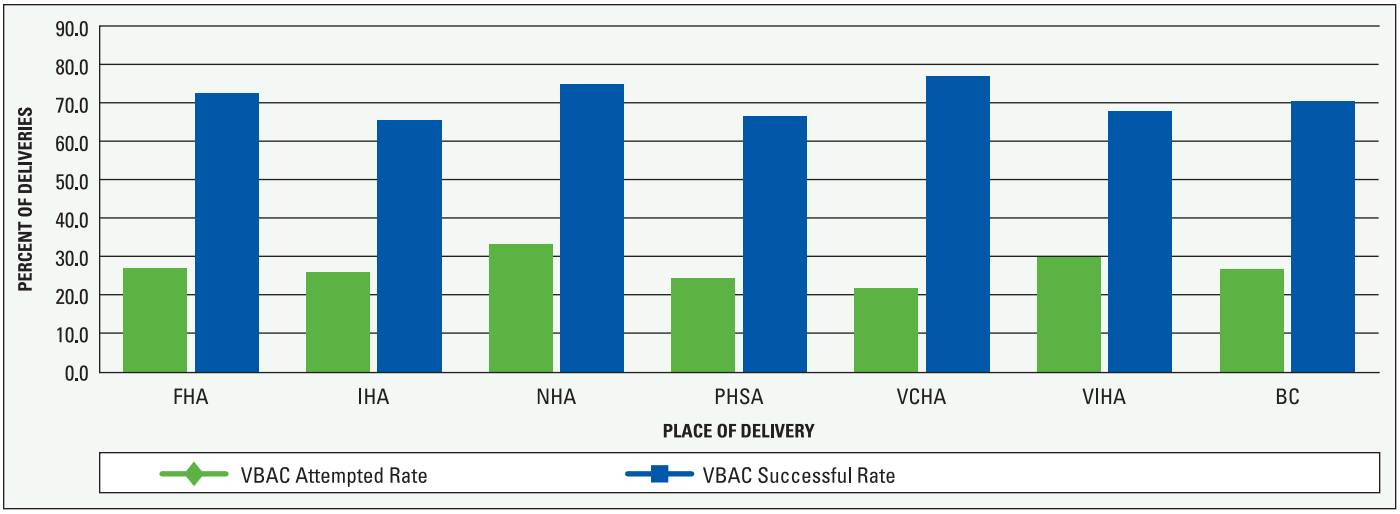
**Figure 3.7.0 Rate of attempted and successful VBAC delivery, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only women considered eligible for a VBAC were included.

There was some regional variation in both the rate of attempted and successful VBAC (Figure 3.7.1). For instance, although VCHA had the lowest rate of attempted VBAC among eligible mothers at only **22.1%**, the rate of successful VBAC was highest in that Health Authority, at **77.2%**. Success rates were lowest in IHA (**65.7%**) where **26.1%** of eligible mothers attempted VBAC. NHA had the highest percentage of eligible mothers attempting VBAC at **33.6%**; **75.2%** of these women successfully delivered via VBAC.

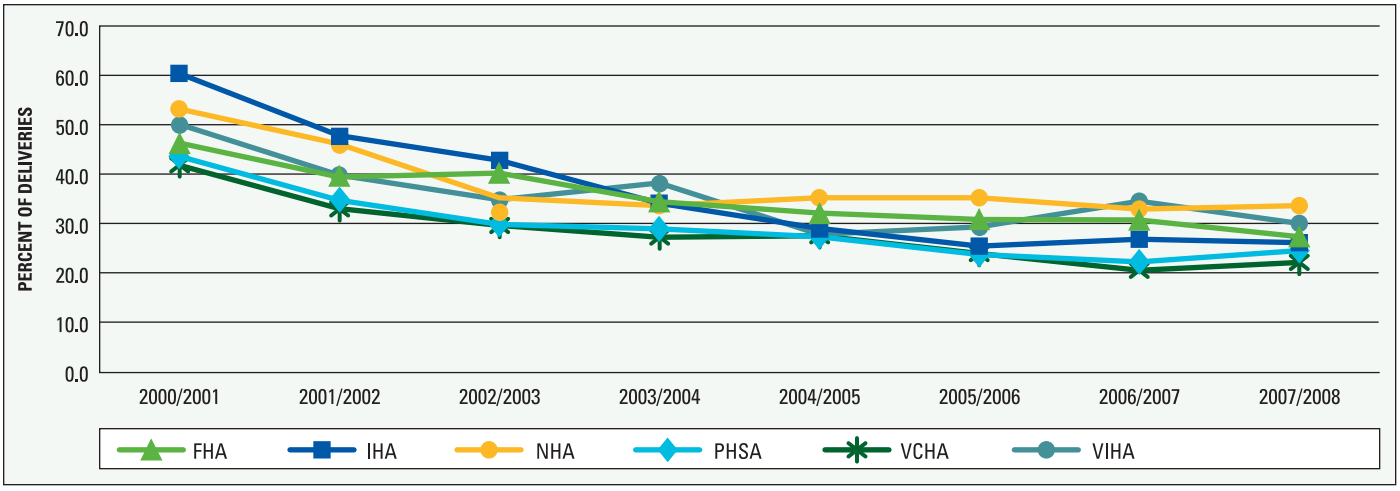
**Figure 3.7.1 Rate of attempted and successful VBAC by delivery Health Authority and British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.
PHSA refers to BC Women's Hospital patients only.
Only women considered eligible for a VBAC were included.

As with the provincial rates, the Health Authority-specific attempted VBAC rates have declined substantially over the last eight years (Figure 3.7.2). The rate of decline, however, has differed across regions. For instance, in IHA, the attempted VBAC rate decreased from a high of **60.4%** (the highest rate in any region in any year) in 2000/2001 to a low of **25.4%** in 2005/2006; this rebounded to only **26.1%** by 2007/2008 (a **56.8%** decrease). On the other hand, in NHA, the attempted VBAC rate decreased from **53.2%** in 2000/2001 to **33.6%** in 2007/2008, a decrease of **36.8%**. In VIHA, the only other Health Authority where the attempted VBAC rate was 50% or higher in 2000/2001 (at **50.1%**), the rate has decreased **40.1%** in the last eight years and was **30.0%** in 2007/2008. VIHA rates showed more variation during this time period than did other regions.

**Figure 3.7.2 Rate of attempted VBAC by delivery Health Authority, 2000/2001 to 2007/2008**



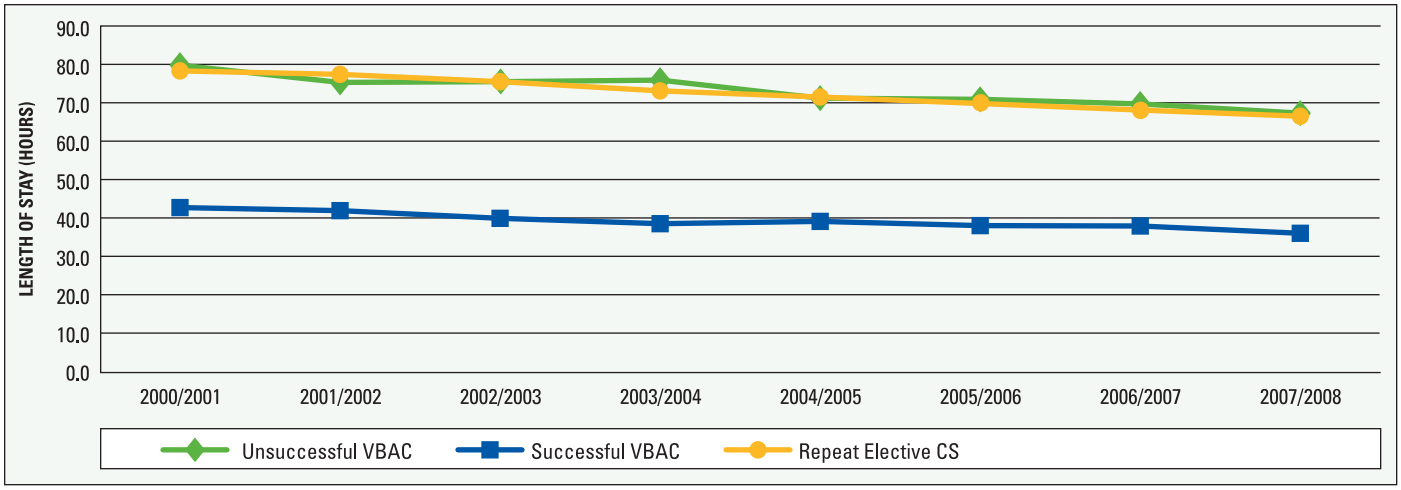

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.
PHSA refers to BC Women's Hospital patients only.
Only women considered eligible for a VBAC were included.

### VBAC – Maternal Outcomes

Successful VBAC delivery was associated with shorter duration in hospital for eligible mothers in comparison to mothers who attempted and were unsuccessful in having a vaginal delivery (and thus ultimately delivered via emergent c-section) and for eligible mothers who delivered via repeat elective caesarean (Figure 3.7.3). For example, in 2007/2008, mothers who successfully delivered via VBAC were in hospital for an average of **36.6** hours after delivery, while mothers who attempted and were unsuccessful having a VBAC delivery were in hospital for an average of **67.3** hours. Mothers considered eligible for VBAC but who delivered via elective caesarean were in hospital for an average of **66.6** hours in that year.

For all groups of mothers, the average length of stay in hospital has been decreasing over the last eight years. The rate of decline has been consistent across groups (a **14.4%** decrease for mothers who successfully delivered via VBAC, a **15.7%** decrease for those who attempted and were unsuccessful in having a VBAC, and a **15.0%** decrease for eligible mothers who delivered via elective c-section).

**Figure 3.7.3 Average length of hospital stay (hours) for VBAC eligible women who attempted VBAC (successful and unsuccessful) and women who delivered via repeat elective caesarean, British Columbia, 2000/2001 to 2007/2008**

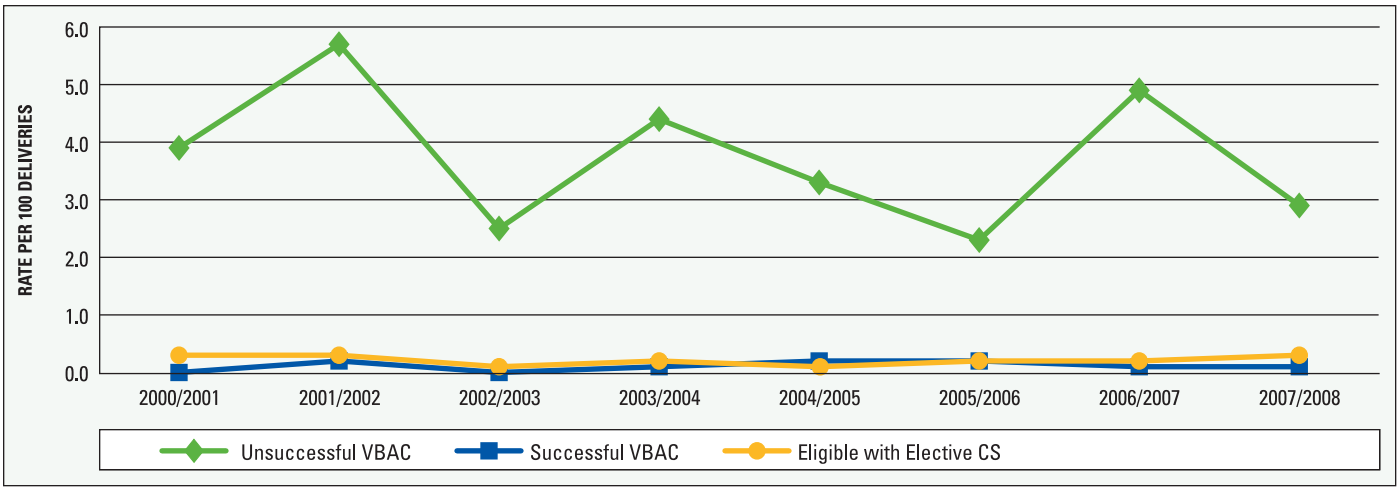



Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only women considered eligible for a VBAC were included.

A second maternal health outcome that was examined in relation to VBAC success was the incidence of uterine rupture and/or dehiscence (Figure 3.7.4). From 2004/2005 onwards, the two conditions, uterine rupture and uterine dehiscence, can be differentiated in the BCPHP database, however, prior to that time, the two conditions could not be differentiated. Thus, in this analysis, both conditions were considered together. Of note, an examination of cases of uterine rupture and uterine dehiscence across the four available years of data (2004 to 2008) where the two conditions could be differentiated demonstrated 14 cases of uterine rupture compared to 61 cases of uterine dehiscence for both successful and unsuccessful VBAC.

Although overall the number of mothers who were eligible for VBAC and who experienced uterine rupture/dehiscence were small, there was a vast difference between the rupture/dehiscence rate among women who had attempted and were unsuccessful for a VBAC delivery compared to women who had successfully delivered via VBAC or who had an elective caesarean delivery instead. The uterine rupture/dehiscence rate for women who had attempted and were unsuccessful for a VBAC delivery fluctuated from a high of **5.7** per 100 in 2001/2002 to a low of **2.3** per 100 in 2005/2006. The uterine rupture/dehiscence rate for women who had attempted and were unsuccessful for a VBAC delivery was **2.9** per 100 in 2007/2008, the rate for eligible women who delivered via elective caesarean at **0.3** per 100 and the rate for eligible women who successfully delivered via VBAC at **0.1** per 100.

**Figure 3.7.4 Rate of uterine rupture/dehiscence for women who attempted VBAC (successful and unsuccessful) and women eligible for VBAC who delivered via elective caesarean, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Uterine rupture = full thickness separation of the uterine wall and the underlying serosa, a rare occurrence where there is life-threatening maternal and fetal compromise; uterine scar dehiscence = separation of a preexisting scar that does not disrupt the overlying perinatal viscera. (www.emedicine.medscape.com/article/275854-overview)
Only women considered eligible for a VBAC were included.

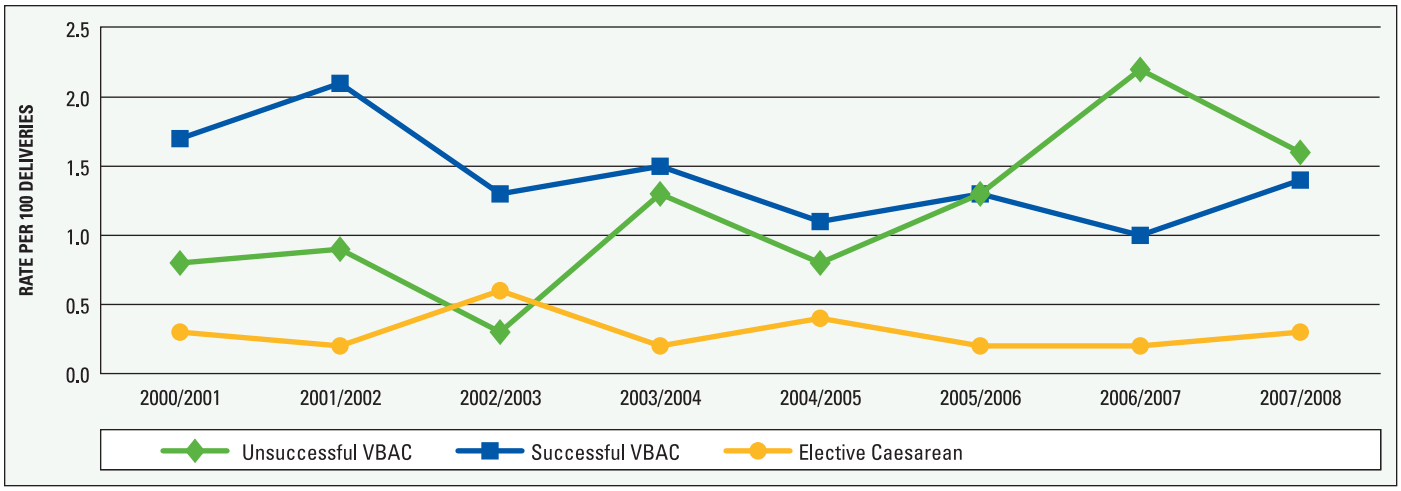
### VBAC – Infant Outcomes

In additional to maternal outcomes, infant health outcomes were also examined, including the incidence of Apgar scores less than 7 at 5 minutes after birth (Figure 3.7.5). Apgar scores evaluate five criteria that can be used as indicators of the need for immediate medical attention: colour, heart rate, reflex irritability, muscle tone, and respiration.

Infants born to mothers who attempted VBAC have slightly higher incidence of low Apgar scores than infants born to mothers who delivered via elective caesarean section. For instance, in 2007/2008, infants born to mothers who attempted and were unsuccessful for a VBAC delivery had a low Apgar score incidence of **1.6** per 100 and those born to mothers who successfully delivered via VBAC had a low Apgar score incidence of **1.4** per 100. In comparison, infants born to mothers who had an elective caesarean delivery had a low Apgar score incidence of only **0.3** per 100.

However, there was considerable variation when comparing infants born to mothers who attempted and were unsuccessful for a VBAC to infants born to mothers who successfully delivered via VBAC. Much of this variation is due to the fact that the number of low Apgar-scoring babies is quite low overall. Further monitoring over the next few years is required to determine whether a trend is developing, or whether apparent increases and decreases are simply normal variation.

**Figure 3.7.5 Rate of low Apgar scores among infants born to mothers who attempted VBAC (successful and unsuccessful) and women eligible for VBAC who delivered via elective caesarean, British Columbia, 2000/2001 to 2007/2008**



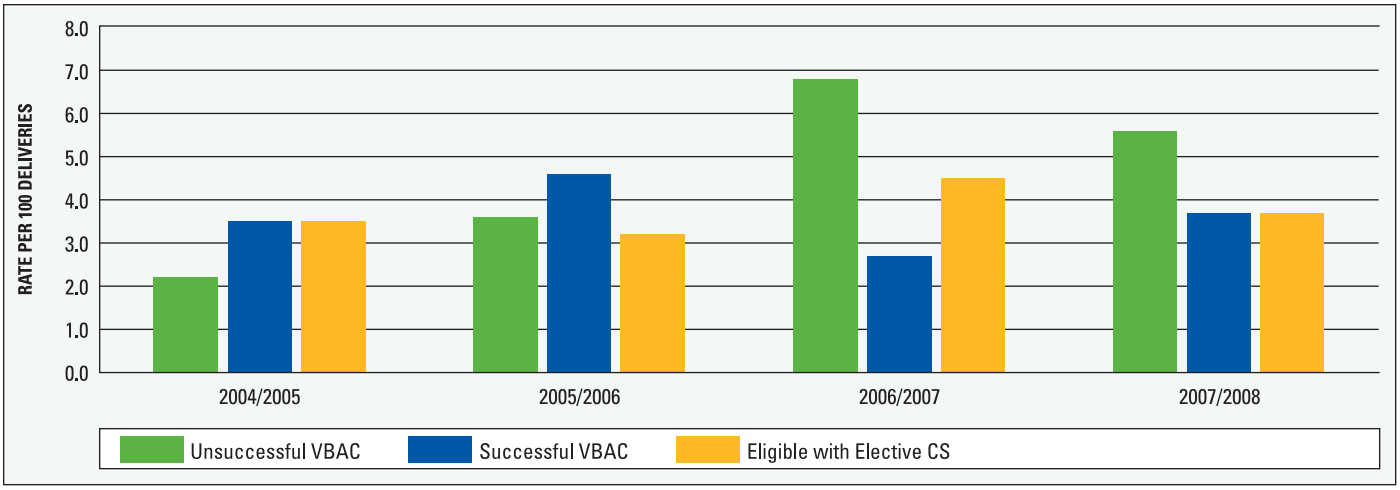

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only women considered eligible for a VBAC were included.

### NICU Admissions

A final infant health outcome was the rate at which infants were admitted into the Neonatal Intensive Care Unit (NICU) after birth (Figure 3.7.6). As with Apgar scores, small sample sizes overall contribute to a substantial amount of variation in the data, making it difficult to interpret. Analyzing this measure is further hampered by the fact that data is only available from 2004/2005 forward; however, there does not appear to be any increasing or decreasing trend over time for any of the delivery groups.

In 2007/2008, the NICU hospitalization rate for infants born to mothers who successfully delivered via VBAC was **3.7** per 100, as was the rate for infants born to mothers who delivered via elective c-section. In contrast, infants born to mothers who attempted and were unsuccessful for a VBAC delivery were hospitalized in NICU at a rate of **5.6** per 100.

**Figure 3.7.6 Rate of NICU admissions among infants born to mothers who attempted VBAC (successful and unsuccessful) and women eligible for VBAC who delivered via elective caesarean, British Columbia, 2004/2005 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only women considered eligible for a VBAC were included.

## 3.8 Robson Caesarean Classification System

As mentioned at the onset of this chapter, the Robson Caesarean Classification System was developed to delineate the incidence of caesarean deliveries among different groups of mothers, recognizing that the appropriateness of caesarean section differs depending on a number of factors. These factors include the mother's previous obstetric record (for instance, whether or not she has had children previously, and whether previous deliveries were c-section deliveries); the course of the current delivery (whether labour began spontaneously, was induced, or whether c-section was chosen for delivery before labour began); the category of pregnancy (single cephalic, single breech, multiple, or single transverse/oblique); the gestational age of the fetus at delivery.[15] The system, then, is another way of presenting data on caesareans that provides more detailed information, which will be beneficial to better understand how these factors are influencing caesarean rates.

An eleventh grouping was added to the system – "other (presentation unknown)" to better classify the data into caesarean cases. This category was used when it was not known whether the infant was cephalic, breech, or transverse/oblique. As well, while the original classification system did not differentiate between type of delivery for Groups 2, 4, and 5 (Figure 3.8.0), the BCPHP data allows for the subdivision of these categories into spontaneous, induced, and elective c-section deliveries.

During the period from 2000/2001 to 2007/2008 there was an increase in caesarean section rates from **24.1%** to **30.7%**. Exploring this rate change in terms of previous birth history, current conditions, and presentation revealed an increase in the caesarean section rate for all groupings with the exception of singleton births with transverse or oblique presentation (Group 9). In 2000/2001, **91.9%** of singleton births in this group resulted in a caesarean section whereas by 2007/2008 this rate had fallen to **59.7%**. However, these births accounted for less than **0.5%** of all births in both years (**1.4%** and **1.3%** of all c-sections in 2000/2001 and 2007/2008 respectively).

The largest change in caesarean section rates was among term singleton births to women who had given birth via caesarean section in the past (Group 5). Among this group the caesarean rate increased from **66.1%** in 2000/2001 to **80.6%** in 2007/2008. This group of births accounted for **5.8%** of all births in 2000/2001 increasing to **8.9%** in 2007/2008, making it the largest contributor to the c-section rate in both years. This finding is consistent with findings in other jurisdictions, where women with a history of previous c-section consistently experienced the highest caesarean rates in current pregnancies.[18] In 2007/2008, this category accounted for **28.9%** of all caesarean deliveries.

Among women giving birth to their first singleton child at term with spontaneous labour (Group 1) the rate increased **3.9%** from **16.3%** in 2000/2001 to **20.0%** in 2007/2008. This group of births accounted for **4.4%** of all births in 2000/2001 and increased to **5.4%** in 2007/2008. Nulliparous women whose labour was induced or whose delivery was via elective c-section (Group 2) were the third-largest contributor to the caesarean rates (**5.3%** in 2007/2008); the proportion of women in this category who delivered via c-section increased from **35.2%** to **44.1%** between 2000/2001 and 2007/2008. Nulliparous women with spontaneous labour accounted for **17.4%** of all caesarean deliveries in 2007/2008, while nulliparous women whose labour was induced accounted for a further **13.4%**. In 2007/2008, nulliparous women who were induced experienced a higher caesarean section rate (**38%**) than nulliparous women who laboured spontaneously (**20.0%**).

There was also a **13.3%** increase in the caesarean section rate for multiple pregnancies (Group 8) from **41.4%** in 2000/2001 to **68.1%** in 2007/2008.

The contribution of these births to the overall c-section rate was small; however, it too increased, from **0.3**% to **1.1**%.

In brief, the use of the Robson classification is a method of categorizing women into comparable mutually exclusive groups (e.g., parity, number of births, obstetric history, period of gestation, presentation at delivery, etc), which has been applied to British Columbia deliveries for 2000 and 2007.

Another advantage of the Robson classification is that it can be used at the facility or Health Authority level, to compare over time, or to other peer facilities, to address caesarean section rates in specific subsets of the obstetric population. Further detailed analysis of the BCPHP data using the Robson classification in future publications will be beneficial in comparing caesarean section rates in British Columbia for evaluative purposes.

**Table 3.8.0 Robson Classification System birth types and births by caesarean section, 2000/2001 and 2007/2008**

| | 2000/2001 | | | | | | 2007/2008 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Total | | Caesarean Sections | | % of Total CS | Contribution to CS Rate | Total | | Caesarean Sections | | % of Total CS | Contribution to CS Rate |
| Group | # | % | # | % | | | # | % | # | % | | |
| 1 Nulliparous, singleton, cephalic, 37+, spontaneous | 10,867 | 27.2 | 1,767 | 16.3 | 18.4 | 4.4 | 11,655 | 26.8 | 2,328 | 20.0 | 17.4 | 5.4 |
| 2 Nulliparous, singleton, cephalic, 37+, induced/elective c-section | 4,109 | 10.3 | 1,446 | 35.2 | 15.0 | 3.6 | 5,232 | 12.0 | 2,309 | 44.1 | 17.3 | 5.3 |
| (2a) induced | 3,946 | 9.9 | 1,283 | 32.5 | 13.3 | 3.2 | 4,711 | 10.8 | 1,788 | 38.0 | 13.4 | 4.1 |
| (2b) c-section | 163 | 0.4 | 163 | 100.0 | 1.7 | 0.4 | 521 | 1.2 | 521 | 100.0 | 3.9 | 1.2 |
| 3 Multiparous, singleton, cephalic, 37+, spontaneous, no previous c-section | 11,997 | 30.0 | 281 | 2.3 | 2.9 | 0.7 | 11,607 | 26.7 | 303 | 2.6 | 2.3 | 0.7 |
| 4 Multiparous, singleton, cephalic, 37+, induced/elective, no previous c-section | 3,153 | 7.9 | 238 | 7.5 | 2.5 | 0.6 | 3,217 | 7.4 | 369 | 11.5 | 2.8 | 0.8 |
| (4a) induced | 3,079 | 7.7 | 164 | 5.3 | 1.7 | 0.4 | 3,016 | 6.9 | 168 | 5.6 | 1.3 | 0.4 |
| (4b) c-section | 74 | 0.2 | 79 | 106.8 | 0.8 | 0.2 | 201 | 0.5 | 201 | 100.0 | 1.5 | 0.5 |
| 5 Multiparous, singleton, cephalic, 37+, previous c-section | 3,502 | 8.8 | 2,315 | 66.1 | 24.1 | 5.8 | 4,789 | 11.0 | 3,861 | 80.6 | 28.9 | 8.9 |
| (5a) spontaneous | 1,577 | 3.9 | 632 | 40.1 | 6.6 | 1.6 | 1,480 | 3.4 | 663 | 44.8 | 5.0 | 1.5 |
| (5b) induced | 369 | 0.9 | 127 | 34.4 | 1.3 | 0.3 | 186 | 0.4 | 75 | 40.3 | 0.6 | 0.2 |
| (5c) c-section | 1,556 | 3.9 | 1,556 | 100.0 | 16.2 | 3.9 | 3,123 | 7.2 | 3,123 | 100.0 | 23.4 | 7.2 |
| 6 Nulliparous, breech | 1,158 | 2.9 | 1,064 | 91.9 | 11.1 | 2.7 | 1,039 | 2.4 | 989 | 95.2 | 7.4 | 2.3 |
| 7 Multiparous, breech | 1,018 | 2.5 | 871 | 85.6 | 9.1 | 2.2 | 698 | 1.6 | 615 | 88.1 | 4.6 | 1.4 |
| 8 Multiple pregnancy | 280 | 0.7 | 116 | 41.4 | 1.2 | 0.3 | 700 | 1.6 | 477 | 68.1 | 3.6 | 1.1 |
| 9 Singleton, transverse/oblique | 149 | 0.4 | 137 | 91.9 | 1.4 | 0.3 | 283 | 0.7 | 169 | 59.7 | 1.3 | 0.4 |
| 10 Singleton, cephalic, <37 | 2,254 | 5.6 | 440 | 19.5 | 4.6 | 1.1 | 2,780 | 6.4 | 772 | 27.8 | 5.8 | 1.8 |
| 11 All others where presentation was unknown | 1,482 | 3.7 | 938 | 63.3 | 9.8 | 2.3 | 1,493 | 3.4 | 1,170 | 78.4 | 8.8 | 2.7 |
| Total | 39,969 | 100.0 | 9,613 | 100.0 | 100.0 | 24.1 | 43,493 | 100 | 13,362 | 100.0 | 100.0 | 30.7 |

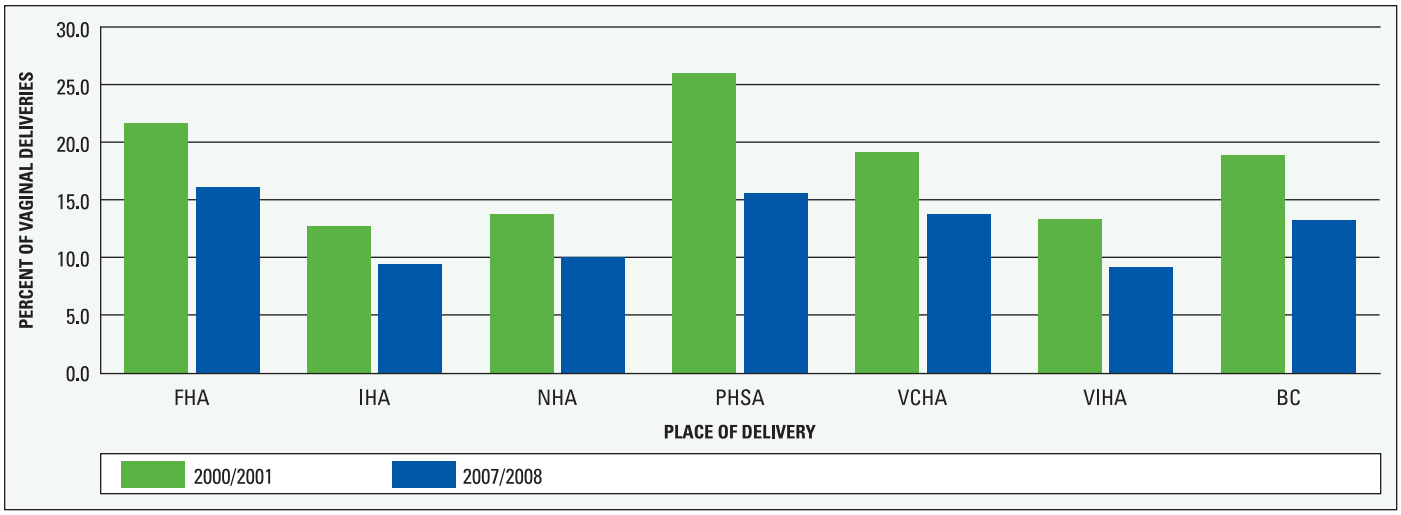
Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
"% of Total CS" refers to the percentage of c-section births in the category out of all births delivered via c-section.
"Contribution to CS rate" refers to the percentage of c-section births in the category out of all births in the year.

## 3.9 Perineal Trauma

Vaginal delivery morbidity focuses on common morbidities of delivery, including episiotomies and severe (third and fourth degree) lacerations.

During the period between 2000/2001 and 2007/2008 episiotomy rates declined in each region throughout the province by an average of **5.4%** (Figure 3.9.0). The greatest decrease was seen in the PHSA, from over one quarter of vaginal deliveries (**26.1%**) in 2000/2001 to **15.7%** in 2007/2008. This change moved PHSA from the highest rate in the province to just below that of FHA which had the highest rate in 2007/2008 at **16.2%**. The lowest rate was seen in VIHA in which **9.2%** of vaginal deliveries included an episiotomy in 2007/2008.

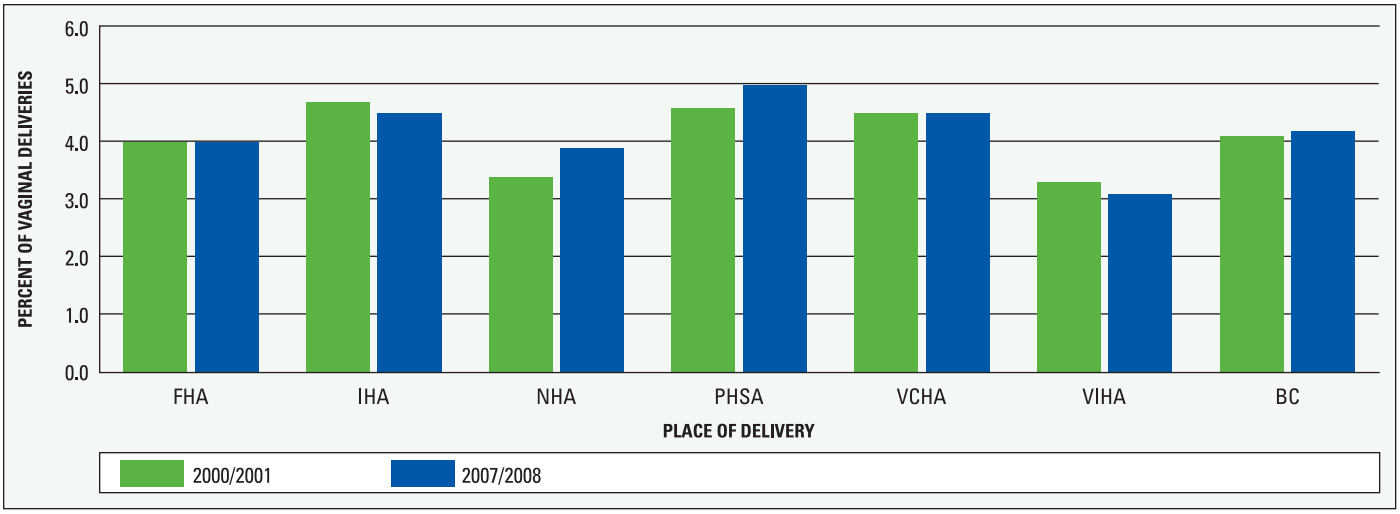
**Figure 3.9.0 Episiotomy rate by delivery Health Authority and British Columbia, 2000/2001 and 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.
PHSA refers to BC Women's Hospital patients only.

Despite the significant decreases in episiotomy rates there were no discernible changes in the rates of third and fourth degree laceration (Figure 3.9.1). Overall, laceration rates in the province were virtually unchanged from **4.1%** in 2000/2001 to **4.2%** in 2007/2008. The largest changes were seen in NHA, which increased **0.5%** from **3.4%** in 2000/2001 to **3.9%** in 2007/2008 and PHSA, which increased **0.4%** from **4.6%** in 2000/2001 to **5.0%** in 2007/2008.

**Figure 3.9.1 Third and fourth degree laceration by delivery Health Authority and British Columbia, 2000/2001 and 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.
PHSA refers to BC Women's Hospital patients only.

The 2008 Canadian Perinatal Health Report provided information on episiotomies and lacerations for women across the country in 2004/2005.[5] At that time, 20.4% of women in Canada had received an episiotomy, compared to 15.4% of women in BC. The proportion of women who experienced lacerations was very similar in that year: 4.0% of women in BC compared to a national average of 3.9%.[5]

## SECTION FOUR

# Maternal Health Outcomes


*Optimizing Neonatal, Maternal and Fetal Health*

Maternal health outcomes include both life-threatening and non-life-threatening conditions that may affect a woman's health and wellbeing. These are conditions that may arise during pregnancy, labour, and delivery; however, maternal health outcomes also encompass chronic conditions that may be affected by pregnancy and giving birth.

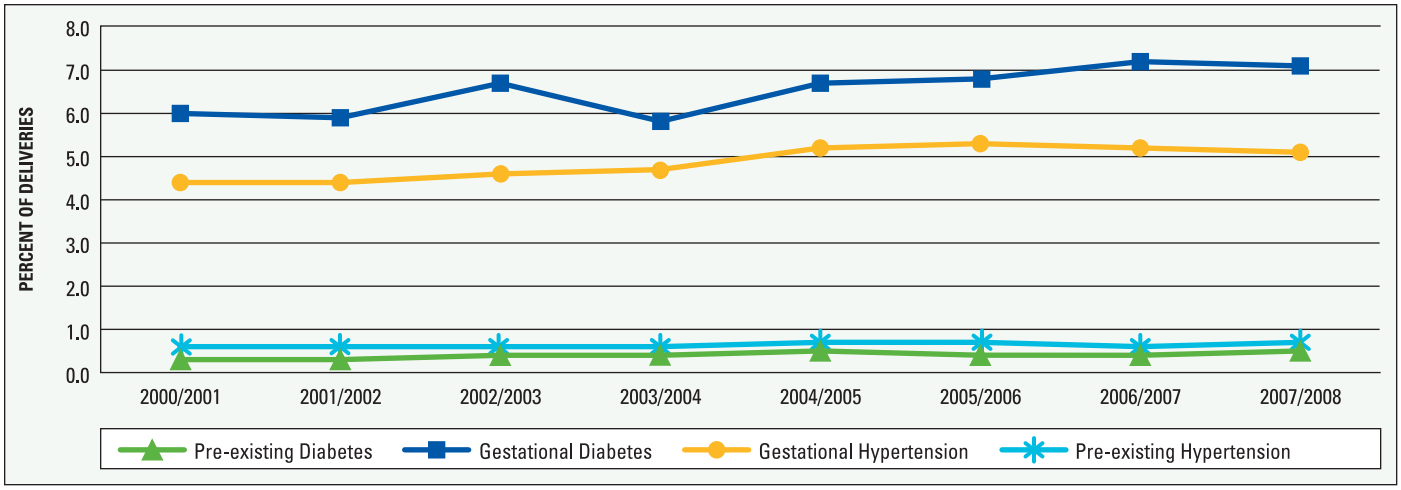
There are many maternal health outcomes of interest, but some health outcomes can be difficult to measure through the use of administrative data. In this report, the maternal health outcomes that are reported are diabetes, hypertension, severe maternal morbidity, antepartum and postpartum length of stay in hospital, and maternal postpartum readmission.

## 4.1 Diabetes and Hypertension

Diabetes and hypertension are chronic conditions that can be exacerbated by pregnancy. As well, both conditions have sub-types that specifically develop during pregnancy and gradually resolve after delivery. Additionally, developing sub-types of these conditions during pregnancy greatly increases a woman's risk of later developing non-gestational sub-types of either disease. Diabetes and hypertension are linked with increased disability and mortality as women age, making early diagnosis of these conditions very important.

Both gestational diabetes and gestational hypertension rates have been increasing over the last eight years (Figure 4.1.0). Gestational diabetes increased from **6.0%** to **7.1%**, a **20%** increase, while gestational hypertension increased from **4.4%** to **5.1%** (also a **20%** increase) between 2000/2001 and 2007/2008. Although the rates were much smaller, pre-existing diabetes and hypertension also increased during that time.

**Figure 4.1.0 Diabetes and hypertension rates, British Columbia, 2000/2001 to 2007/2008**

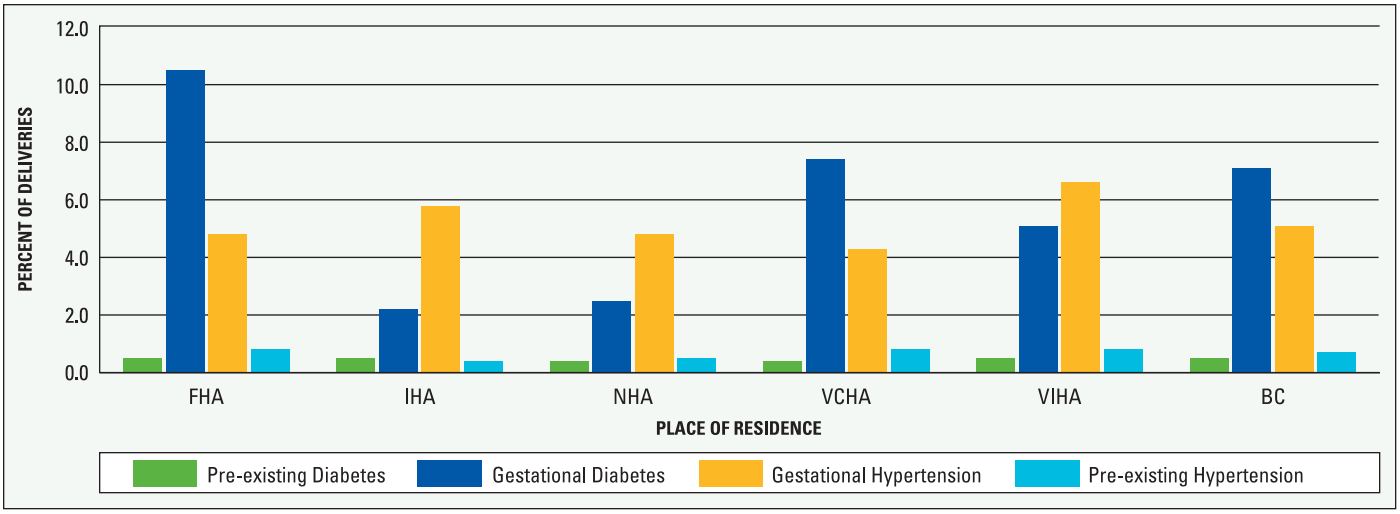



Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

There was some variation in the diabetes and hypertension rates among resident health authorities (Figure 4.1.1). Most notably, gestational diabetes rates among women residing in the FHA and the VCHA were considerably higher (at **10.5%** and **7.4%**, respectively, for 2007/2008) than elsewhere in the province.

Gestational hypertension, on the other hand, was highest in VIHA and IHA, at **6.6%** and **5.8%**, respectively, compared to a provincial average of **5.1%**. However, IHA had the lowest rate of pre-existing hypertension in the province at **0.4%**. The rate of pre-existing hypertension was also low in NHA at **0.5%**; in all other health authorities, the rate was **0.8%** in 2007/2008.

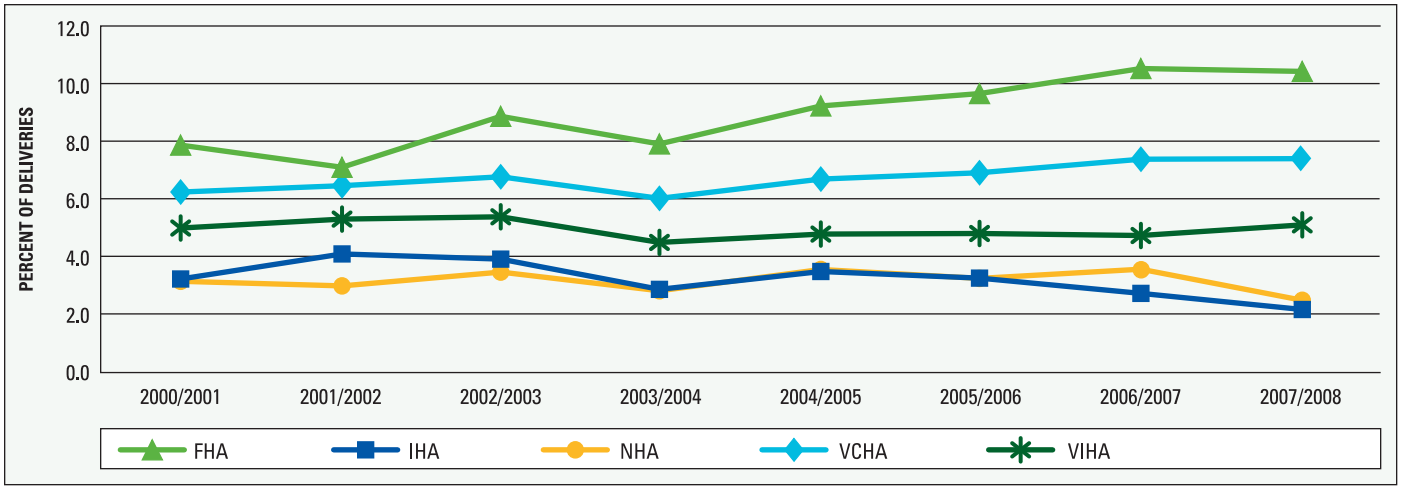
**Figure 4.1.1 Diabetes and hypertension rates by resident Health Authority and British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.

Examining trends over time showed that the incidence of gestational diabetes is increasing in three health authorities and decreasing in two (Figure 4.1.2). Between 2000/2001 and 2007/2008, the gestational diabetes rate in FHA increased **32%** from **7.9%** of **10.5%**. In VCHA, the rate increased **18%** in the same time period, while VIHA saw a modest increase of **2%**. The latter may be due to normal variation. In contrast, the rate of gestational diabetes decreased in IHA and NHA, by **33%** and **21%** respectively over eight years (Figure 4.1.2).

**Figure 4.1.2 Gestational diabetes rates by resident Health Authority, 2000/2001 to 2007/2008**

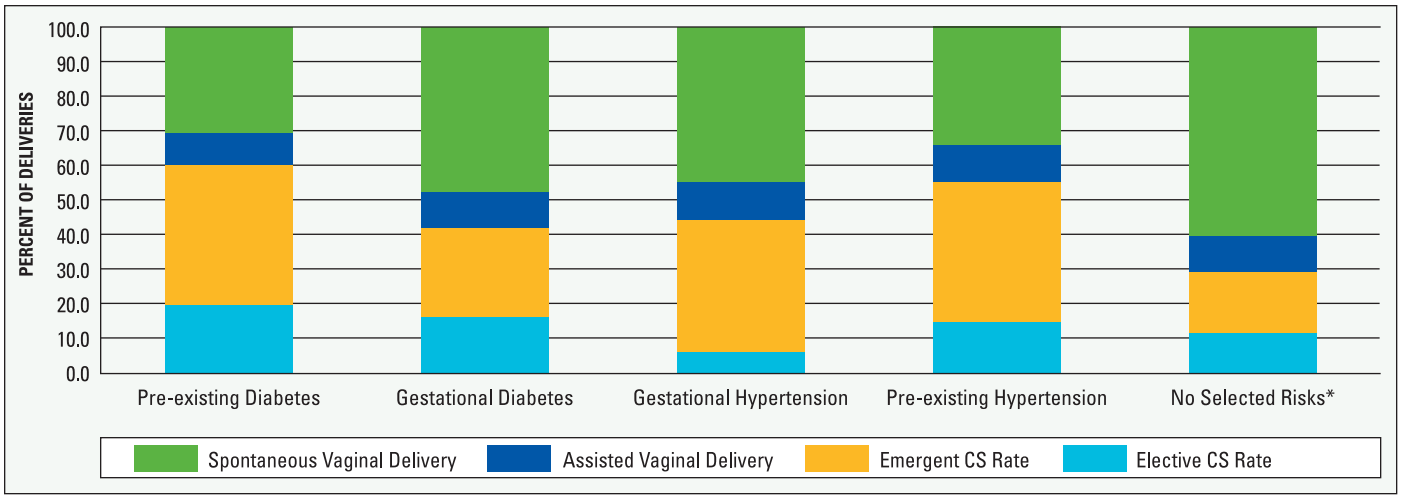



Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.

Because chronic diseases can complicate pregnancy and delivery, women with hypertension or diabetes are more likely to deliver via c-section (Figure 4.1.3). In 2007/2008, only **30.6%** of mothers with pre-existing diabetes, **47.5%** of mothers with gestational diabetes, **34.3%** of mothers with pre-existing hypertension, and **44.7%** of mothers with gestational hypertension had spontaneous vaginal births, compared with **60.3%** of women without diabetes or hypertension (pre-existing or gestational). Conversely, **40.8%** and **40.3%** of mothers with pre-existing diabetes and pre-existing hypertension, respectively, delivered via emergent caesarean section that year. Although, the emergent caesarean rates for gestational diabetes and hypertension were lower in comparison, at **26.0%** and **38.2%**, the rate was still substantially higher than that for women with neither condition (**17.4%**).

Interestingly, the elective caesarean rate for women with gestational diabetes was lower than for women who had neither condition. Rates for assisted vaginal deliveries were roughly equivalent for all groups.

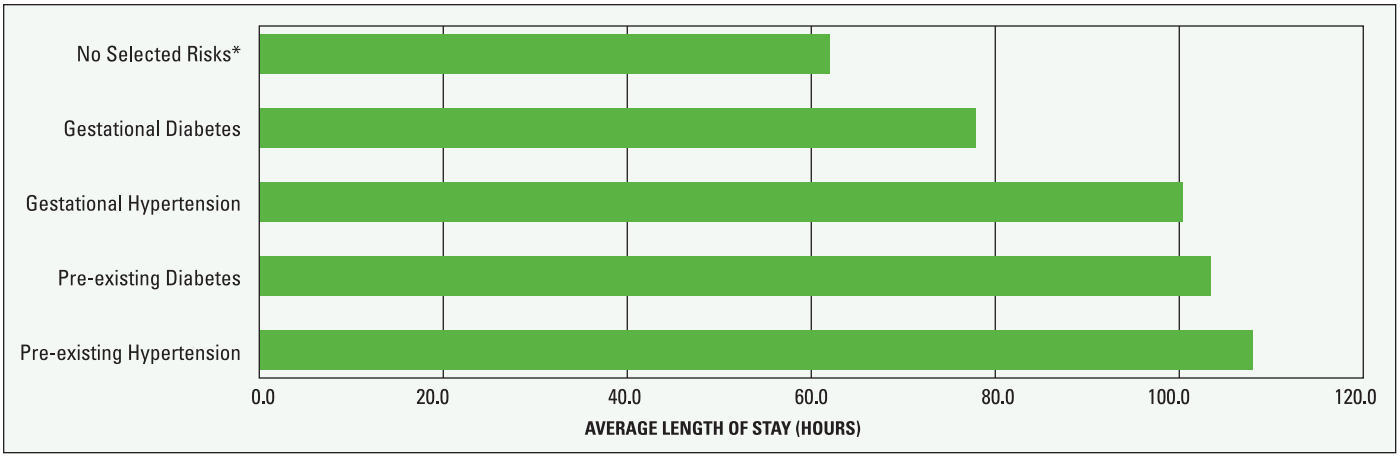
**Figure 4.1.3 Method of delivery rates by diabetes and hypertension categories, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
*No selected risks = mothers without diabetes or hypertension (gestational or pre-existing) in pregnancy.

The presence of chronic illnesses like diabetes and hypertension may cause complications throughout labour, delivery and postpartum, including a higher likelihood of caesarean section delivery, resulting in longer than average hospital stays than women without chronic illnesses (Figure 4.1.4). Mothers with diabetes or hypertension, whether gestational or pre-existing, had longer lengths of stay than mothers with neither condition. However, those with pre-existing conditions experienced longer lengths of stay than mothers with gestational conditions. Mothers with pre-existing hypertension had the longest hospital stays, at an average of **108.0** hours (Figure 4.1.4).

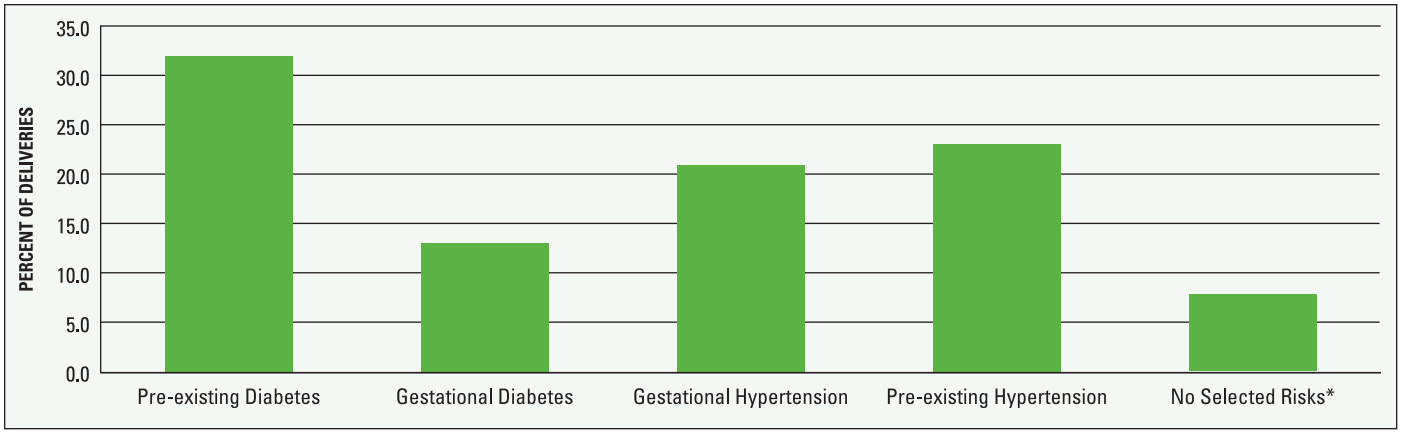
**Figure 4.1.4 Average length of stay (hours) for diabetes and hypertension categories, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Includes only hospital admissions.
*No selected risks = mothers without diabetes or hypertension (gestational or pre-existing) in pregnancy.

The relationship between chronic disease and infant health outcomes was also examined. Mothers with pre-existing diabetes or hypertension were more likely to give birth prematurely compared to mothers who developed the diseases during pregnancy (Figure 4.1.5). For instance, in 2007/2008, **32.0**% of mothers with pre-existing diabetes experienced a preterm birth, compared to only **13.0**% of mothers with gestational diabetes. The differences for hypertension were not as severe (**23.0**% of mothers with pre-existing hypertension compared to **20.0**% of mothers with gestational hypertension gave birth prematurely). The presence of chronic disease, regardless of whether it was pre-existing or developed during pregnancy, increased the risk of preterm birth – the rate for mothers with neither condition was only **7.8**%.

**Figure 4.1.5 Preterm birth rates by diabetes and hypertension categories, British Columbia, 2007/2008**

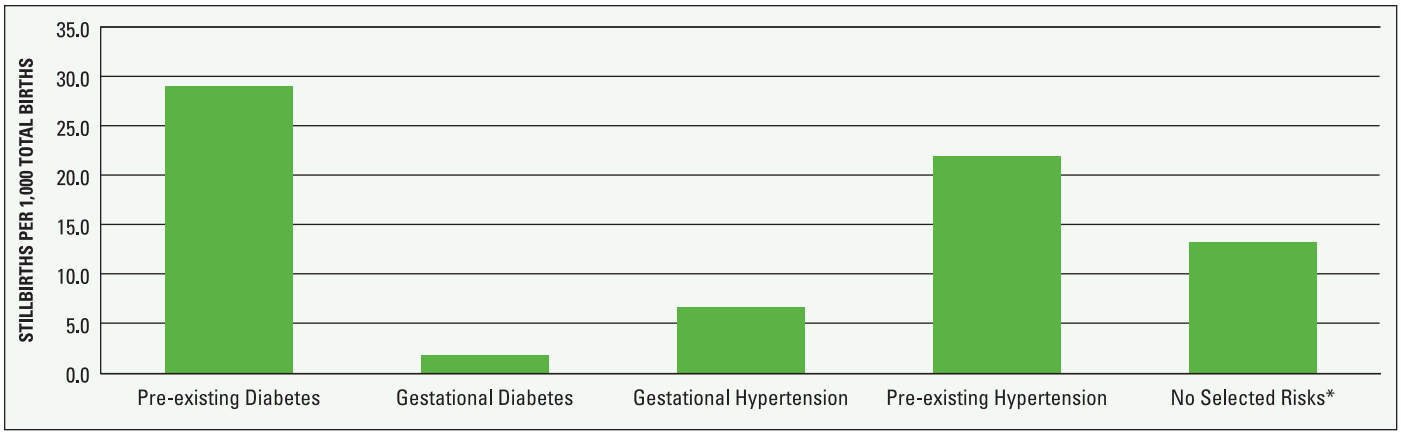



Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
*No selected risks = mothers without diabetes or hypertension (gestational or pre-existing) in pregnancy.

Pre-existing hypertension and diabetes were also associated with substantially higher stillbirth rates (Figure 4.1.6). In 2007/2008, women with pre-existing diabetes had a stillbirth rate of **29.1** per 1,000 births, more than twice the rate of women who had neither condition (**13.3** per 1,000 births). Women with pre-existing hypertension had a stillbirth rate of **22.0** per 1,000 births. Women with gestational diabetes or hypertension actually experienced lower stillbirth rates than women with neither chronic disease.

Although this analysis demonstrated a relationship between chronic disease status and stillbirth rates, it is important to acknowledge that other factors, such as maternal age, may contribute to this finding. With increasing maternal age, risk of developing conditions such as hypertension and diabetes increases. It is therefore important to realize that chronic disease may contribute to stillbirth rates, but is not necessarily directly causal.

**Figure 4.1.6 Stillbirth rates by diabetes and hypertension categories, British Columbia, 2007/2008**



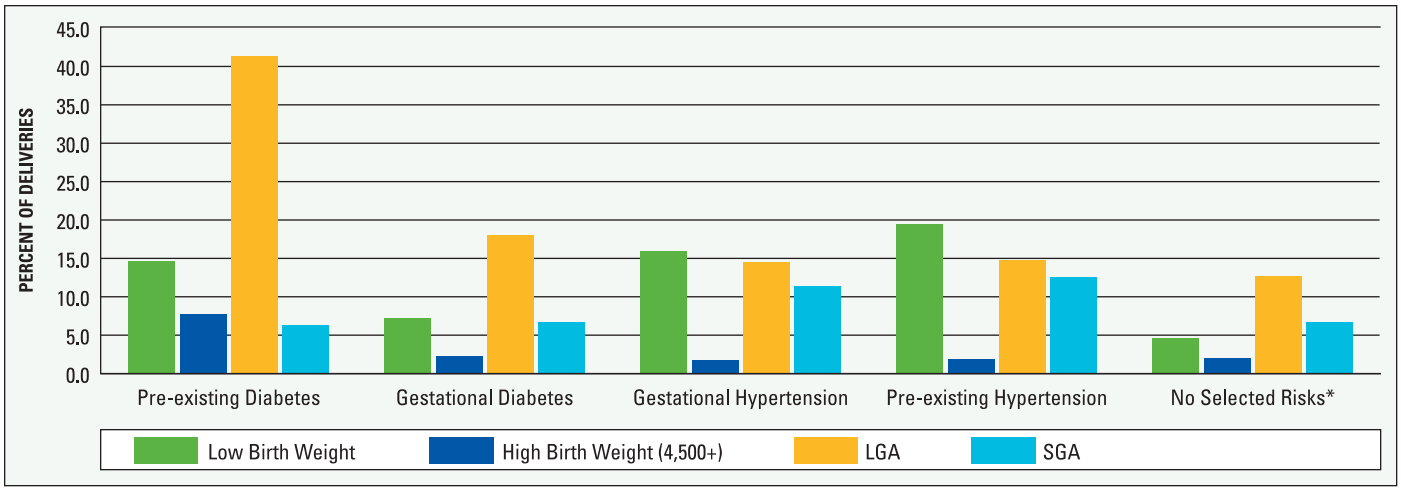

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
*No selected risks = mothers without diabetes or hypertension (gestational or pre-existing) in pregnancy.
Late terminations have been excluded.

Finally, birth weight was examined in conjunction with the presence of chronic disease in mothers (Figure 4.1.7). The most significant finding was the strong relationship between pre-existing diabetes in mothers and large-for-gestational-age infants (**41.3%** in 2007/2008). Mothers with pre-existing diabetes also had the largest proportion of high birth weight babies (**7.8%**).

On the other hand, mothers with pre-existing hypertension had the largest proportion of small-for-gestational-age and low birth weight babies (**12.9%** and **19.5%** respectively).

Although the rates were lower, the birth weight and size outcomes for babies born to mothers with gestational diabetes and hypertension tended to follow the same patterns as were identified for pre-existing conditions.

**Figure 4.1.7 Low birth weight, high birth weight, LGA and SGA by diabetes and hypertension categories, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
*No selected risks = mothers without diabetes or hypertension (gestational or pre-existing) in pregnancy.

## 4.2 Severe Maternal Morbidity

Severe maternal morbidity refers to a variety of severe, life-threatening conditions that may affect mothers as a consequence of labour and delivery. In industrialized countries where maternal mortality is rare, examining severe morbidity provides a measure of the burden of illness that may result from rare but serious conditions that can arise during labour and delivery.

While there is no universally recognized list of such conditions, the Canadian Perinatal Surveillance System (CPSS)[19] has developed a list of morbidities that may represent the illnesses of most concern. Not all conditions that are identified by the CPSS can be monitored on a population level through the data available in British Columbia. Further, some conditions occur so rarely that they may not have occurred at all in the province during the four year period from 2004/2005 to 2007/2008 for which data on severe maternal morbidity is available. Information on rare but severe maternal morbidity such as maternal mortality has been reported separately through the BC Perinatal Health Program.[20]

This report focuses on severe maternal morbidities diagnosed during delivery admissions occurring during fiscal years 2004/2005 to 2007/2008. A change in coding practices, beginning with 2004/2005 data, precludes a comparison with older data. These conditions include (specific ICD-10 codes used to identify these conditions are listed in Appendix 1):

- Anesthetic complications
- Postpartum hemorrhage (PPH)
  - With transfusion
  - With hysterectomy
- Antepartum hemorrhage (APH) with transfusion
- Eclampsia
- Pulmonary embolism
- Shock
- Stroke

Table 4.2.0 summarizes the rate per 100 deliveries for each of these conditions in the last four years. With the exception of anesthetic complications, less than half a percentage of women per year experienced any of these morbidities in BC. Moreover, for nearly all conditions, the rate per 100 has remained relatively stable over time. The exception to this is anesthetic complications, which saw an increase from **0.35%** in 2004/2005 to **0.56%** in 2006/2007. Because of the extreme variability associated with rare conditions, several more years' of data will be required before any definitive trend over time can be identified.

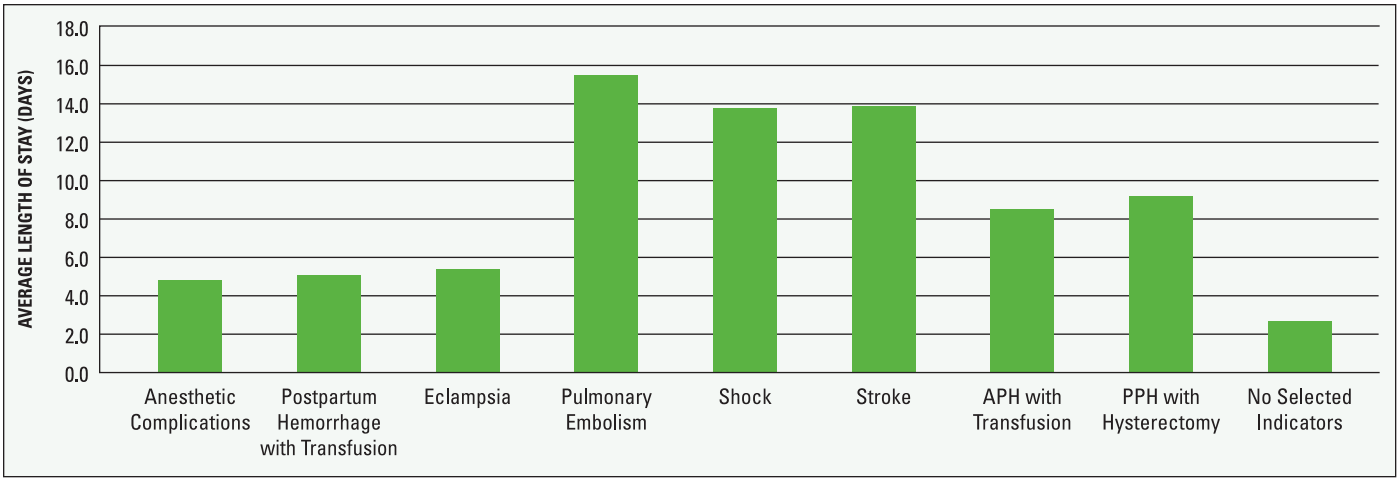
**Table 4.2.0 Severe maternal morbidity rates per 100 deliveries, British Columbia, 2004/2005 to 2007/2008**

| Morbidity | 2004/2005 | | 2005/2006 | | 2006/2007 | | 2007/2008 | |
|---|---|---|---|---|---|---|---|---|
| | # | % | # | % | # | % | # | % |
| Anesthetic complications | 141 | 0.35 | 219 | 0.54 | 234 | 0.56 | 232 | 0.53 |
| PPH with transfusion | 134 | 0.33 | 163 | 0.40 | 141 | 0.34 | 169 | 0.39 |
| APH with transfusion | 41 | 0.10 | 45 | 0.11 | 42 | 0.10 | 47 | 0.11 |
| PPH with hysterectomy | 30 | 0.07 | 28 | 0.07 | 17 | 0.04 | 27 | 0.06 |
| Eclampsia | 27 | 0.07 | 31 | 0.08 | 14 | 0.03 | 23 | 0.05 |
| Pulmonary embolism | 8 | 0.02 | 10 | 0.02 | 11 | 0.03 | 12 | 0.03 |
| Shock | 14 | 0.03 | 9 | 0.02 | 10 | 0.02 | 9 | 0.02 |

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
The number of women having 'stroke' diagnosed during delivery admission was ≤ 5 per fiscal year; thus, the number of incidence of stroke per year has been omitted in the table to protect privacy.

While anesthetic complications and PPH with transfusion were the most commonly experienced morbidities, they did not make a corresponding impact on maternal length of stay in hospital (Figure 4.2.0). Compared to mothers who experienced no severe maternal morbidity, who had an average length of stay of **2.7** days, anesthetic complications resulted in an average length of stay of **4.8** days; for PPH with transfusion, this figure was **5.1**. In comparison, the longest average length of stay was associated with pulmonary embolism at **15.5** days, while stroke (**13.9** days) and shock (**13.8**) were also quite high.

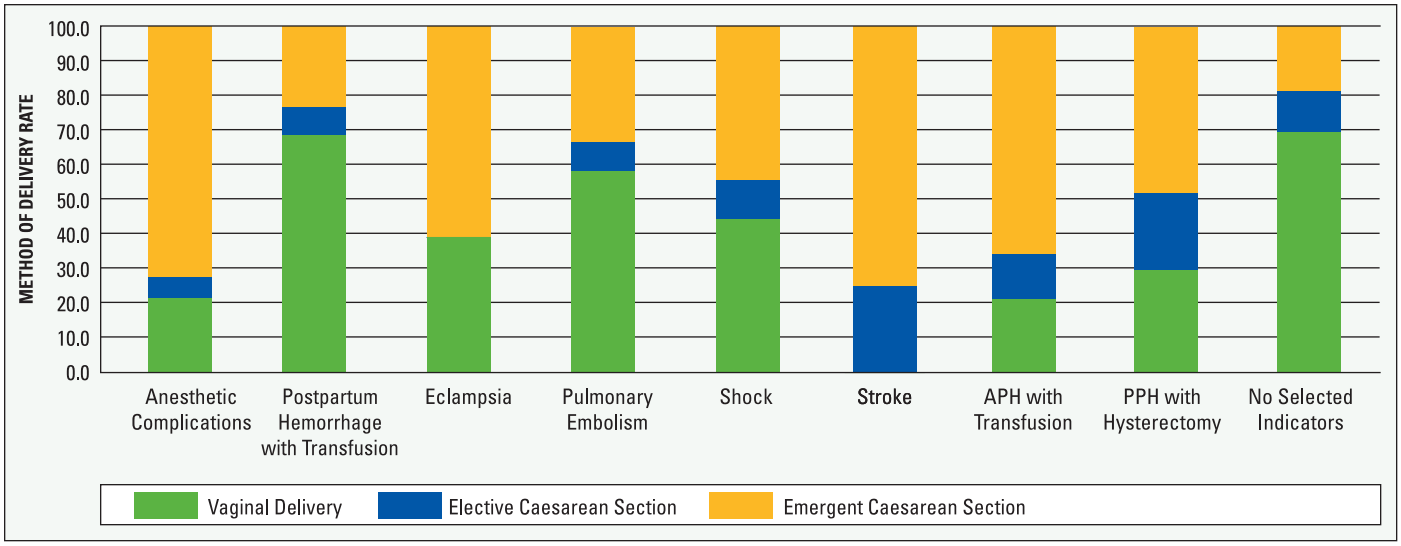
**Figure 4.2.0 Average length of stay (days) by severe maternal morbidity categories, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
No Selected Indicators = none of the listed severe maternal morbidity categories were diagnosed during the delivery admission.

As evidenced in Table 4.2.0, the incidence of various severe maternal morbidities is very low in BC. Figure 4.2.1 shows the method of delivery type where these maternal morbidities are present. With the exception of postpartum hemorrhage with transfusion, the other severe maternal morbidities show a different distribution of method of delivery than those women with no selected indicators. For example, women with anesthetic complications are much more likely to have had an emergent caesarean delivery (**72.4%**) than a vaginal delivery (**21.6%**). As well, women experiencing antepartum hemorrhage with transfusion during delivery are more likely to deliver via emergent caesarean delivery (**66.0%**) than via vaginal delivery (**21.3%**). The lowest caesarean rate among women with maternal morbidity was for those who experienced postpartum hemorrhage with transfusion; at **31.4%** (**8.3%** elective and **23.1%** emergent), this rate did not differ much from the rate for women with no maternal morbidities, which was **30.4%** (**11.8%** elective and **18.6%** emergent). Again, it should be noted that the incidence of these morbidities over the entire population of delivering women was very low; these rates should be interpreted with caution.

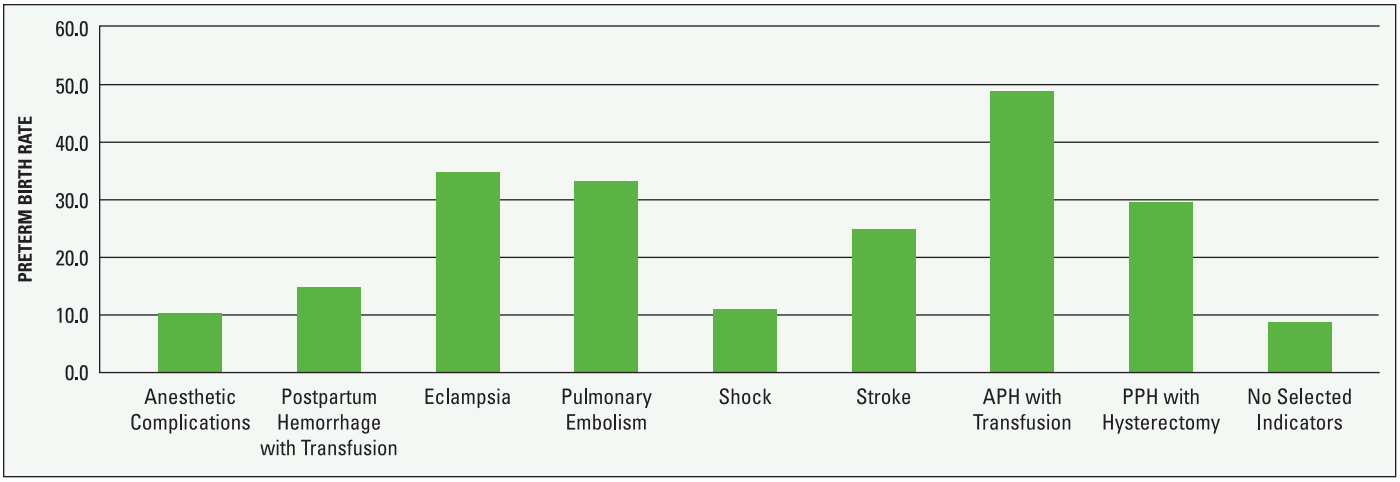
**Figure 4.2.1 Method of delivery by severe maternal morbidity categories, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
No Selected Indicators = none of the listed severe maternal morbidity categories were diagnosed during the delivery admission.

Maternal morbidity and gestational age at birth was also analyzed (Figure 4.2.2). Nearly one-half (**48.9%**) of mothers who experienced antepartum hemorrhage with a transfusion delivered prematurely in 2007/2008, as did **34.8%** of those who experienced eclampsia, **33.3%** of mothers who experienced pulmonary embolism, and **29.6%** of mothers who experienced postpartum hemorrhage with hysterectomy. In comparison, only **11.1%** of mothers who experienced shock and **10.3%** of mothers who experienced anesthetic complications gave birth prematurely. The preterm birth rate for mothers who experienced no maternal morbidity was **8.7%**.

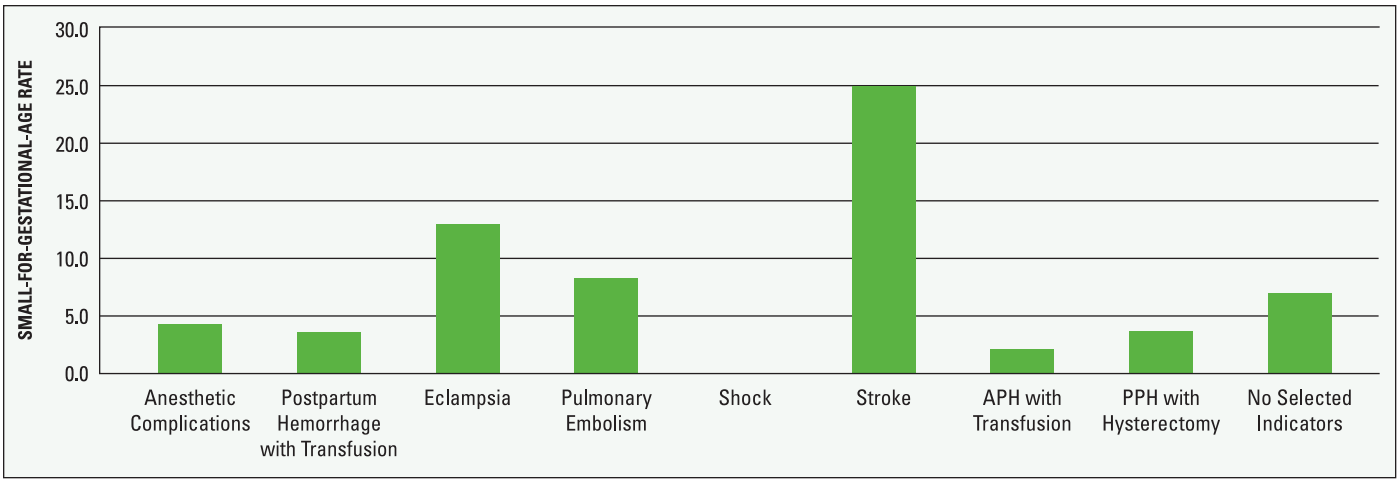
**Figure 4.2.2 Preterm birth rate by severe maternal morbidity categories, British Columbia, 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
No Selected Indicators = none of the listed severe maternal morbidity categories were diagnosed during the delivery admission.

Finally, the effects of maternal morbidity of infant birth weight were considered (Figure 4.2.3). In 2007/2008, one-quarter (**25.0%**) of women who experienced a stroke gave birth to a small-for-gestational-age infant compared to **13.0%** of women who experienced eclampsia and **8.3%** of women who experienced pulmonary embolism. In comparison, women who experienced no maternal morbidity had a small-for-gestational-age birth rate of **7.0%**. Thus women who experienced anesthetic complications, antepartum hemorrhage with transfusion, and postpartum hemorrhage (both with transfusion and with hysterectomy), had lower rates of small-for-gestational-age births than women with no maternal morbidity, ranging from **2.1%** to **4.3%** among these categories. Caution should be used, however, as these rates are influenced by small sample sizes.

**Figure 4.2.3 Small-for-gestational-age rate by severe maternal morbidity categories, British Columbia, 2007/2008**



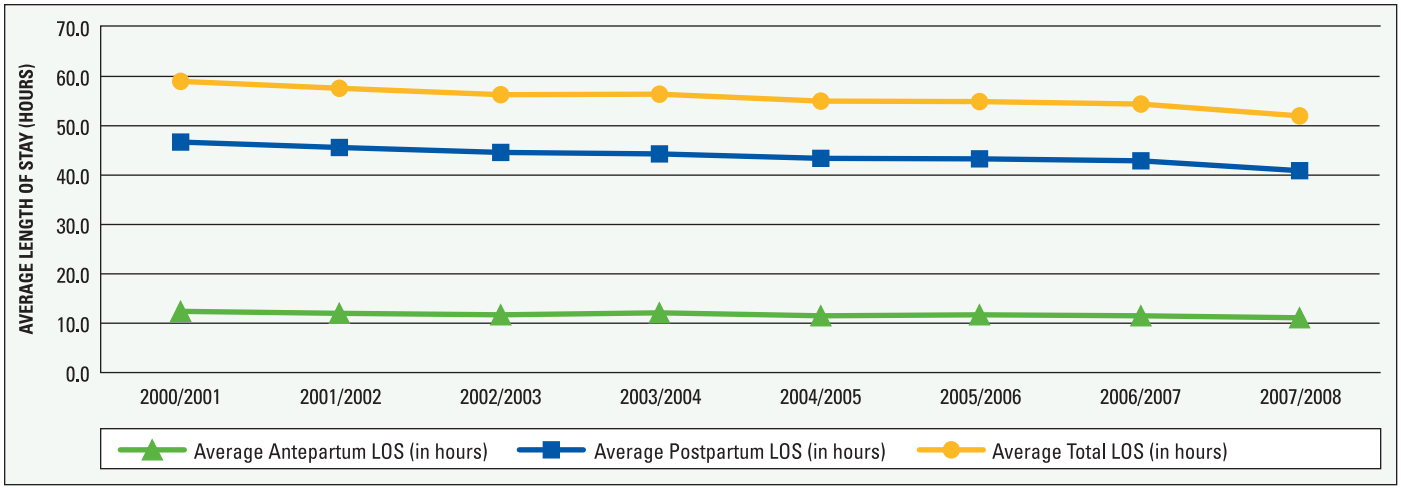

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
No Selected Indicators = none of the listed severe maternal morbidity categories were diagnosed during the delivery admission.
There were no cases of "Shock" in relation to small-for-gestational-age and severe maternal morbidity in 2007/2008.

## 4.3 Antepartum and Postpartum Length of Stay

Length of stay in hospital can serve as an indicator of overall maternal health. Antepartum length of stay refers to the number of hours that a mother stayed in hospital prior to delivery, while postpartum length of stay refers to the number of hours that a mother stayed in hospital after delivery. It should be noted that mothers' postpartum length of stay does not always correspond to the length of time that infants stay in hospital, which is reported in a separate section.

Among women who experienced a vaginal birth in British Columbia there has been a moderate decrease in the average total length of stay in hospital from **59.0** hours in 2000/2001 to **52.0** hours in 2007/2008 (Figure 4.3.0). Antepartum length of stay decreased from an average of **12.4** hours in 2000/2001 to **11.1** hours in 2007/2008; a difference of **1.3** hours. The decrease in postpartum length of stay has been more significant from **46.7** hours in 2000/2001 to **40.9** hours in 2007/2008; a difference of **5.7** hours.

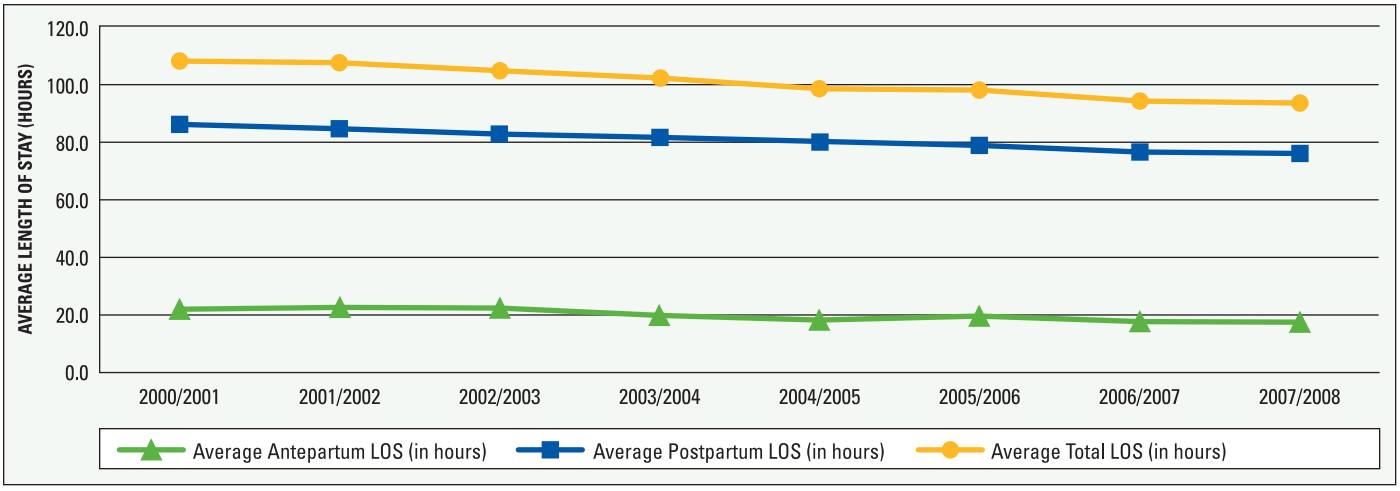
**Figure 4.3.0 Average length of stay (hours) for vaginal births in British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only deliveries occurring in hospital were included.

As expected, the average length of stay among women who gave birth via caesarean section was considerably longer compared to vaginal births (Figure 4.3.1). However, although there was also a decrease in the total length of stay among those who gave birth via caesarean section, the decrease was sharper than that seen among those who gave birth vaginally. Average total length of stay for caesarean section births decreased from **108.2** hours in 2000/2001 to **93.6** hours in 2007/2008; a difference of **14.6** hours. As above, the majority of the total time spent in hospital among caesarean section births occurred postpartum. Postpartum average length of stay decreased from **86.2** hours in 2000/2001 to **76.1** hours in 2007/2008. Antepartum average length of stay decreased from **22.0** hours in 2000/2001 to **17.5** hours in 2007/2008. In 2000/2001 women who gave birth via caesarean section stayed in hospital an average of **49.1** hours longer compared to those who gave birth vaginally, whereas by 2007/2008 this difference had dropped to **41.6** hours.

**Figure 4.3.1 Average length of stay (hours) for caesarean section births in British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only deliveries occurring in hospital were included.

In British Columbia in 2007/2008, the average total length of stay in hospital among women who gave birth vaginally was **52.0** hours (Table 4.3.0). This ranged from a high of **65.2** hours in PHSA to a low of **45.2** hours in FHA. Average antepartum length of stay was lowest in NHA at **7.8** hours and highest in PHSA at **15.1** hours. Average postpartum length of stay was lowest in FHA at **35.1** hours and highest again in PHSA at **50.0** hours.

**Table 4.3.0 Average length of stay (hours) by method of delivery by delivery Health Authority and British Columbia, 2007/2008**

| | Average Antepartum LOS | Average Postpartum LOS | Average Total LOS |
|---|---|---|---|
| **Vaginal Delivery** | | | |
| FHA | 10.2 | 35.1 | 45.2 |
| IHA | 9.0 | 42.3 | 51.4 |
| NHA | 7.8 | 40.9 | 48.7 |
| PHSA | 15.1 | 50.0 | 65.2 |
| VCHA | 12.3 | 40.1 | 52.4 |
| VIHA | 11.6 | 43.8 | 55.4 |
| BC | 11.1 | 40.9 | 52.0 |
| **Caesarean Section Delivery** | | | |
| FHA | 16.3 | 71.8 | 88.1 |
| IHA | 13.5 | 76.8 | 90.3 |
| NHA | 13.6 | 74.5 | 88.1 |
| PHSA | 25.4 | 80.8 | 106.2 |
| VCHA | 15.1 | 74.0 | 89.1 |
| VIHA | 19.0 | 82.1 | 101.1 |
| BC | 17.5 | 76.1 | 93.6 |

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
PHSA refers to BC Women's Hospital patients only.
Only deliveries occurring in hospital were included.

In 2007/2008, the average total length of stay in hospital among all British Columbia women who gave birth via caesarean section was **93.6** hours (Table 4.3.0). This ranged from a high of **106.2** hours in PHSA to a low of **88.1** hours for both FHA and NHA. Average antepartum stay was lowest in IHA at **13.5** hours and highest in PHSA at **25.4** hours. Average postpartum length of stay was lowest in FHA at **71.8** hours and highest in VIHA at **82.1** hours.

Among nulliparous women in British Columbia giving birth vaginally in 2007/2008, the average total length of stay in hospital was **62.3** hours (Table 4.3.1). This was comprised of an average of **14.2** hours antepartum and **48.1** hours postpartum. Among women with parity ≥1 who gave birth vaginally in 2007/2008, the average total length of stay in hospital was **43.5** hours, including an average of **8.5** hours antepartum and **35.0** hours postpartum. Overall, nulliparous women spent an average of **18.8** hours more in hospital compared to women with parity ≥1, including an average of **5.7** hours more antepartum and **13.0** hours more postpartum.

**Table 4.3.1 Average length of stay (hours) by method of delivery and parity, British Columbia, 2007/2008**

| | Average Antepartum LOS | Average Postpartum LOS | Average Total LOS |
|---|---|---|---|
| **Vaginal Delivery** | | | |
| Nulliparous | 14.2 | 48.1 | 62.3 |
| Parity ≥1 | 8.5 | 35.0 | 43.5 |
| Total | 11.1 | 40.9 | 52.0 |
| **Caesarean Section Delivery** | | | |
| Nulliparous | 22.5 | 80.5 | 103.0 |
| Parity ≥1 | 12.5 | 71.7 | 84.2 |
| Total | 17.5 | 76.1 | 93.6 |

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only deliveries occurring in hospital were included.

Nulliparous British Columbia women who gave birth via caesarean section during 2007/2008 spent an average of **103.0** hours in hospital in total, including **22.5** hours antepartum and **80.5** hours postpartum (Table 4.3.0). Women with parity ≥1 who gave birth via caesarean section in the same year spent an average of **84.2** hours in hospital in total, including **12.5** hours antepartum and **71.7** hours postpartum. The difference in the average total length of hospital stay between nulliparous women and women with parity ≥1 who gave birth via caesarean section was identical to that discussed above between women who gave birth vaginally. Nulliparous women who gave birth via caesarean section spent an average of **18.8** hours more in hospital compared to women with parity ≥1; however, on average more of the difference in hours was attributed to antepartum (**10.0**) hours as opposed to postpartum (**8.8**) hours.

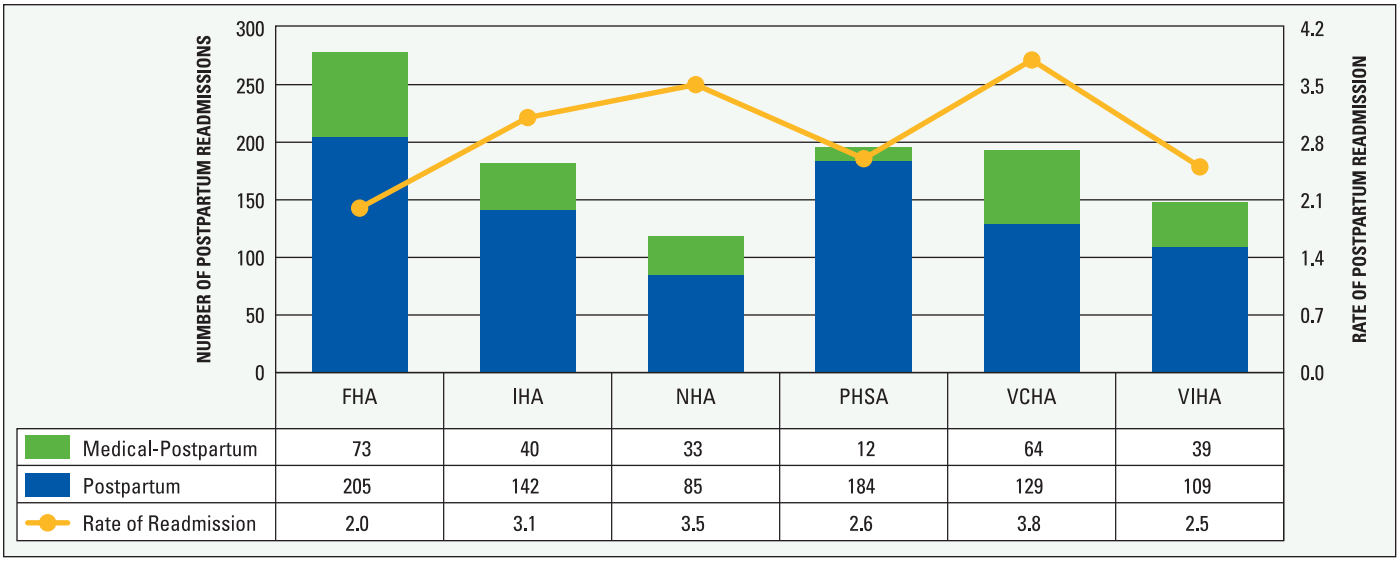
## 4.4 Readmission to Hospital Post-Discharge

Readmission to hospital post-discharge is defined as any mother who is readmitted to hospital, as an inpatient or surgical day care patient, within 42 days of delivery. The most recent data available were for readmissions occurring during fiscal 2006/2007. Because data is reported by fiscal year, some readmissions at the beginning of the time period will be for births that occurred in the previous (i.e. 2005/2006) fiscal year.

For the purposes of this report, maternal postpartum readmission was categorized as postpartum (PP) and medical-postpartum (M) by reviewing each individual coding diagnosis. Postpartum (PP) was defined as any reason for readmission that could be directly attributed to a woman being in a postpartum state. Anything that appeared to be indirectly related to the postpartum period, such as a medical condition that was pre-existing but possibly exacerbated by a woman being in a postpartum state was subsequently classified as Medical-Postpartum (M). This process was used to best reflect the level of morbidity directly related to the pregnancy, and therefore potentially preventable, and what morbidity is more closely related to another condition.

While the overall number of mothers readmitted to hospital post-discharge was highest in FHA in 2006/2007, the rate per 100 delivering mothers was actually lowest in this area, at **2.0** per 100 Figure 4.4.0). The highest rate of readmission was seen in VCHA (**3.8** per 100). The readmission rate was highest in VCHA for both postpartum and medical-postpartum readmissions. Like the overall rate, the rate of postpartum readmissions was lowest in FHA, but medical-postpartum rates were lowest in PHSA (at **0.2** per 100 delivering mothers). The overall readmission rate for BC was **2.7** per 100 delivering mothers.

**Figure 4.4.0 Maternal postpartum readmission by Health Authority, 2006/2007**




| | FHA | IHA | NHA | PHSA | VCHA | VIHA |
|---|---|---|---|---|---|---|
| Medical-Postpartum | 73 | 40 | 33 | 12 | 64 | 39 |
| Postpartum | 205 | 142 | 85 | 184 | 129 | 109 |
| Rate of Readmission | 2.0 | 3.1 | 3.5 | 2.6 | 3.8 | 2.5 |

Source: BC Ministry of Health Services
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.
Each individual coding diagnosis was reviewed to derive the postpartum and medical-postpartum categories. Postpartum (PP) is defined as any reason for readmission that could be directly attributed to a woman being in a postpartum state. Anything that appeared to be indirectly related to the postpartum period, such as a medical condition that was pre-existing but possibly exacerbated by a woman being in a postpartum state was subsequently classified as Medical-Postpartum (M).
PHSA refers to BC Women's Hospital patients only.
Readmissions were classified according to the Health Authority where the mother was readmitted (not necessarily the Health Authority where she delivered).

Mothers were readmitted to hospital for a variety of reasons (Table 4.4.0). Postpartum hemorrhage was the most common reason for readmission, representing nearly one-third (**30.3%**) of all postpartum (excluding medical-postpartum) readmissions overall in 2006/2007. Postpartum puerperal sepsis represented **16.1%** of all readmissions, while an additional **13.8%** of readmissions were for postpartum care and examination after delivery.

**Table 4.4.0 Top 10 most responsible diagnoses for postpartum readmission, British Columbia, 2006/2007**

| Top 10 Readmission Diagnoses | # of Readmissions | % of Readmissions |
|---|---|---|
| Postpartum hemorrhage | 260 | 30.3% |
| Postpartum puerperal sepsis | 138 | 16.1% |
| Postpartum care and exam after delivery | 118 | 13.8% |
| Infection of surgical wound/postpartum | 66 | 7.7% |
| Routine postpartum follow-up | 39 | 4.6% |
| Hypertension | 39 | 4.6% |
| Other specified surgical follow-up care | 29 | 3.4% |
| Other specified diseases/conditions complicating pregnancy, childbirth postpartum | 22 | 2.6% |
| Spinal/epidural headache | 22 | 2.6% |
| Retained placenta/portions without postpartum hemorrhage | 19 | 2.2% |

Source: BC Ministry of Health Services
Notes: Indicator definitions are listed in Appendix 1.
Postpartum puerperal sepsis includes – other urinary tract infection following delivery postpartum, other infections of the urinary tract following delivery, pyrexia of unknown origin following delivery.
Medical-postpartum readmissions are not included in this data.

Similar to the BCPHP data reported in this section, the Canadian Perinatal Health Report also indicates that postpartum hemorrhage was the most common reason for readmission among Canadian women who delivered vaginally.[5] For women who delivered via caesarean, however, the most common reason for readmission was puerperal infections or complications.

## SECTION FIVE

# Fetal and Infant Health Outcomes


*Optimizing Neonatal, Maternal and Fetal Health*

Like maternal health outcomes, fetal and infant health outcomes can be understood as either life-threatening or non-life-threatening. However, fetal and infant health is in many ways more fragile than maternal health, and as a result a number of important measures must be taken into consideration. These include mortality and morbidity which encompass congenital anomalies, prematurity, multiple births, as well as newborn feeding; all factors shown to have a lasting effect on infant health outcomes.

In this report we discuss fetal and infant health outcomes such as neonatal mortality (including stillbirth), various neonatal morbidities, congenital anomalies, gestational age at birth, multiple births, average length of stay in hospital, readmission rates, and newborn feeding in hospital.

## 5.1 Neonatal Mortality

Neonatal mortality encompasses stillbirths, early neonatal deaths, late neonatal deaths, and infant deaths (Table 5.1.0 describes these distinctions in more detail). Neonatal mortality is calculated based on matched files from the BC Vital Statistics Agency. At the time of publication mortality information to 2003/2004 was available.

The neonatal mortality rate is slightly higher for all births than for singleton births only. For instance, the infant mortality rate for all births in 2003/2004 was **4.2** per 1,000 live births, while for singleton births only this rate fell to **3.4** per 1,000. This is not surprising, given that multiple births increase the risk of neonatal mortality, including the risk of stillbirths.[5]

Stillbirths are defined as a fetal death with a gestation of 20 weeks or greater or a weight of at least 500 grams. The stillbirth rate in British Columbia was **5.0** per 1,000 total births in 2007/2008. Mortality was higher in the early neonatal period (less than 7 days after birth) than in the late neonatal period (7-27 days after birth): **2.4** deaths per 1,000 live births compared to only **0.4**.

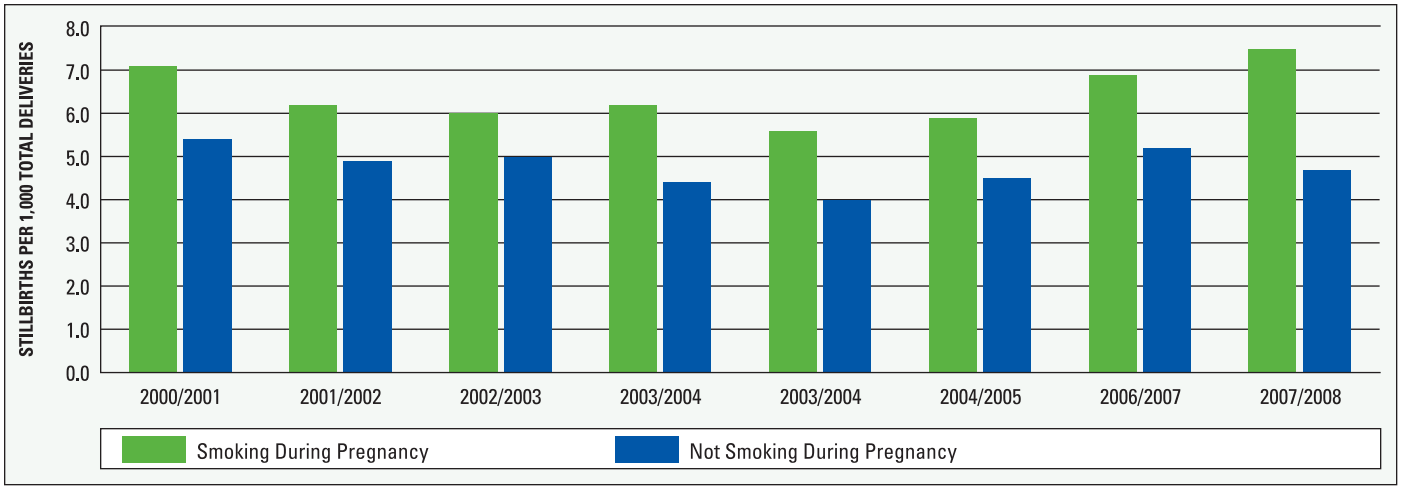
**Table 5.1.0 Neonatal, perinatal and infant mortality rates, British Columbia, 2000/2001 to 2007/2008**

| | Fiscal Year | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2000/2001 | 2001/2002 | 2002/2003 | 2003/2004 | 2004/2005 | 2005/2006 | 2006/2007 | 2007/2008 |
| **All births** | | | | | | | | |
| Stillbirth rate per 1,000 total births | 5.6 | 5.0 | 5.1 | 4.6 | 4.2 | 4.7 | 5.4 | 5.0 |
| Early neonatal death rate (<7 days) per 1,000 live births | 2.2 | 2.7 | 2.7 | 2.4 | n/a | n/a | n/a | n/a |
| Perinatal mortality rate (stillbirths + early neonatal deaths) per 1,000 total births) | 7.8 | 7.7 | 7.7 | 7.0 | n/a | n/a | n/a | n/a |
| Late neonatal death rate (7-27 days) per 1,000 live births | 0.6 | 0.5 | 0.7 | 0.4 | n/a | n/a | n/a | n/a |
| Total neonatal death rate (10-27 days) per 1,000 live births | 2.8 | 3.1 | 3.4 | 2.8 | n/a | n/a | n/a | n/a |
| Infant mortality rate (0-365 days) | 3.8 | 4.4 | 4.4 | 4.2 | n/a | n/a | n/a | n/a |
| **Singleton births only** | | | | | | | | |
| Stillbirth rate per 1,000 total births | 5.2 | 4.7 | 4.6 | 4.3 | 3.8 | 4.3 | 5.2 | 4.6 |
| Early neonatal death rate (<7 days) per 1,000 live births | 1.8 | 2.2 | 2.0 | 1.8 | n/a | n/a | n/a | n/a |
| Perinatal mortality rate (stillbirths + early neonatal deaths) per 1,000 total births) | 7.1 | 7.0 | 6.6 | 6.1 | n/a | n/a | n/a | n/a |
| Late neonatal death rate (7-27 days) per 1,000 live births | 0.5 | 0.4 | 0.7 | 0.3 | n/a | n/a | n/a | n/a |
| Total neonatal death rate (10-27 days) per 1,000 live births | 2.4 | 2.7 | 2.7 | 2.1 | n/a | n/a | n/a | n/a |
| Infant mortality rate (0-365 days) | 3.4 | 3.9 | 3.6 | 3.4 | n/a | n/a | n/a | n/a |

Source: BC Perinatal Database Registry, BC Vital Statistics Agency
Notes: Indicator definitions are listed in Appendix 1.
Deaths post-discharge are not captured in the BCPDR but are supplemented by data from BC Vital Stats Agency; from 2004/2005 onwards, the supplementary data from BC Vital Stats is unavailable.
n/a = data not available.
BCPHP data only was used to calculate stillbirth rates; late terminations excluded.

Stillbirth rates were affected by a number of factors. For instance, stillbirth rates were considerably higher among women who smoked during pregnancy than among women who did not (Figure 5.1.0). In 2000/2001, for instance, the stillbirth rate for women who smoked during pregnancy was **7.1** per 1,000 total births, compared to **5.4** per 1,000 for women who did not smoke. In 2007/2008, the stillbirth rate among women who smoked during pregnancy was **7.5** per 1,000 total births, compared to **4.7** per 1,000 for women who did not smoke. For women who did not smoke during pregnancy, the stillbirth rate declined in the last year of available data (a decrease of **10%** from **5.2** per 1,000 total births in 2006/2007 to **4.7** per 1,000 births in 2007/2008).

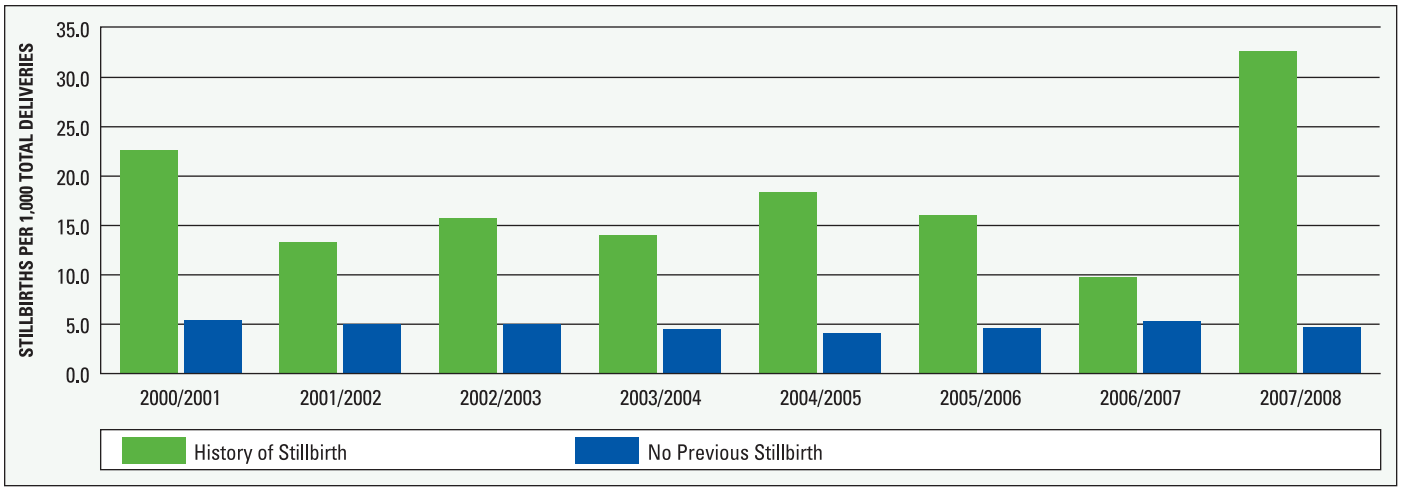
**Figure 5.1.0 Stillbirth rates and smoking status, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Late terminations have been excluded.

Figure 5.1.1 illustrates stillbirth rates between women with and without a history of previous stillbirth. Women with a history of stillbirth have higher rates of stillbirth in the current pregnancy. For example, in 2000/2001, the stillbirth rate among women with a history of stillbirth was **22.6** per 1,000 total births, while the rate among women without a history of previous stillbirth was **5.45** per 1,000 total births. The difference was more dramatic in 2007/2008, with rates of **32.64** per 1,000 total births among women with a history of stillbirth compared to **4.74** per 1,000 total births among those without a history of stillbirth.

**Figure 5.1.1 Stillbirth rates among women with or without a history of previous stillbirth, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Late terminations have been excluded.

Stillbirth rates were highest in NHA in 2007/2008 at **5.74** per 1,000 total births (Table 5.1.1); however, due to small numbers, the stillbirth rate for that Health Authority was extremely variable over time, ranging from a high of **7.60** per 1,000 total births in 2005/2006 to a low of **3.90** per 1,000 in 2004/2005. However, when all eight fiscal years were combined (Table 5.1.1), the stillbirth rate in NHA remained the highest at **5.97** per 1,000 total births.

In 2007/2008, the stillbirth rate was lowest for FHA at **4.43** per 1,000 total births. This was followed by VCHA at **4.84** per 1,000; IHA at **4.94** per 1,000; and VIHA at **5.36** per 1,000. These regions experienced considerable variation over time as well. The aggregated stillbirth rate for British Columbia was **4.95** per 1,000 total births (Table 5.1.1).

**Table 5.1.1 Stillbirth rate per 1,000 total births by resident Health Authority and British Columbia, 2000/2001 to 2007/2008 and an Aggregated Rate by resident Health Authority and British Columbia**

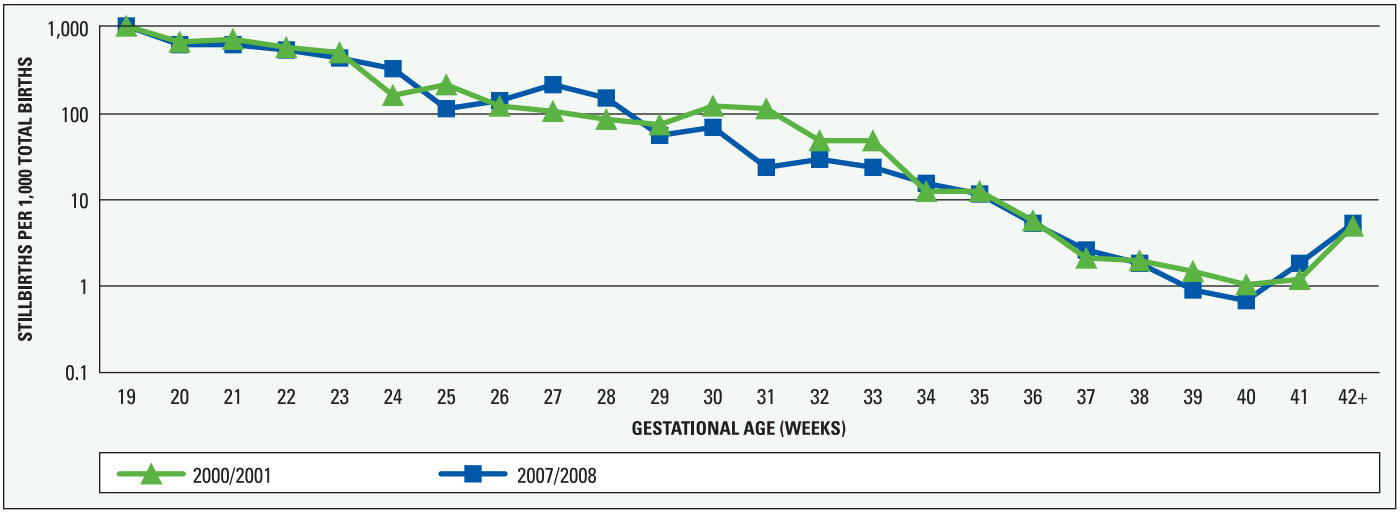
| | Fiscal Year | | | | | | | | Aggregated |
|---|---|---|---|---|---|---|---|---|---|
| | 2000/2001 | 2001/2002 | 2002/2003 | 2003/2004 | 2004/2005 | 2005/2006 | 2006/2007 | 2007/2008 | Rate |
| FHA | 5.79 | 5.53 | 5.73 | 4.71 | 3.80 | 4.72 | 5.30 | 4.43 | 4.99 |
| IHA | 4.68 | 3.71 | 4.37 | 4.39 | 5.66 | 5.38 | 6.30 | 4.94 | 4.94 |
| NHA | 7.12 | 7.51 | 6.70 | 6.18 | 3.90 | 7.60 | 2.94 | 5.74 | 5.97 |
| VCHA | 4.54 | 4.69 | 5.18 | 3.62 | 4.05 | 2.95 | 5.65 | 4.84 | 4.45 |
| VIHA | 6.25 | 4.52 | 2.81 | 4.66 | 3.95 | 5.04 | 5.17 | 5.36 | 4.73 |
| BC | 5.60 | 5.08 | 5.08 | 4.60 | 4.21 | 4.68 | 5.38 | 4.96 | 4.95 |

Source: BC Perinatal Database Registry
Notes: Please refer to the inside back cover for legend of Health Authorities.
Aggregated rate combines data for all eight fiscal years.
Late terminations have been excluded.

The relationship between gestational age and stillbirth rate has not changed much between 2000/2001 and 2007/2008 (Figure 5.1.2). The rate was slightly higher in 2007/2008 for 26-28 weeks' gestational age and slightly lower for 29-33 weeks' gestational age; however, this is likely due to normal variation.

Stillbirth rates generally declined with increasing gestational age. The reverse in trend noted in stillbirth rates between 41 and 42+ weeks' gestation (from **1.9** per 1,000 total births to **5.4** per 1,000 in 2007/2008), which is mirrored in historical data from 2000/2001 (an increase from **1.1** to **4.7** per 1,000) is once again due to small sample size.

**Figure 5.1.2 Stillbirth rate by gestational age, British Columbia, 2000/2001 and 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Late terminations have been excluded.

The 2008 Canadian Perinatal Health Report states that the neonatal mortality rate for Canada in 2003/2004 was 4.3 per 1,000 total births.[5] In comparison, BCPHP data show that the neonatal (infant) mortality rate for the same year was slightly lower at **4.2** per 1,000 (Table 5.1.0). For singleton infants only, the Canadian mortality rate was 4.1 while in BC this rate was only **3.4** (Table 5.1.0).

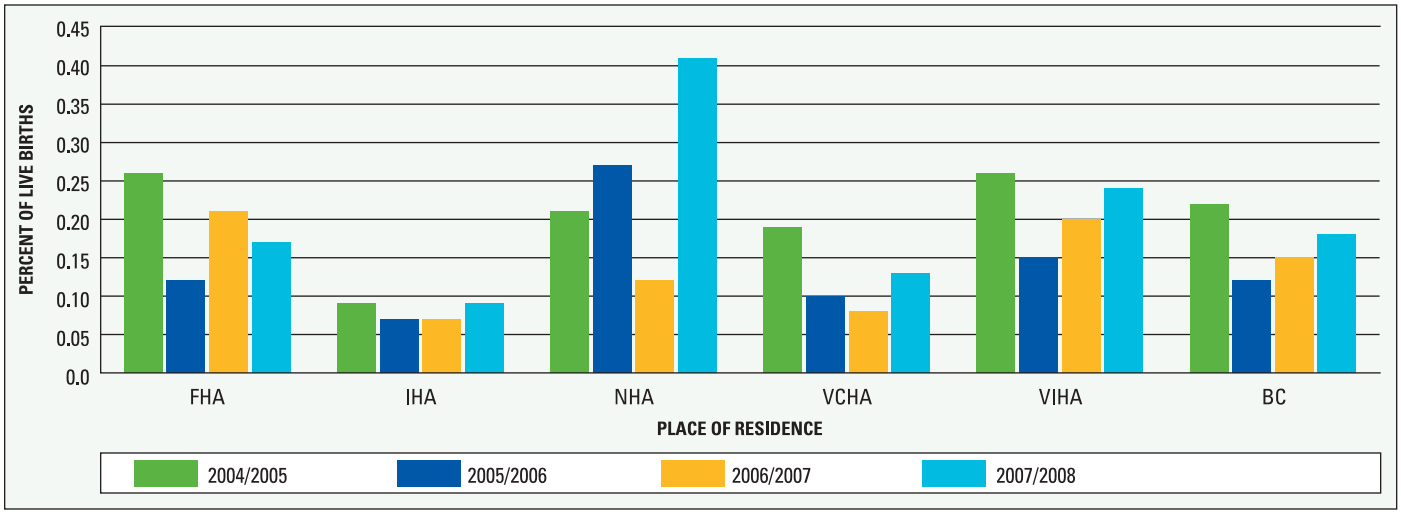
While information-specific causes of neonatal mortality were unavailable in the BCPHP data, the Canadian Perinatal Health Report[5] contained information on frequent causes of infant death on a national level in 2003/2004. The highest mortality came from immaturity (mortality rate of 1.6 per 1,000 live births), followed by congenital anomalies (1.2 per 1,000) and asphyxia (0.5 per 1,000). Infection, Sudden Infant Death Syndrome (SIDS), other unexplained infant deaths (also known as Sudden Unexpected Deaths (SUD)) and external causes had mortality rates of 0.2, 0.3, 0.2 and 0.1 per 1,000 live births respectively. An additional 0.9 deaths per 1,000 live births were attributed to "other" causes.

## 5.2 Neonatal Morbidity

Neonatal morbidity refers to morbidity that occurs in the first month after birth (0-27 days of age). For the purposes of this report, neonatal morbidity refers to morbidity that is diagnosed during the birth admission. Neonatal morbidity is an important factor in postneonatal morbidity and in long-term disability in children.[5] Five neonatal conditions were examined: sepsis, intracranial hemorrhage, respiratory distress syndrome, transient tachypnea, and other respiratory morbidity. These conditions were identified as a proxy for at-risk babies among newborns who had an NICU admission during the birth admission using ICD-10 coding. As ICD-10 was implemented in the BCPHP database for discharges in the fiscal 2004/2005 year, only four years of data (2004/2005 to 2007/2008) have been reported. Specific ICD-10 codes that were used to identify these conditions are listed in the glossary.

Sepsis with NICU admission rates have been consistently higher in NHA and VIHA and lower in VCHA and IHA (Figure 5.2.0). While there has been variation within regions over time, the sepsis rate in NHA in 2007/2008 of **0.41** per 100 live births was further examined. Preliminary investigation with NHA reveals that this Health Authority is reviewing its coding practices. The lowest rate was found in VCHA, at **0.13** per 100 live births, while the provincial rate overall was **0.18** per 100 live births.

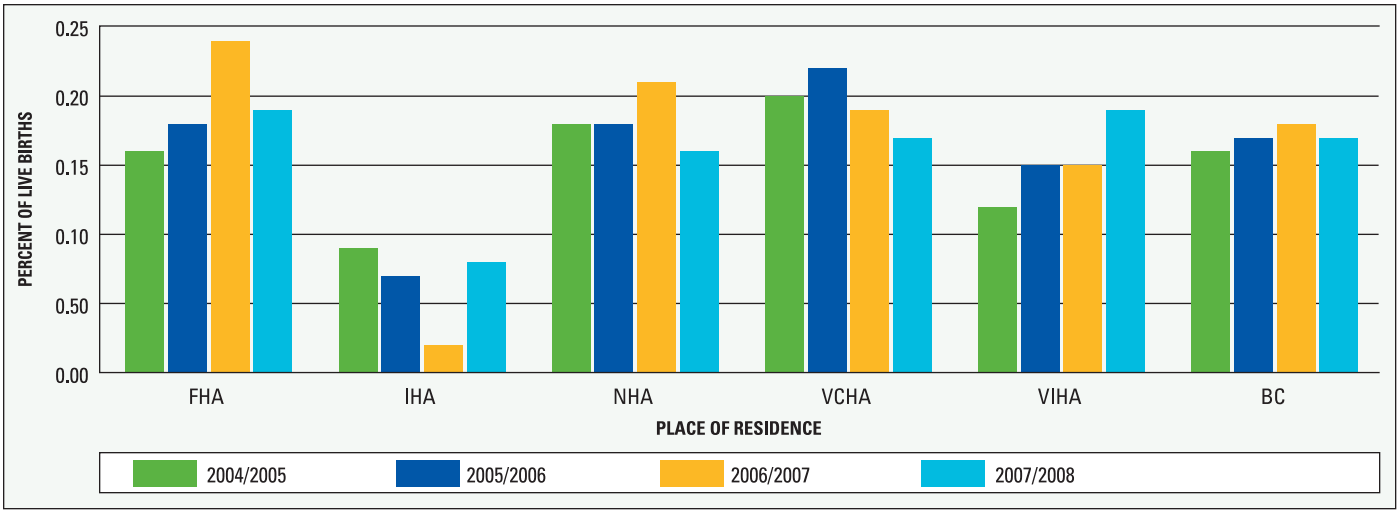
**Figure 5.2.0 Sepsis with NICU admission for maternal resident Health Authority and British Columbia, 2004/2005 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only confirmed diagnoses used in this analysis.
Please refer to the inside back cover for legend of Health Authorities.

Intracranial hemorrhage in NICU was highest in VIHA and FHA (both at **0.19** per 100 live births) in 2007/2008 (Figure 5.2.1). The provincial rate was **0.17** per 100 live births and the lowest rate was found in IHA (**0.08** per 100 live births). Rates declined in the last year for FHA, VCHA and NHA, but have increased for both VIHA and IHA. However, despite this dramatic increase, it should be noted that the absolute rate in IHA, as in all regions, is very low, such that even small differences can appear exaggerated.

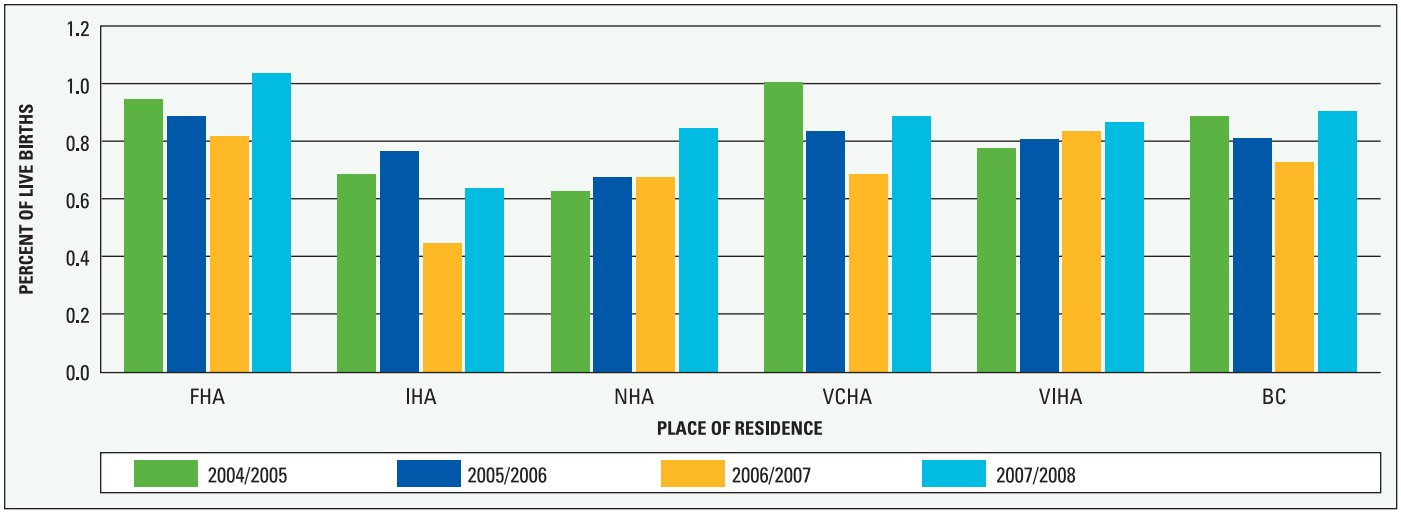
**Figure 5.2.1 Intracranial hemorrhage in NICU for maternal resident Health Authority and British Columbia, 2004/2005 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only confirmed diagnoses used in this analysis.
Please refer to the inside back cover for legend of Health Authorities.

With regard to respiratory distress syndrome with admission to NICU, IHA once again showed the lowest rates in 2007/2008 at **0.64** per 100 live births (Figure 5.2.2). The highest rate was in FHA, the only region where the rate reached **1.04** per 100 live births. VCHA, NHA and VIHA were equivalent to the provincial average of **0.91** per 100 live births. Rates have increased in all regions between 2006/2007 and 2007/2008. For the province as a whole, the rate increased by **25%**.

**Figure 5.2.2 Respiratory distress syndrome with admission to NICU for maternal resident Health Authority and British Columbia, 2004/2005 to 2007/2008**

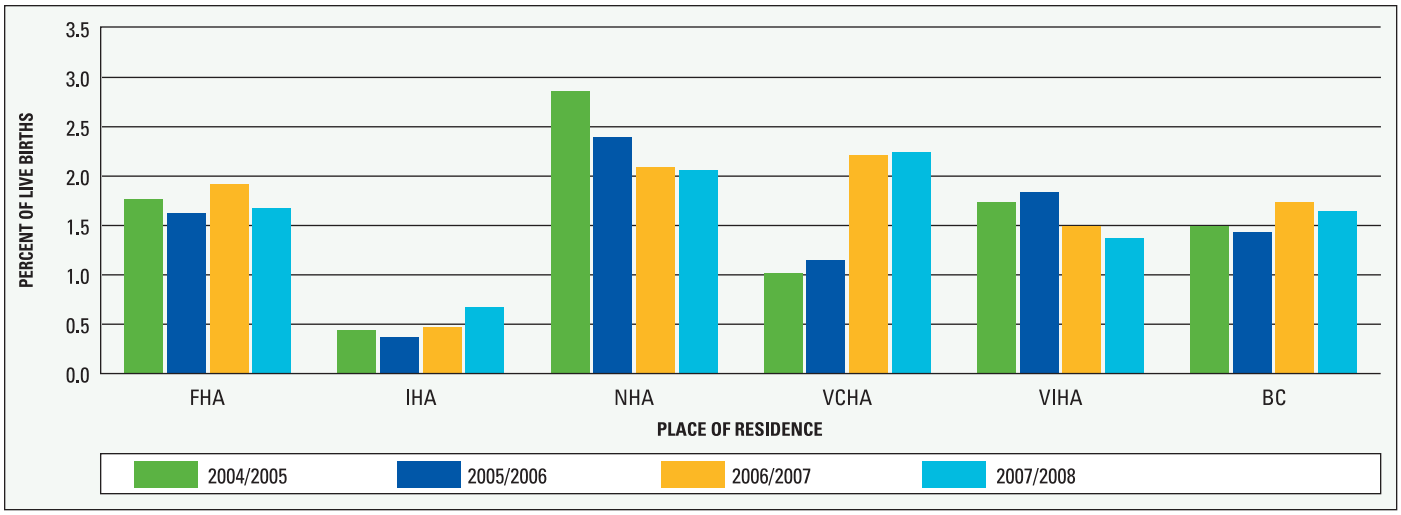



Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only confirmed diagnoses used in this analysis.
Please refer to the inside back cover for legend of Health Authorities.

VCHA had the highest rate of transient tachypnea with admission to NICU in 2007/2008 at **2.24** per 100 live births (Figure 5.2.3). Once again the lowest rate was in IHA (**0.67** per 100 live births). The provincial rate overall was **1.65** per 100 live births.

Transient tachypnea with admission to NICU rates decreased in FHA, NHA, and VIHA between 2006/2007 and 2007/2008, while they increased in IHA and VCHA. There was a greater increase seen in VCHA from **1.15** per 100 live births in 2005/2006 to **2.21** per 100 live births in 2006/2007. However, once again the very small number of cases precludes monitoring of trends with certainty.

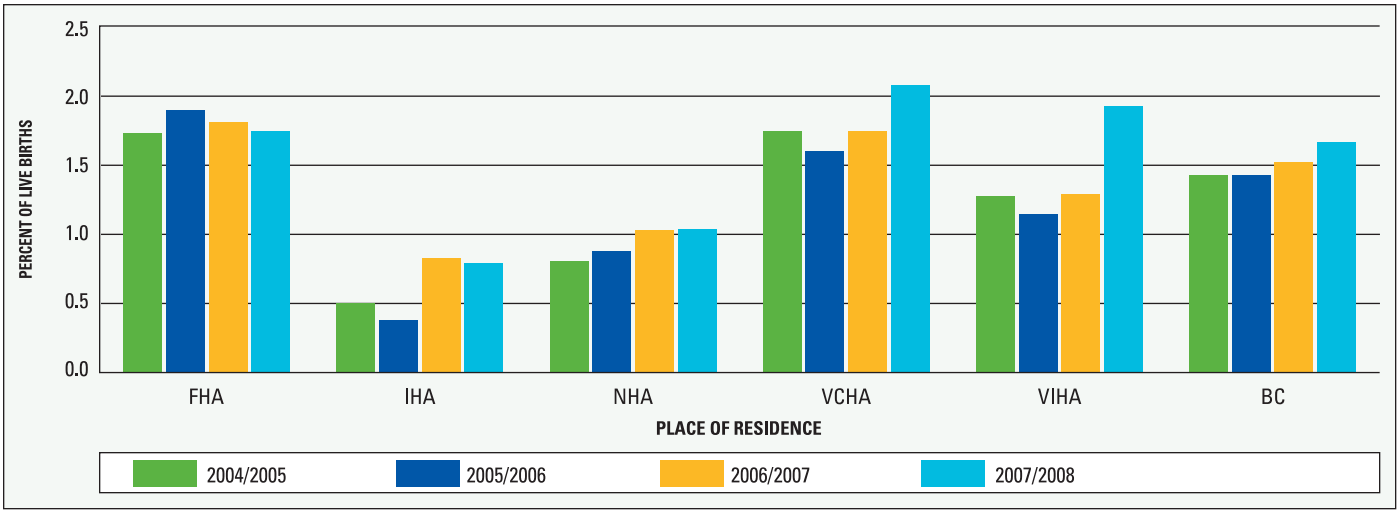
**Figure 5.2.3 Transient tachypnea of the newborn with admission to NICU for maternal resident Health Authority and British Columbia, 2004/2005 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only confirmed diagnoses used in this analysis.
Please refer to the inside back cover for legend of Health Authorities.

Finally, with regard to other respiratory morbidity (excluding respiratory distress syndrome and transient tachypnea of the newborn) with admission to NICU, VCHA shows the highest rate per 100 live births in 2007/2008 at **2.08** per 100 (Figure 5.2.4). This is followed by VIHA at **1.93** per 100 and FHA at **1.75** per 100. Once again, IHA had the lowest rate at **0.79** per 100 live births. The provincial rate was **1.67** per 100 live births.

**Figure 5.2.4 Other respiratory morbidity with NICU admission for maternal resident Health Authority and British Columbia, 2004/2005 to 2007/2008**

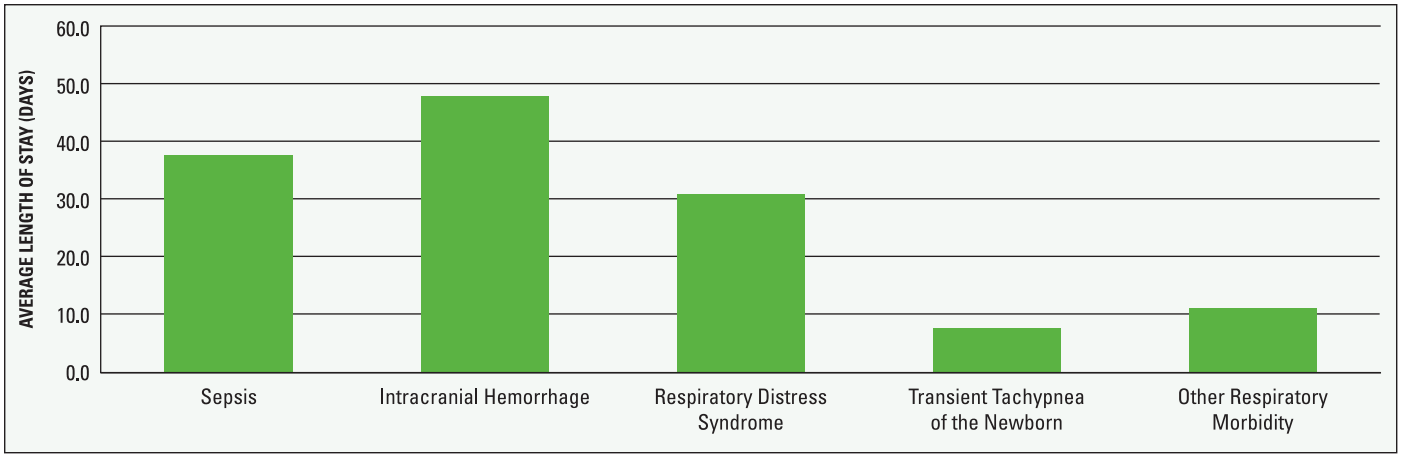



Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only confirmed diagnoses used in this analysis.
Excludes respiratory distress syndrome and transient tachypnea of the newborn.
Please refer to the inside back cover for legend of Health Authorities.

Although the provincial rate for intracranial hemorrhage (with NICU admissions) was lower than the rate for any other condition (at **0.17** per 100 live births), the average length of hospital stay was highest for these infants, compared to those with other conditions (Figure 5.2.5). Infants with intracranial hemorrhage stayed in the hospital for an average of **47.8** days, which may be associated with extreme prematurity.

Transient tachypnea, one of the more common comorbidities of the conditions selected at a rate of **1.65** per 100 live births (second only to other respiratory morbidity) had the shortest average length of stay (**7.5** days). This was followed by respiratory morbidity at **11.0** days.

**Figure 5.2.5 Average length of stay (days) for selected newborn indicators, British Columbia, 2007/2008**



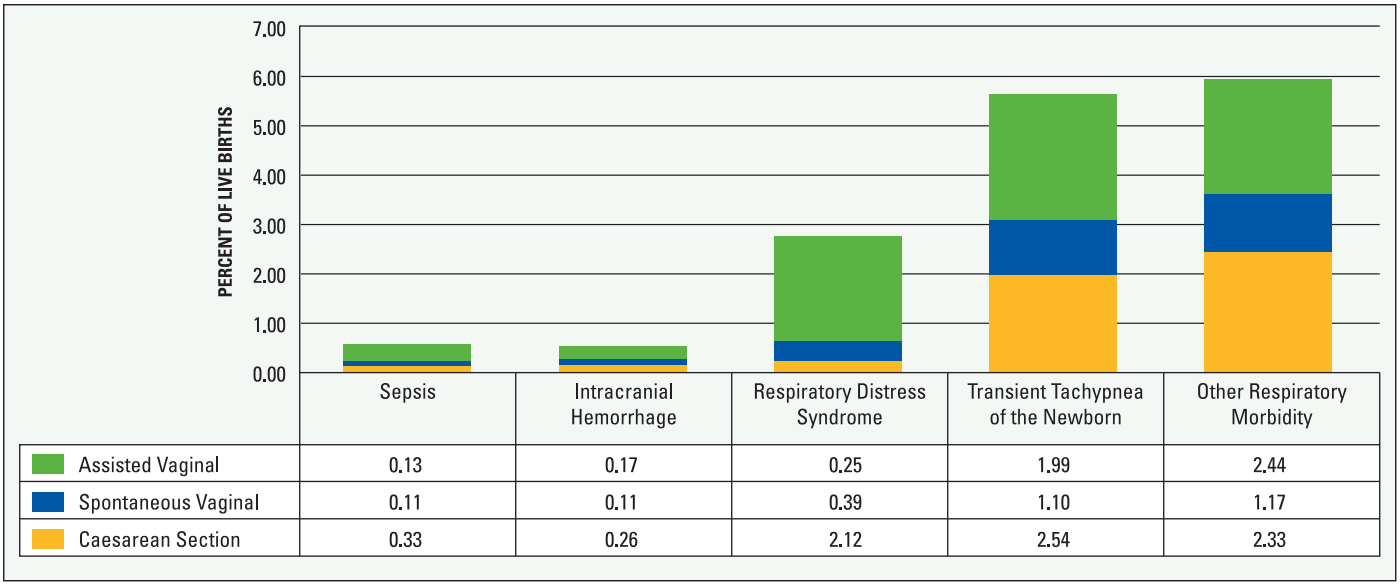

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only confirmed diagnoses used in this analysis.
Length of stay describes the total LOS in hospital including the admission to the Neonatal Intensive Care Unit.

For most morbidities, rates were higher among infants who had been delivered via c-section as compared to those who had been delivered via assisted or spontaneous vaginal delivery (Figure 5.2.6). The exception was other respiratory morbidity, where rates for assisted vaginal delivery and caesarean delivery were nearly equivalent (**2.44** per 100 live births compared to **2.33** per 100 live births, respectively).

Morbidity rates among infants delivered via c-section were highest for transient tachypnea (**2.54** per 100 live births) and lowest for intracranial hemorrhage (**0.26** per 100 live births). For both spontaneous and assisted vaginal deliveries, rates were highest for other respiratory morbidity (**1.17** and **2.44** per 100 live births, respectively) and lowest for sepsis (**0.11** and **0.13** per 100 live births, respectively).

Proportionately, caesarean delivered infants represented the majority of infants who experienced both sepsis (**58.2%**) and respiratory distress syndrome (**72.6%**). While not the majority, these infants represented the largest proportion of all other conditions (**43.9%** for other respiratory morbidity, **48.4%** for transient tachypnea, and **49.3%** for intracranial hemorrhage).

**Figure 5.2.6 Newborn diagnoses (with NICU admission) by method of delivery, British Columbia, 2007/2008**



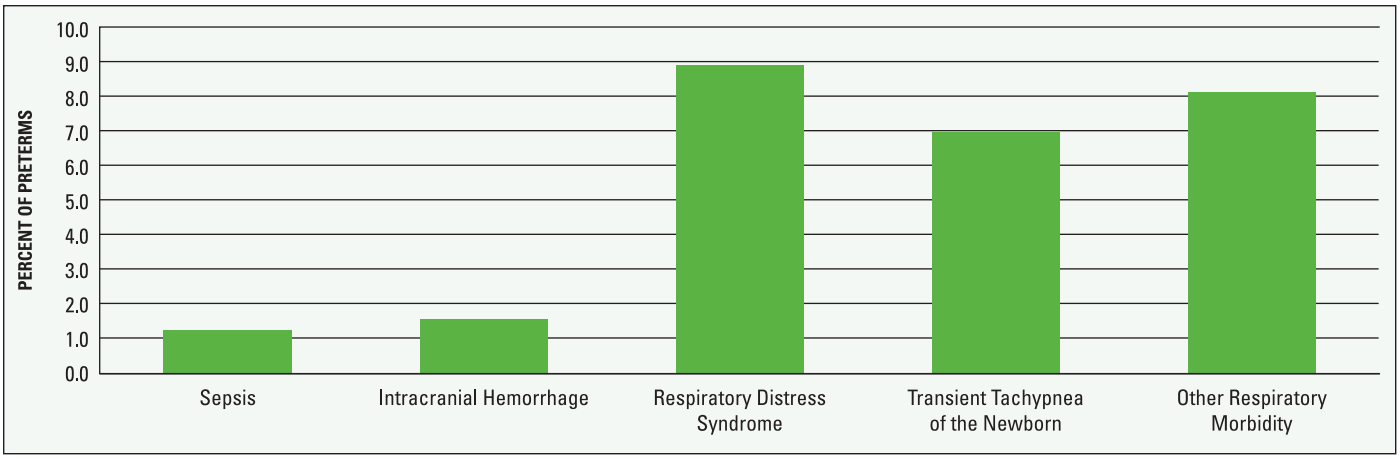

| | Sepsis | Intracranial Hemorrhage | Respiratory Distress Syndrome | Transient Tachypnea of the Newborn | Other Respiratory Morbidity |
|---|---|---|---|---|---|
| Assisted Vaginal | 0.13 | 0.17 | 0.25 | 1.99 | 2.44 |
| Spontaneous Vaginal | 0.11 | 0.11 | 0.39 | 1.10 | 1.17 |
| Caesarean Section | 0.33 | 0.26 | 2.12 | 2.54 | 2.33 |

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only confirmed diagnoses used in this analysis.

Being born prematurely can increase an infant's risk of morbidity (Figure 5.2.7). Among preterm infants in BC, the morbidity rates in 2007/2008 were highest for respiratory distress syndrome (**8.92** per 100 preterm births) and other respiratory morbidity (**8.14** per 100 preterm births). Sepsis (**1.26** per 100 preterm births) and intracranial hemorrhage (**1.58** per 100 preterm births) were the least common for preterm infants. The preterm morbidity rate for transient tachypnea was **7.00** per 100 preterm births.

Rates for all conditions were considerably higher among preterm infants than among all infants in BC. This difference was most pronounced for respiratory distress syndrome, where the preterm rate was **9.7** times that of the overall BC rate, and for intracranial hemorrhage (**9.5** times the rate for BC overall) in 2007/2008.

**Figure 5.2.7 Preterm birth rate (per 100 preterm births in NICU) by selected diagnoses, British Columbia, 2007/2008**



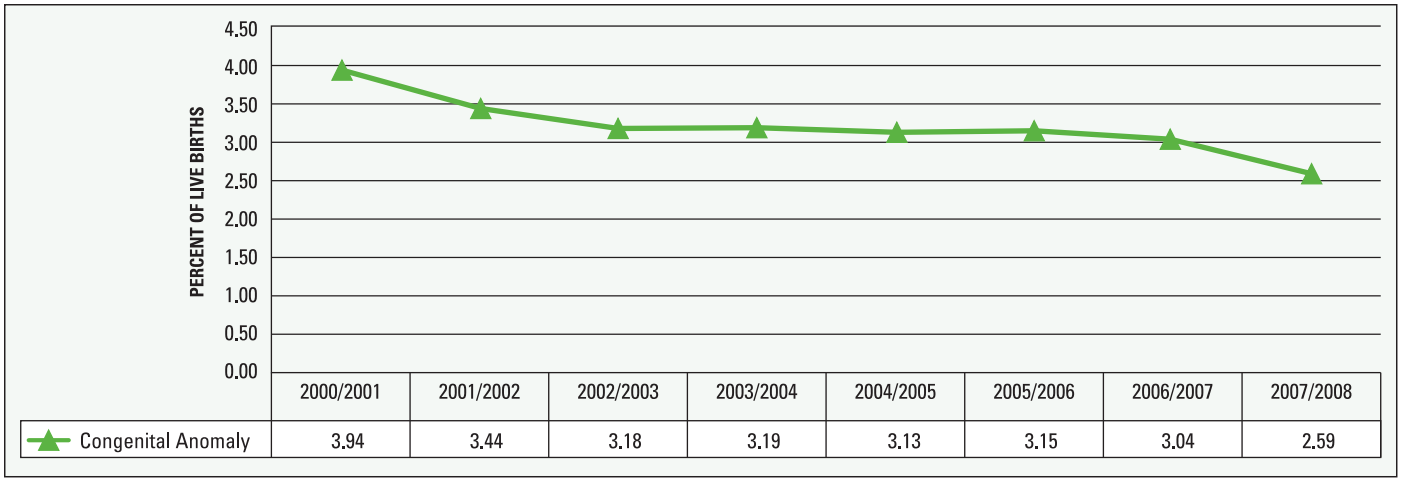

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only confirmed diagnoses used in this analysis.

## 5.3 Congenital Anomalies

Congenital anomalies refer to abnormalities of structure or function that are present in a neonate at birth; that is, conditions that develop prior to birth. Congenital anomalies are a leading cause of infant deaths and are also significant factors in morbidity and disability in infants and children. Congenital anomalies consist of a large number of conditions, including heart defects, neural tube defects, physical anomalies such as cleft lip and palate, and chromosomal disorders such as Down syndrome.

For this report, congenital anomalies included only those diagnosed during the delivery admission. A specific list of conditions and ICD codes used to identify the anomalies can be found in Appendix 1 of this report. In BC, the rate of congenital anomalies in live births declined (Figure 5.3.0). In 2000/2001, this rate was **3.94** per 100 live births, and by 2007/2008 this had decreased to **2.59** per 100 live births.

**Figure 5.3.0 Congenital anomaly rate for British Columbia, 2000/2001 to 2007/2008**




| | 2000/2001 | 2001/2002 | 2002/2003 | 2003/2004 | 2004/2005 | 2005/2006 | 2006/2007 | 2007/2008 |
|---|---|---|---|---|---|---|---|---|
| Congenital Anomaly | 3.94 | 3.44 | 3.18 | 3.19 | 3.13 | 3.15 | 3.04 | 2.59 |

Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

The congenital anomalies rate in BC was lower than the national average of 4.8 per 100 births in 2003/2004, according to the Canadian Perinatal Health Report (2008).[5] The report demonstrated that while the BC rate may be declining, this is not the case for the rest of Canada, where between 1995 and 2004 the rate remained fairly steady. However, it should be noted that the specific conditions that were included in the definition of "congenital anomalies" may differ in the BCPHP and Canadian Perinatal Health Report data sets.

One important caution that the Canadian Perinatal Health Report (CPHR) emphasizes is that prenatal screening for congenital anomalies has improved significantly; identification of some disorders during pregnancy may lead individual women to choose to terminate pregnancy. Furthermore, the CPHR has noted that congenital anomalies are related to stillbirth rates. Because of coding differences over time, it is difficult to separate stillbirths and pregnancy terminations in cases where prenatal screening has identified a congenital anomaly. As a category, however, the proportion of neonatal deaths/ stillbirths where

the neonate weighed less than 500 grams and attributed to "congenital anomalies or pregnancy termination" has increased to about 40% of deaths in this category. On the other hand, improvements in screening have also correlated with a drastic reduction in late neonatal deaths due to congenital anomalies.[5]

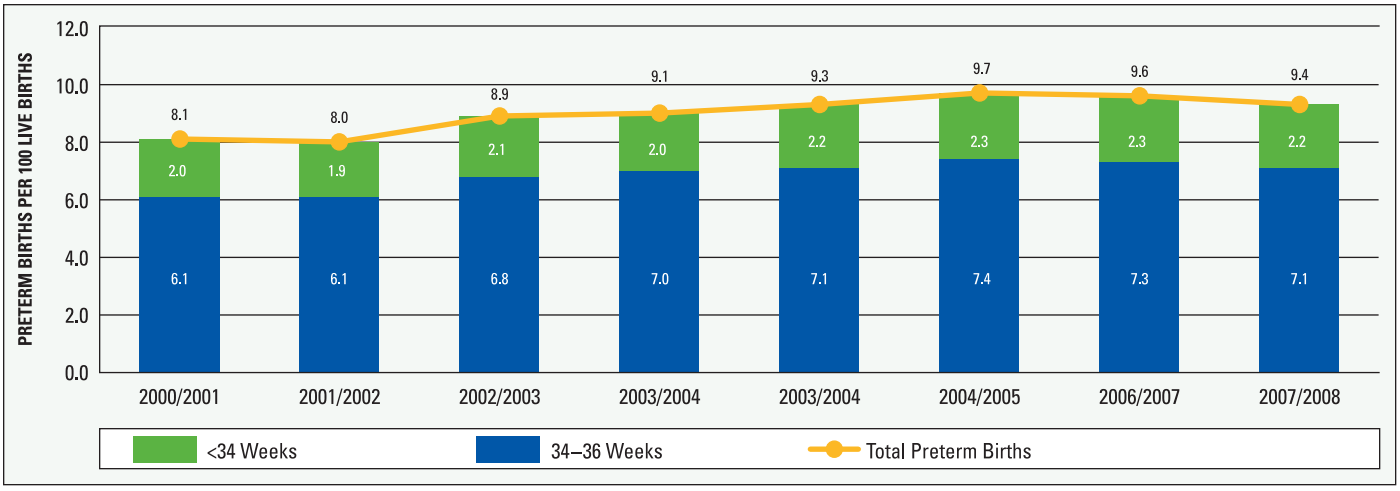
With the recent enhancement of the Prenatal Genetic Screening Program and its associated database under the BCPHP, surveillance of prenatal genetic screening and birth outcomes will further improve access to prenatal screening services for women in BC. With appropriate follow-up and genetic counseling, the goal is to increase detection of chromosomal anomalies and reduce the incidence of neonatal morbidity and mortality.

## 5.4 Gestational Age at Birth

As described in the section above, preterm birth is a leading cause of infant death in Canada.[5] While the most severe effects of prematurity are noted among infants who were less than 32 weeks' gestational age at birth, even mild prematurity can put infants at increased risk of mortality and morbidity. Prematurity has been linked to adverse health outcomes such as respiratory failure, gastrointestinal complications, immunological deficiencies, and longer term problems with cognition, motor skills, hearing, vision, growth and behaviour.[5]

In BC, between 8% and 10% of all live births are born prior to 37 weeks' gestation (for instance, in 2007/2008, this figure was **9.4%**). Of those, the majority (**76.1** per 100 preterm live births in 2007/2008) were between 34 and 36 weeks' gestation at birth (Figure 5.4.0). The proportion of births that are severely premature (less than 28 weeks' gestation at birth) is small in BC, ranging from a low of **3.7** per 100 preterm live births in 2006/2007 to a high of **5.6** per 100 in 2000/2001; in 2007/2008, this rate was **4.6** per 100 preterm live births (data not tabulated). Overall, the distribution of preterm births across gestational ages has been stable over the past eight years.

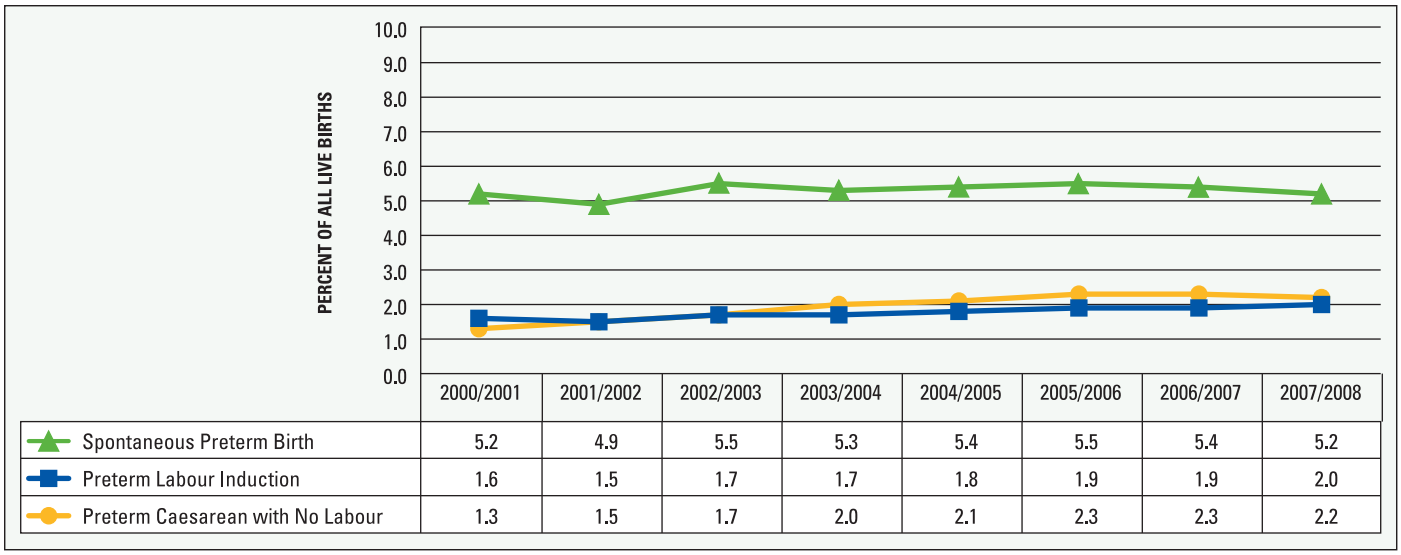
**Figure 5.4.0 Preterm birth rate (per 100 live births) by gestational age groups, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

There have, however, been changes over time in the proportion of preterm live births that were spontaneous versus iatrogenic (i.e. that occurred following preterm labour induction and/or preterm caesarean section in the absence of labour).[16] Iatrogenic preterm live births have increased from **2.9%** of all live births in 2000/2001 to **4.2%** of all live births in 2007/2008 (Figure 5.4.1). Iatrogenic preterm live births that were as a result of caesarean section with no labour have increased from **1.3%** of all live births in 2000/2001 to **2.2%** in 2007/2008. Preterm labour induction rates have increased from **1.6%** of all live births in 2000/2001 to **2.0%** in 2007/2008 (Figure 5.4.1).

**Figure 5.4.1 Spontaneous and iatrogenic preterm birth rates (<37 weeks gestational age), British Columbia, 2000/2001 to 2007/2008**

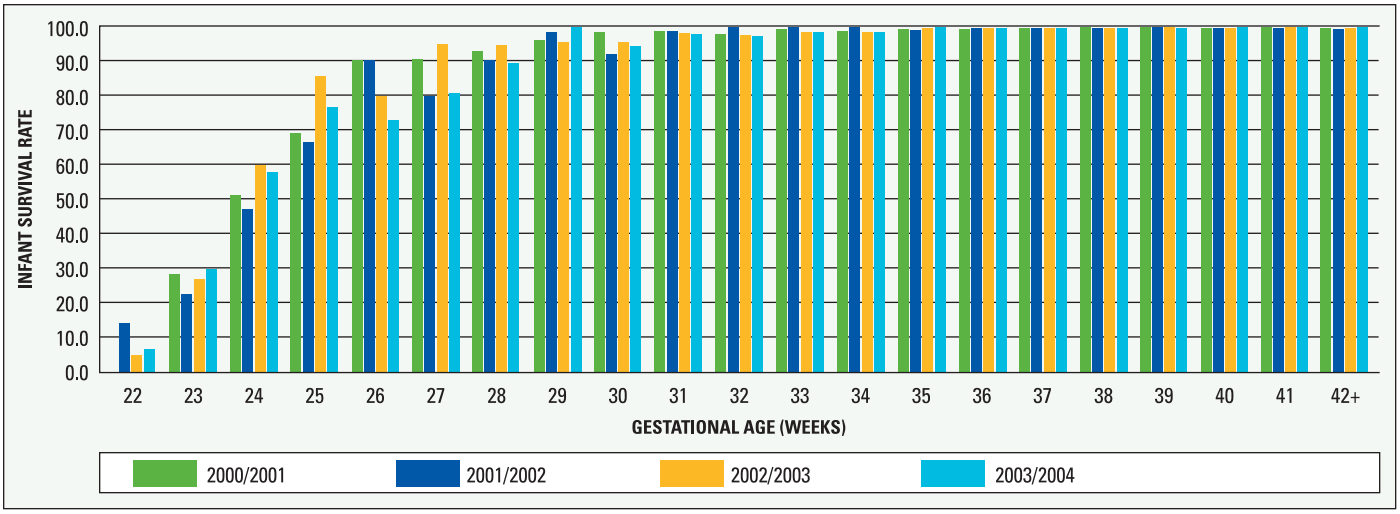



| | 2000/2001 | 2001/2002 | 2002/2003 | 2003/2004 | 2004/2005 | 2005/2006 | 2006/2007 | 2007/2008 |
|---|---|---|---|---|---|---|---|---|
| Spontaneous Preterm Birth | 5.2 | 4.9 | 5.5 | 5.3 | 5.4 | 5.5 | 5.4 | 5.2 |
| Preterm Labour Induction | 1.6 | 1.5 | 1.7 | 1.7 | 1.8 | 1.9 | 1.9 | 2.0 |
| Preterm Caesarean with No Labour | 1.3 | 1.5 | 1.7 | 2.0 | 2.1 | 2.3 | 2.3 | 2.2 |

Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

One year infant survival rates (the proportion of infants born who survive for at least 365 days) for preterm births improves with every week of additional gestation (Figure 5.4.2). For instance, while the survival rate for infants born at 22 weeks' gestation was only **6.7** per 100 preterm infants in 2003/2004, by 30 weeks this rate was **94.4** per 100. Over the four years for which data was available, there was very little change in the survival rates at different gestational ages. Fluctuations in the data are likely due to the small number of preterm births at any given gestational age point, rather than a worsening or improving trend for prematurely born infants.

**Figure 5.4.2 One year infant survival rate by gestational age, British Columbia, 2000/2001 to 2003/2004**




Source: BC Perinatal Database Registry, BC Vital Statistics Agency
Notes: Indicator definitions are listed in Appendix 1.
Deaths post-discharge are not captured in the BCPDR but are supplemented by data from BC Vital Stats Agency; from 2004/2005 onwards, the supplementary data from BC Vital Stats are unavailable.
Infant survival rate = ((Total live births – Total infant deaths)/Total births)*100.

## 5.5 Multiple Births

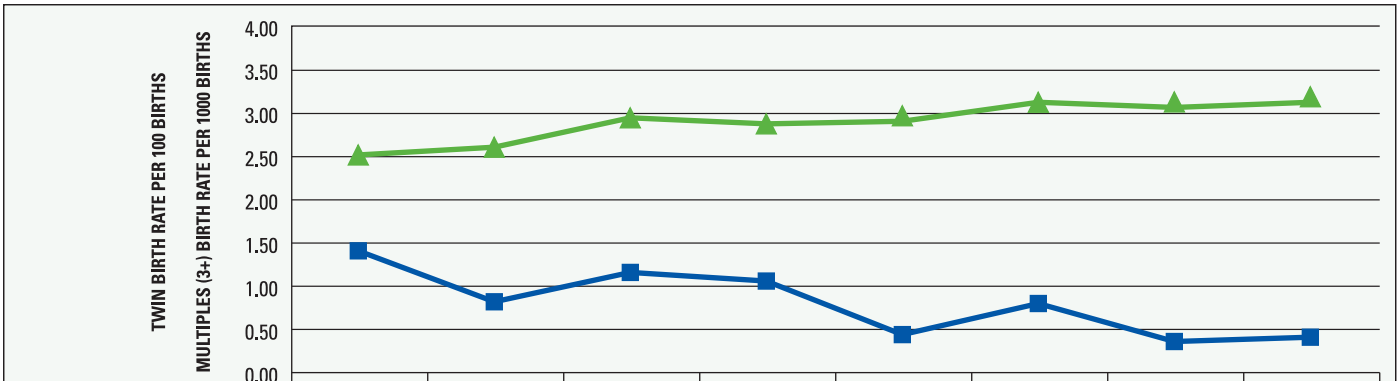
Multiple births increase the risk of adverse health outcomes for both mothers and infants. For instance, mothers of multiples are more likely to experience anemia or pre-eclampsia and to go into labour prematurely.[5] Multiple birth infants are more likely to have a low birth weight, be small-for-gestational-age, and have a higher mortality rate compared to singletons. Multiple births have socio-economic and psychological impacts on families as well and although they cannot be measured using administrative data, should not be forgotten.[21]

National data on multiple births show an increasing trend with an overall rate of 3.0 per 100 live births in Canada in 2003/2004.[5] BCPHP data shows that the corresponding provincial rate (twins and multiples of three or more) was **2.99** per 100 births.

The increase in multiple births in Canada has been linked to assisted reproduction such as in vitro fertilization (IVF) methods as well as to the increase in maternal age.[5] Older mothers are more likely to give birth to multiples even without fertility treatments. Although no data on the use of fertility treatments are currently available for BC, the BCPHP has developed a field on the antenatal care forms where care providers can indicate if IVF was used, which will allow for a better understanding in the future of the relationship between IVF and multiple births.

In BC, the rate per 100 total births has been increasing for twins, but decreasing for multiples of three or more (Figure 5.5.0). The twin birth rate increased **24.2%** between 2000/2001 and 2007/2008, going from **2.52** per 100 births to **3.13** per 100. During the same time period, the multiple (3+) birth rate decreased from **1.41** per 1,000 total births to **0.41** per 1,000 births, a decrease of **70.9%**. It is difficult to say for certain why the multiple (3+) birth rate is declining while the twin birth rate is rising; however, the 2008 Canadian Perinatal Health Report notes that new medical techniques that reduce multiple pregnancies with three or more fetuses to twin pregnancies or that limit the number of embryos implanted during IVF may be a contributing factor.[5]

**Figure 5.5.0 Twins and multiple births of three or more, British Columbia, 2000/2001 to 2007/2008**

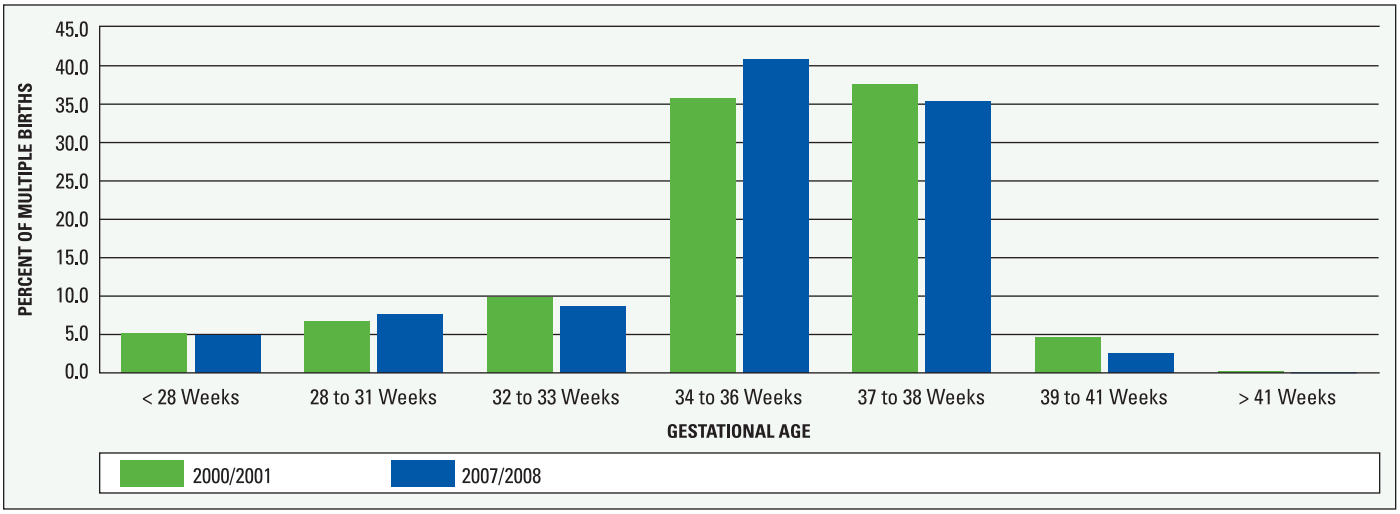



| | 2000/2001 | 2001/2002 | 2002/2003 | 2003/2004 | 2004/2005 | 2005/2006 | 2006/2007 | 2007/2008 |
|---|---|---|---|---|---|---|---|---|
| Twin birth rate | 2.52 | 2.61 | 2.95 | 2.88 | 2.91 | 3.13 | 3.07 | 3.13 |
| Multiples 3+ birth rate | 1.41 | 0.82 | 1.16 | 1.06 | 0.44 | 0.80 | 0.36 | 0.41 |

Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

Multiple births tend to happen prematurely (Figure 5.5.1). In BC in 2007/2008, the majority (**62%**) of multiple births occurred prior to 37 weeks' gestational age; the bulk of these occurred between 34 and 36 weeks. This pattern is similar to that seen in 2000/2001.

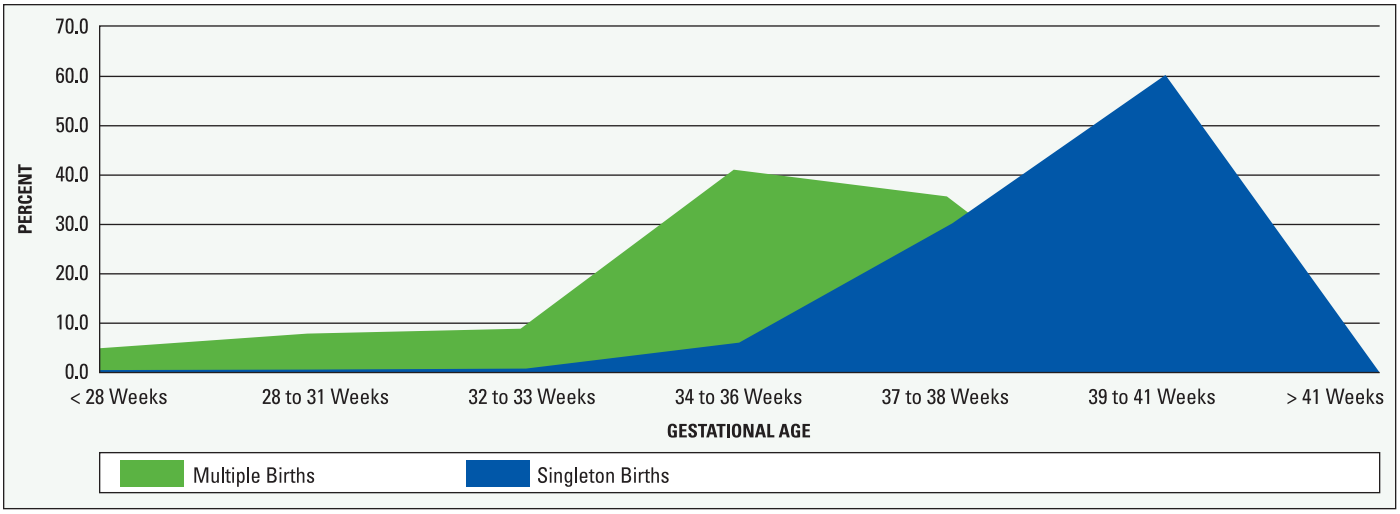
**Figure 5.5.1 Multiple births by gestational age, British Columbia, 2000/2001 and 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

The bulk of multiple births are occurring 4-7 weeks earlier than the majority of singleton births (Figure 5.5.2). As described in the previous figure, multiple births peaked at 34 to 36 weeks' gestational age (**40.8%** of all multiple births) in 2007/2008, whereas singleton births were more likely to be full term and peak at 39 to 40 weeks' gestational age (**60.3%** of all singleton births) in the same year.

**Figure 5.5.2 Birth type (singleton/multiple) by gestational age, British Columbia, 2000/2001 to 2007/2008**

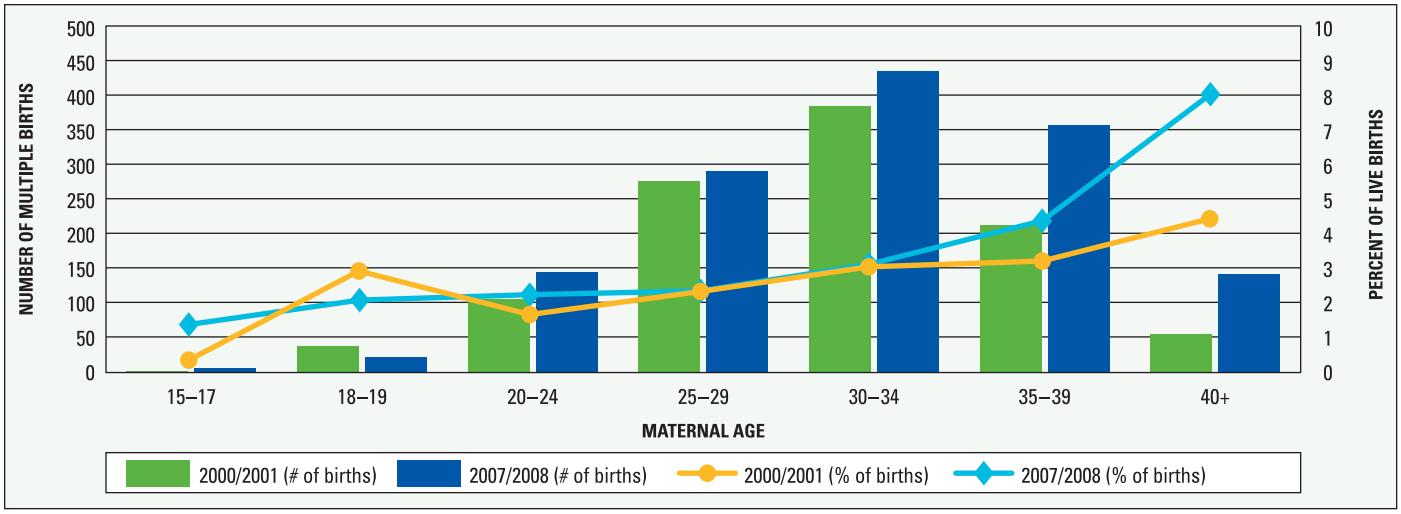



Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

The multiple birth rate varies considerably with maternal age (Figure 5.5.3). Mothers age 30 and older experienced more multiple births than did younger mothers. The absolute number of multiple births to mothers in each age group has increased only slightly between 2000/2001 and 2007/2008, with the exception of mothers aged 35 and older, where the increase has been more substantial (**1.85** times higher).

More importantly, the multiple birth rate was higher in 2007/2008 compared to 2000/2001, and the increase in the multiple birth rate with increasing maternal age has become more pronounced. For instance, in 2000/2001, the multiple birth rate increased from **3.1** per 100 live births for mothers aged 30-34 to **4.5** per 100 live births for mothers aged 40 and older. In 2007/2008 in contrast, the rate increased from **3.1** per 100 to **8.1** per 100 live births for mothers aged 30-34 and 40 and older, respectively.

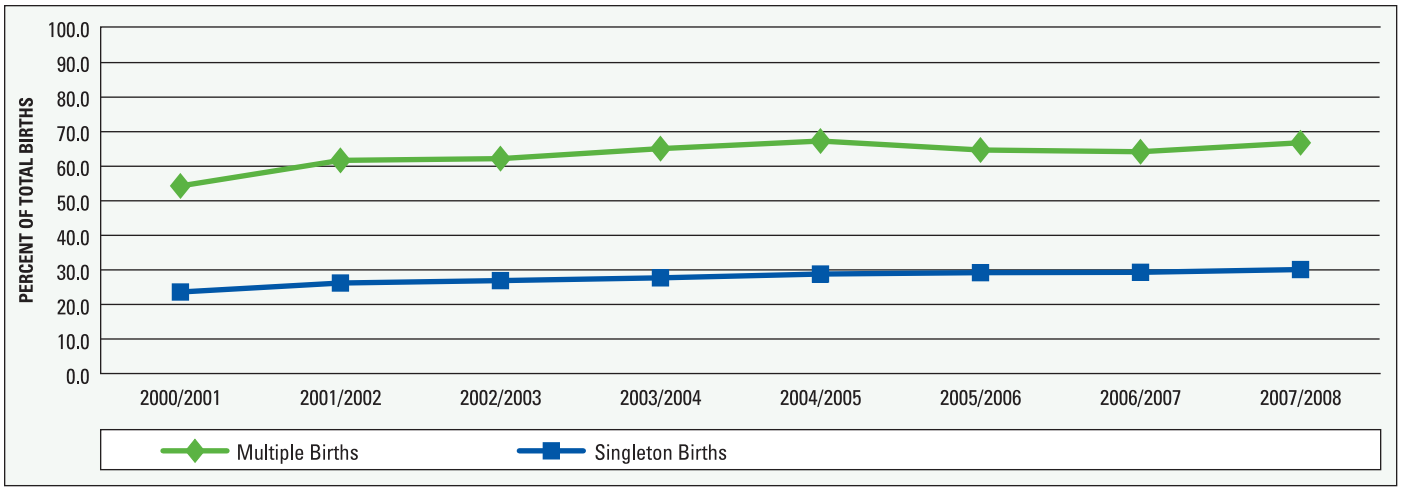
**Figure 5.5.3 Number and rate of multiple births by maternal age, British Columbia, 2000/2001 and 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

Mothers carrying multiples are more likely to deliver via caesarean section than mothers carrying singletons (Figure 5.5.4). This pattern has remained fairly consistent over time.

**Figure 5.5.4 Caesarean section rates for singleton and multiple births, British Columbia, 2000/2001 to 2007/2008**




Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

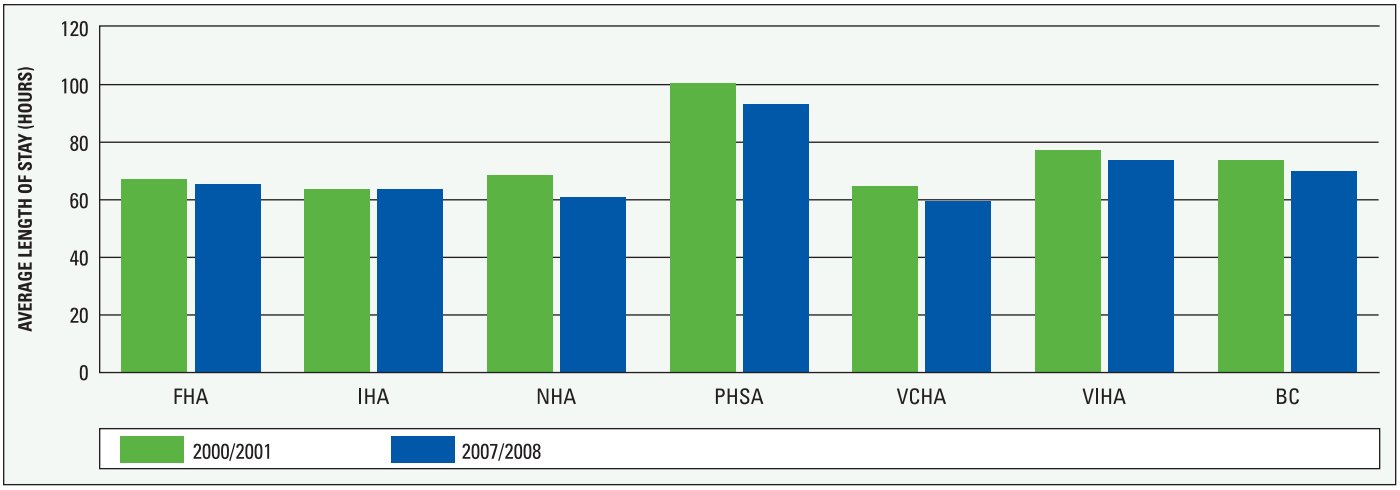
## 5.6 Length of Stay in Hospital at Birth

The Society of Obstetricians and Gynaecologists of Canada recommend that infants who are healthy and born at term have a hospital stay between 12 and 48 hours in length.[22] This recommendation was made in response to concerns that early discharge was related to adverse health outcomes in newborns, particularly with regard to jaundice and feeding problems.

In BC, the average length of stay for all newborns born in hospital (including preterm infants and infants with morbidities) has decreased over the last eight years, from **73.8** hours in 2000/2001 to **70.1** hours in 2007/2008 (Figure 5.6.0). Infant hospital stays were shortest on average in VCHA (**59.6** hours) and longest on average at PHSA (**93.1** hours) in 2007/2008, which likely reflects the higher number of complicated pregnancies and deliveries attended at PHSA. Other than PHSA, the only Health Authority with an average length of stay that was higher than the provincial average overall was VIHA, at **73.8** hours in 2007/2008.

Decreases in the length of stay were most pronounced in NHA, where the average length of stay decreased by **11.2%** between 2000/2001 and 2007/2008. In contrast, length of stay in IHA changed only slightly (by **–0.2%**) during the same time period.

**Figure 5.6.0 Newborn average length of stay (hours) by delivery Health Authority and British Columbia, 2000/2001 and 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
As this field captures data that reflects activity during the hospital admission, lengths of stay for births that occur at home were not included in the analysis.
Please refer to the inside back cover for legend of Health Authorities.
PHSA – refers to BC Women's Hospital patients only.

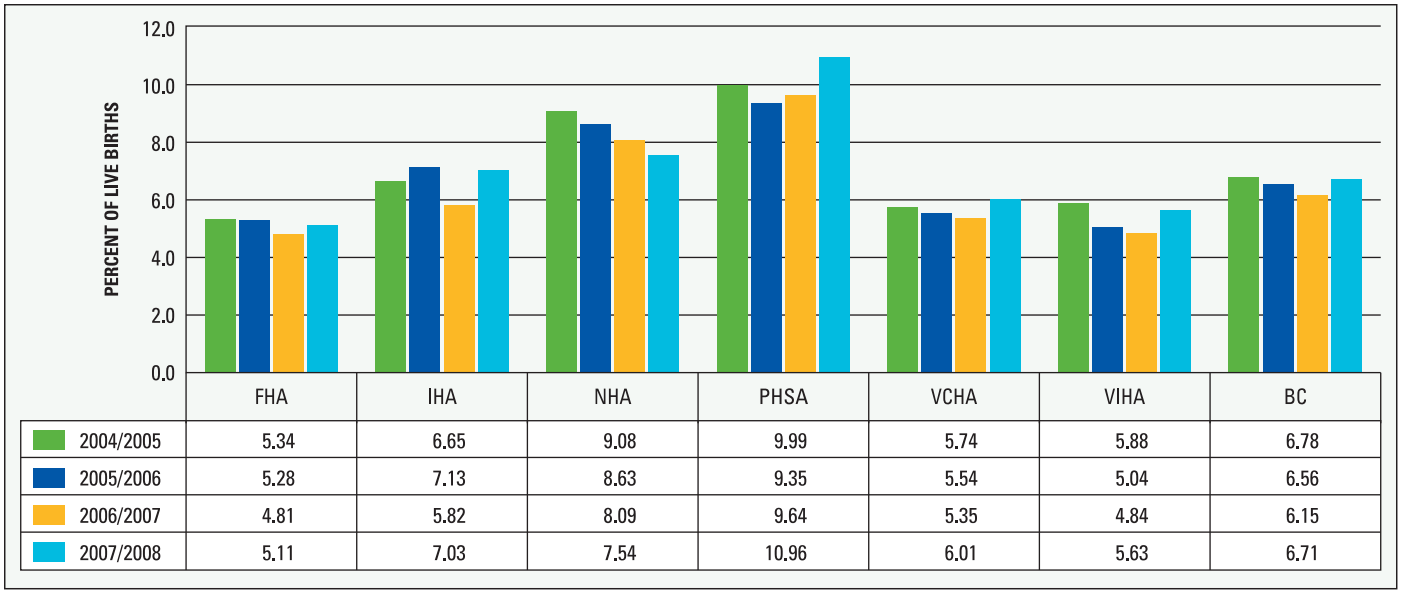
The 2008 Canadian Perinatal Health Report[5] provides information on the proportion of term newborns that are discharged within two days of birth across the country. Nationally, this early discharge rate was 26.6 per 100 live births in 2003/2004; for BC, this rate was 32.4 per 100 live births.

## 5.7 Newborn Readmissions

The newborn readmission rate is the number of infants readmitted to hospital divided by the number of live babies discharged from the same region (such as a Health Authority). The readmission rate accounts only for readmissions that occur within the first 28 days of life. Some readmissions may in fact be transfers from hospital units; that is, an infant may not have returned home between being discharged from the delivery hospital and being admitted to another hospital. Figure 5.7.0 below shows the high rate of readmissions attributed to PHSA which may be partially due to transfers from other hospitals.

Hospital readmissions have been variable in most regions in BC over the last four years; the exception to this is in NHA, where rates have declined from **9.08** per 100 to **7.54** per 100 between 2004/2005 and 2007/2008. In FHA and VIHA, rates have declined as well between these two years (down **0.23** and **0.25** per 100 respectively), although in both instances the rates in 2007/2008 were slightly higher than in 2006/2007. For IHA, PHSA, and VIHA – as, indeed, for the province overall – rates in 2007/2008 were higher compared to 2004/2005 rates.

**Figure 5.7.0 Newborn readmission rates by Health Authority and British Columbia, 2004/2005 to 2007/2008**




| | FHA | IHA | NHA | PHSA | VCHA | VIHA | BC |
|---|---|---|---|---|---|---|---|
| 2004/2005 | 5.34 | 6.65 | 9.08 | 9.99 | 5.74 | 5.88 | 6.78 |
| 2005/2006 | 5.28 | 7.13 | 8.63 | 9.35 | 5.54 | 5.04 | 6.56 |
| 2006/2007 | 4.81 | 5.82 | 8.09 | 9.64 | 5.35 | 4.84 | 6.15 |
| 2007/2008 | 5.11 | 7.03 | 7.54 | 10.96 | 6.01 | 5.63 | 6.71 |

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Please refer to the inside back cover for legend of Health Authorities.
PHSA – refers to BC Women's Hospital patients only.

The most frequent diagnosis responsible for newborn readmissions to hospital was neonatal jaundice (Table 5.7.0), accounting for between **21.6%** and **21.9%** of readmissions between 2004/2005 and 2007/2008. Low birth weight and "other preterm infants" diagnoses were also common, accounting for **18.0%** and **5.1%** of all readmissions in 2007/2008. Beyond these conditions, the remainder of the top nine most responsible readmission diagnoses accounted for **11.2%** of readmissions annually.

**Table 5.7.0 Top 9 most responsible readmission diagnoses for newborns, British Columbia, 2004/2005 to 2007/2008**

| Most Responsible Diagnosis | Percentage of all Readmissions | | | |
|---|---|---|---|---|
| | 2004/2005 | 2005/2006 | 2006/2007 | 2007/2008 |
| Neonatal jaundice | 21.6% | 23.7% | 21.0% | 21.9% |
| Low birth weight | 10.6% | 13.1% | 13.8% | 18.0% |
| Other preterm infants | 7.2% | 6.0% | 6.3% | 5.1% |
| Supervision/care of healthy infant and child | 2.0% | 2.1% | 2.0% | 3.2% |
| Feeding problems of newborn | 1.9% | 1.4% | 2.0% | 2.0% |
| Transient tachypnea of newborn | 1.5% | 1.3% | 1.7% | 1.7% |
| Other apnea of newborn | 1.9% | 1.8% | 1.7% | 1.6% |
| Respiratory distress syndrome of newborn | 2.2% | 2.1% | 2.6% | 1.5% |
| Acute bronchiolitis due to respiratory syncytial virus | 4.3% | 1.0% | 4.7% | 1.2% |

Source: BC Perinatal Database Registry
Note: Indicator definitions are listed in Appendix 1.

Data from the 2008 Canadian Perinatal Health Report[5] are available on newborn readmissions in 2004/2005; the BC rate reported in this document is 3.4 per 100 infants discharged from hospital, equivalent to the Canadian average (also 3.4 per 100). These rates are considerably lower than those reported by the BCPHP of **6.78** per 100 live births for the same year; however, this is most likely due to infants being transferred from hospital to hospital. National data excluded hospital transfers. As well, the BC rate incorporates a small number of infants who were born outside hospital and then admitted, while the Canadian rate excludes any births outside of hospital.

Consistent with national rates, jaundice was the most common readmission diagnosis. Other common conditions identified in the national report included respiratory conditions, feeding problems, sepsis, and congenital anomalies.

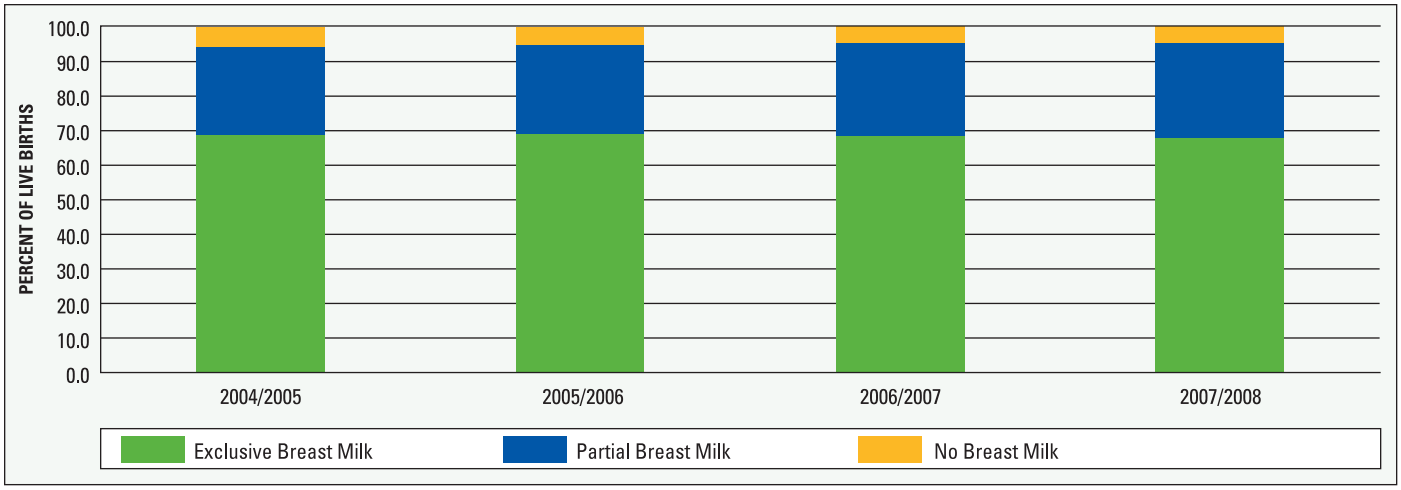
## 5.8 Newborn Feeding

Breastfeeding is considered the optimal method of infant feeding, with health benefits for both infants and mothers.[5] The newborn feeding rate is defined as the number of live born infants breast-fed, either exclusively or supplemented with breast milk substitutes (formula) during the birth admission, expressed as a proportion of all live born infants. As this field captures data that reflects activity during the hospital admission, newborn feeding for births that occur at home were not included in the analysis.

Beginning with April 1, 2004 discharges, the BCPDR began collecting data on newborn feeding during the birth admission based on the Breastfeeding Committee for Canada (BCC) definitions, which have also been adopted by the Canadian Perinatal Program Coalition Committee, as the definitions used by Perinatal Programs.[23] For information prior to April 1, 2004, please refer to the BC Perinatal Database Registry Annual Report 2005.

The proportion of newborns who are not breastfed at all has declined slightly over the last four years, from **5.7%** in 2004/2005 to **5.0%** in 2007/2008 (Figure 5.8.0). Exclusive breastfeeding rates have also declined, from **67.7%** to **66.9%**. Correspondingly, a small increase in the proportion of newborns who are partially breastfed has occurred in the last four years (from **25.3%** to **27.0%**).

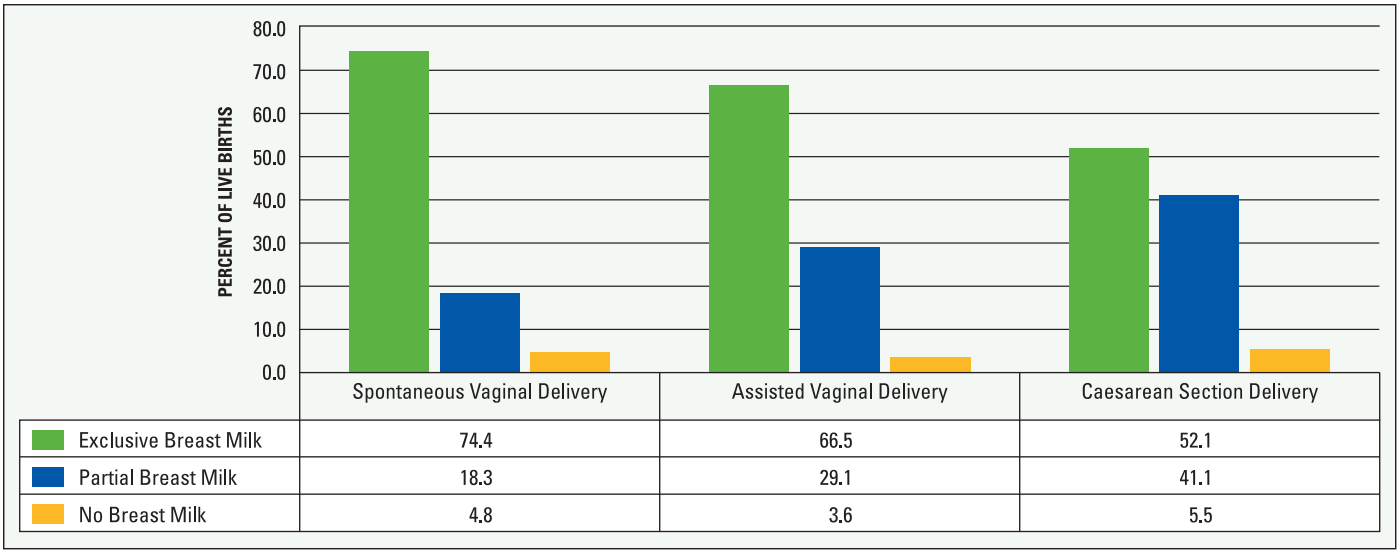
**Figure 5.8.0 Newborn feeding for British Columbia, 2004/2005 to 2007/2008**




Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only hospitals births included in this analysis.

Method of delivery has an effect on the extent to which infants are breastfed during their birth admission (Figure 5.8.1). For instance, in 2007/2008, **74.4%** of infants who were born by spontaneous vaginal delivery were exclusively breastfed, compared to **66.5%** of infants born by assisted vaginal delivery and **52.1%** of infants born by caesarean delivery. Correspondingly, the proportion of infants who were partially breastfed was highest for those born via c-section (**41.1%**), followed by those born via assisted vaginal delivery (**29.1%**) and spontaneous vaginal delivery (**18.3%**). Interestingly, the same pattern was not evident for infants who were not breastfed at all; while rates were highest among those born via caesarean delivery (**5.5%**), they were lowest among those delivered via assisted vaginal delivery (**3.6%**). The proportion of infants delivered spontaneously who were not breastfed was **4.8%**. It is difficult to know whether the differences in proportions among infants who were not breastfed indicate a trend, or whether this reflects normal variation, since the actual number of infants who were not breastfed at all was small.

**Figure 5.8.1 Newborn feeding by method of delivery, British Columbia, 2007/2008**

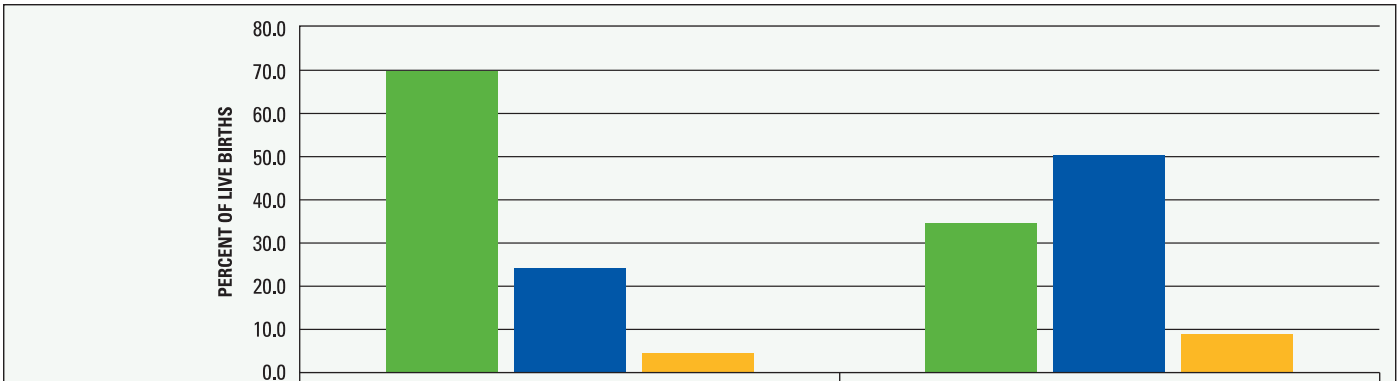



| | Spontaneous Vaginal Delivery | Assisted Vaginal Delivery | Caesarean Section Delivery |
|---|---|---|---|
| Exclusive Breast Milk | 74.4 | 66.5 | 52.1 |
| Partial Breast Milk | 18.3 | 29.1 | 41.1 |
| No Breast Milk | 4.8 | 3.6 | 5.5 |

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only hospitals births included in this analysis.

Newborn feeding is also affected by gestational age at birth (Figure 5.8.2). Infants who are born at term are more likely to be exclusively breastfed than infants born preterm. For instance, in 2007/2008, the proportion of infants who were exclusively breastfed at term was **69.9%** compared to **34.6%** for preterm infants. Preterm infants were partially breastfed in higher proportions (**50.4%** compared to **24.2%**). They were also more likely to not be breastfed at all (**9.0%** of preterm infants received no breast milk during their birth admission, compared to **4.4%** of term infants).

**Figure 5.8.2 Newborn feeding for term and preterm live births, British Columbia, 2007/2008**




| | Term | Preterm |
|---|---|---|
| Exclusive Breast Milk | 69.9 | 34.6 |
| Partial Breast Milk | 24.2 | 50.4 |
| No Breast Milk | 4.4 | 9.0 |

Source: BC Perinatal Database Registry
Notes: Indicator definitions are listed in Appendix 1.
Only hospitals births included in this analysis.

No direct national comparisons are available; however, the 2008 Canadian Perinatal Health Report[5] does provide information on breastfeeding initiation and exclusive breastfeeding for infants up to six months of age, based on self-report survey data. In 2005, 93.0% of women surveyed in BC reported initiating breastfeeding, although not necessarily during their hospital stay after birth, compared to a national average of 87.0%. Nearly one-quarter of surveyed mothers (24.3%) reported exclusively breastfeeding for at least six months, compared to only 16.4% of Canadian mothers overall.

## Notes

# Appendices and References


*Optimizing Neonatal, Maternal and Fetal Health*

## Appendix 1 – Definitions and Notes on Indicators

### Alcohol in Pregnancy (Risk)
Care provider lists mother's use of alcohol as a risk factor in this pregnancy.

### Anesthetic Complications
***(see Severe Maternal Morbidity)***

### Antepartum
Occurring before birth.

### Antepartum Hemorrhage with Transfusion
***(see Severe Maternal Morbidity)***

### Antepartum Length of Stay (APLOS)
Length of hospital stay calculated from admission date/time to delivery date/time of mother. This category excludes those who delivered at home with a B.C. Registered Midwife in attendance.

### Apgar Score
Evaluates five criteria of the newborn that can be used as indicators of the need for immediate medical attention: skin tone, pulse, reflexivity, activity and respiration.

### Assisted Vaginal Delivery
A vaginal delivery involving forceps or vacuum to facilitate delivery of the fetus; includes vaginal breech deliveries.

### Appropriate-for-Gestational-Age (AGA)
Term used to describe babies who are born within the normal range of weight for that gestational age. AGA babies have birth weights between the 10th and 90th percentile of a gender specific weight versus gestational age plot.

### Birth weight
First weight of the fetus or newborn obtained after birth, expressed in grams.

### Caesarean Section Delivery
A delivery involving the surgical incision of the abdomen and uterine walls.

***Elective Caesarean Section*** – A caesarean section delivery in which the decision for Caesarean section is made prior to labour; a booked caesarean section.

***Emergent Caesarean Section*** – A caesarean section delivery in which there is a threat to maternal or fetal health; the patient may or may not be in labour at the time of emergent caesarean section.

***Primary Caesarean Section*** – The woman is having her first caesarean section (not necessarily her first delivery).

***Repeat Caesarean Section*** – The woman is having a second or subsequent caesarean section in the current pregnancy, after a previous caesarean section.

### Care Provider Algorithm
Differs from the 'Care Provider at Delivery' indicator in that it includes all the care providers involved in the delivery admission (i.e. most responsible provider, consultants, other providers, etc) It does not necessarily assess the type of care provider seen during the antenatal period. It includes three different care provider categories, as follows:

***Midwife (MW +/-OB +/-FP)*** – Any patient with a midwife coded during the delivery admission (may or may not be the most responsible care provider). This patient could also have an obstetrictian or family physician coded in conjunction with the midwife code.

***Family Physician (FP +/- OB -MW)*** – Any patient with a family physician coded during the delivery admission (may or may not be the most responsible care provider). This patient could also have an obstetrician coded in conjunction with the family physician but will not have a midwife coded.

***Obstetrician (OB -MW -FP)*** – Any patient with an obstetrician coded during the delivery admission (may or may not be the most responsible care provider). This patient does not have either a family physician or midwife coded.

### Care Provider At Delivery
Person who provides the actual, hands-on care for the delivery of the baby. The categories are: OB/GYN – includes obstetricians (or fellow) and obstetrical residents; Family physician – includes general practitioners, and family practice residents; Midwife – includes registered midwife and midwife trainee; Nurse – includes nurses; Other/Unknown – includes surgeons, family members, ambulance attendants, medical student intern (MSI), if there was no one in attendance or if there was no documentation.

### Congenital Anomaly
Refers to abnormalities of structure or function that are present in a neonate at birth; that is, conditions that develop prior to birth (See Appendix 2 for codes used to identify congenital anomalies for this report).

## Appendix 1 – Definitions and Notes on Indicators (continued)

### Delivery Health Authority (HA)
Refers to the Health Authority in which the patient delivered. The BC Ministry of Health has defined six macro level administrative boundaries called health authorities, which govern the manner in which health care services are delivered within the province of BC. There may be more than one institution in a HA.

### Delivery Health Service Delivery Area (HSDA)
Refers to the Health Service Delivery Area in which the patient delivered. The BC Ministry of Health has defined 15 HSDA's that reside within the five health authorities to ensure community participation in health care decision making and protect local input into the delivery of health services. There may be more than one institution in an HSDA.

### Diabetes
***Abnormal Glucose*** – Impaired glucose tolerance (one abnormal GTT value only), carbohydrate intolerance.

***Gestational*** – Diabetes in pregnancy (was not pre-existing), with or without the use of insulin.

***Pre-Existing*** – Pre-existing diabetes (pre-pregnancy), with or without the use of insulin.

### Drugs in Pregnancy (Risk)
Care provider lists mother's use of drugs (prescription, non-prescription, illicit) as a risk factor in this pregnancy.

### Eclampsia *(see Severe Maternal Morbidity)*

### Elective Caesarean Section *(see Caesarean Section)*

### Emergent Caesarean Section *(see Caesarean Section)*

### Episiotomy
A surgical incision into the perineum and vagina at the time of birth. If it is unknown if mother received an episiotomy, this case would be included in the category "No".

### Fetal Surveillance
Mother received fetal heart monitoring during 1st or 2nd stage of labour. May include patients with fetal monitoring during latent phase of labour.

***Auscultation*** – Monitoring of the fetal heart during the first and/or second stage of labour with an acoustical device (fetoscope) or hand held ultrasound, done intermittently.

***Electronic***

***External*** – Monitoring of the fetal heart during the first and/or second stage of labour using an external monitoring device.

***Internal*** – Monitoring of the fetal heart during the first and/or second stage of labour using an internal monitoring device.

***None*** – No monitoring of the fetal hart rate during first and/or second stage of labour.

### First Contact with Physician or Midwife
Date of mother's first contact with a physician/midwife for the current pregnancy. (May be left blank if first visit is after the first ultrasound date.)

### Fiscal Year
The fiscal year (April 1 to March 31) during which the patient was discharged.

### Gestational Age
The number of completed weeks a fetus has developed since the beginning of the pregnancy (gestation).

### Health Authority (HA)
The BC Ministry of Health has defined six macro level administrative boundaries called health authorities, which govern the manner in which health care services are delivered within the province of BC. There may be more than one institution in a HA.

### Health Service Delivery Area (HSDA)
The BC Ministry of Health has defined 15 HSDA's that reside within the five health authorities to ensure community participation in health care decision making and protect local input into the delivery of health services. There may be more than one institution in an HSDA..

### High Birth Weight
The first weight of the fetus or newborn after birth was at least 4,500 grams.

### Home Birth
Birth that occurred at home and mother was not admitted to an inpatient facility within 24 hours of the birth. The primary care provider was a BC College Registered Midwife.

## Appendix 1 – Definitions and Notes on Indicators (continued)

### Hypertension *(see also Postpartum Readmission)*

***Gestational*** – If patient had a blood pressure reading of ≥140/90 on two consecutive readings during the pregnancy, prior to labour.

***Pre-Existing*** – Hypertension that existed in the patient prior to her pregnancy. (See Appendix 2 for codes used to identify pre-existing hypertension for this report.)

### Iatrogenic Preterm Birth

Birth occurring following preterm labour induction and/or preterm caesarean section in the absence of labour.

### Induction of Labour

Patient who received instrumental or pharmacological assistance to promote labour, prior to the onset of first stage of labour. A patient may be induced by any of the following methods: artificial rupture of membranes (ARM), oxytocin, prostaglandin or other methodology. A failed medical induction is classified as an induction. Induction is categorized as "unknown" if it is unknown how the patient's labour was initiated. Inductions performed prior to a delivery admission (e.g., as an antepartum admission or an outpatient visit) that have resulted in labour with subsequent admission are also classified as an induction.

### Induction of Labour – Method

***Prostaglandin*** – Mother received prostaglandin to induce labour, generally prior to the onset of first stage of labour.

***Oxytocin*** – Mother received oxytocin, pitocin, syntocinon or any other medicinal assistance to induce labour, generally prior to the first stage of labour.

***Artificial Rupture of Membranes (ARM)*** – Mother received instrumental assistance to rupture the membranes to induce labour, generally prior to the onset of first stage of labour.

***Other*** – Mother received another method (not previously listed) to induce labour, generally prior to the onset of first stage of labour.

***>1*** – Mother received more than one type of method of induction to induce labour, generally prior to the onset of first stage of labour.

### Induction of Labour – Primary Indication

***Premature Rupture of Membranes (PROM)*** – Rupture of membranes occurred before onset of uterine contractions.

***Post Dates*** – Pregnancy has gone beyond the due date (≥41 weeks).

***Fetal Compromise*** – Medical concern about newborn's condition.

***Maternal Condition*** – Medical concern about mother's condition, severe enough to compromise mother's health (e.g. Diabetes, pregnancy-induced hypertension, etc.).

***Other*** – Any other condition not listed above (includes logistics, fetal demise).

### Infection of Surgical Wound/Postpartum *(see Postpartum Readmission)*

### Intracranial Hemorrhage *(see Neonatal Morbidity)*

### Intrapartum (IP)

The period between the onset of the first stage of labour and the delivery of the placenta.

### Laceration

A tear and/or rupture occurred to the vagina or perineum during labour, excluding abrasions. The degree of laceration may be first, second, third or fourth (the highest degree is chosen to be abstracted in the BC Perinatal Database Registry).

### Large-for-Gestational-Age (LGA)

Term used to describe babies born weighing more than the usual amount for the number of weeks of pregnancy. LGA babies have birth weights greater than the 90th percentile of a gender specific weight versus gestational age plot.

### Late Termination

The medical termination of a pregnancy beyond 20 weeks of gestation. Gestation is measured in weeks and estimated from the first day of the last normal menstrual period.

### Live Birth

The complete expulsion or extraction from the mother, irrespective of the duration of the pregnancy, of a fetus in which there is breathing, beating of the heart, pulsation of the umbilical cord or unmistakable movement of voluntary muscle, whether or not the umbilical cord has been cut or the placenta is attached.

## Appendix 1 – Definitions and Notes on Indicators (continued)

### Low Birth Weight
The first weight of the fetus or newborn after birth was less than 2,500 grams. (Very low birth weight (VLBW) – birth weight is less than 1,500 grams. (Excludes newborns with weight between 0-300 grams)).

### Macrosomia
A baby with a birth weight of at least 4,500 grams.

### Maternal Age
Age was calculated using mother's date of birth and delivery date.

***Advanced Maternal Age*** – Mothers aged 35 or older.

***Young Maternal Age*** – Mothers aged 19 years or younger.

### Multiple Birth
Birth in which more than one infant is born, including live births and stillbirths.

### Multiple Pregnancy
A pregnancy with more than one fetus.

### Neonatal Morbidity
In this report, refers to morbidity in the newborn that is diagnosed among newborns with an NICU stay, during their birth admission. The morbidity categories include sepsis, intracranial hemorrhage, respiratory distress syndrome, transient tachypnea and other respiratory morbidity. (See Appendix 2 for codes used to identify neonatal morbidities for this report.)

### Newborn Feeding
Breastfeeding definitions in the BCPDR have been updated to include the WHO/UNICEF recommendations.

***Exclusive breastfeeding*** – No food or liquid other than breast milk, not even water, is given to the infant from birth by the mother, health care provider or family member/ supporter with the exception of undiluted drops of syrups consisting of vitamin or mineral supplements or medicines (BCC adapted from WHO/UNICEF, 2004).

***Breast milk and Formula (Partial Breast milk)*** – Infant receives both breast milk and supplementation (such as formula, water, glucose water) with the exception of undiluted drops and syrups consisting of vitamins or mineral supplements or medicines during the hospital period.

***No Breast milk*** – The infant/child receives no breast milk.

***Not Applicable*** – The baby was immediately transferred to another hospital, was a stillbirth or neonatal death or a midwife case.

### Nulliparous
A woman who has never delivered a baby (500 grams birth weight or 20 weeks gestation) in a previous pregnancy.

### Other Respiratory Morbidity *(see Neonatal Morbidity)*

### Other Specified Diseases/Conditions Complicating Pregnancy, Childbirth or Postpartum
*(see Postpartum Readmission)*

### Other Specified Surgical Follow-up Care
*(see Postpartum Readmission)*

### Parity ≥ 1
The condition of having carried a previous pregnancy to a point of viability (500 grams birth weight or 20 weeks gestation) regardless of outcome.

### Postpartum Care and Exam after Delivery
*(see Postpartum Readmission)*

### Postpartum Hemorrhage *(see Pospartum Readmission)*

### Postpartum Hemorrhage with Hysterectomy
*(see Severe Maternal Morbidity)*

### Postpartum Hemorrhage with Transfusion
*(see Severe Maternal Morbidity)*

## Appendix 1 – Definitions and Notes on Indicators (continued)

### Postpartum Length of Stay (PPLOS)

Length of hospital stay calculated from delivery date/time to discharge date/time of mother. This category excludes those who delivered at home with a B.C. Registered Midwife in attendance.

### Postpartum Puerperal Sepsis

***(see Postpartum Readmission)***

### Postpartum Readmission

Any mother who is readmitted to hospital as an inpatient or as a surgical daycare patient, within 42 days of delivery. The following conditions were identified as the top diagnoses for postpartum readmission in this report: postpartum hemorrhage, postpartum puerperal sepsis, postpartum care and exam after delivery, infection of surgical wound (postpartum), routine postpartum follow-up, hypertension, other specified surgical follow-up care, other specified diseases/conditions complicating postpartum period, spinal/epidural headache, and retained placenta/portions without postpartum hemorrhage. (See Appendix 2 for codes used to identify postpartum readmission conditions for this report.)

### Prenatal Visits

Total number of primary care antenatal visits. Does not include consultations and clinic visits (e.g. Diabetes Clinic).

### Pre-pregnancy Body Mass Index (BMI)

Ratio of weight to height, as measured pre-pregnancy or up to 12 weeks gestation. It is calculated using the formula: BMI = weight (kg)/height $(m)^2$.

| Classification | BMI Category ($kg/m^2$) |
|---|---|
| Underweight | <18.5 |
| Normal Weight | 18.5 – 24.9 |
| Overweight | 25.0 – 29.9 |
| Obese | ≥ 30 |
| Unclassified | Not Available |

Source: Health Canada, Canadian Guidelines for Body Weight Classification in Adults, Ottawa: Minister of Public Works and Government Service Canada; 2003.

### Preterm Live Birth

Live birth after 20 and before 37 weeks completed weeks of gestation.

### Primary Indication for Caesarean Section (C/Section)

***Repeat CS*** – Mother had a previous C/Section and is not a candidate for a vaginal birth after C/Section.

***VBAC Declined/Maternal Request*** – VBAC Declined: Mother had a previous C/Section and is eligible for a vaginal birth after C/Section but declines the VBAC. Maternal Request: Mother is either a nullipara or has had a previous vaginal delivery and has requested a C/Section. *(This is a new indication in the BCPDR beginning with fiscal 2004/2005 discharges).*

***Active Herpes*** – Mother has active herpes.

***Placenta Previa*** – Placenta is lying low in the uterus and partially or completely covers the cervix.

***Abruptio Placentae*** – Premature separation of the placenta from the uterus.

***Nonreassuring Fetal Heart Rate*** – Increased or decreased fetal heart rate especially during and after a contraction. Decreased variability in fetal heart rate.

***Dystocia/CPD*** – abnormal or difficult childbirth or labour (includes failure to progress, incoordinate uterine activity, cephalopelvic disproportion (CPD).

***Breech*** – position of the baby in the uterus is such that it will be delivered buttocks first as opposed to head first position.

***Malposition/Malpresentation*** – Abnormal position of the fetus at birth, making normal delivery difficult or impossible (includes persistent occipito-posterior, brow presentation and transverse lie).

***Other*** – Other reason not listed in the other indication categories.

### Proportion

A proportion is a measure of the number of persons having a specific condition or intervention at a designated time. It is defined as the number of existing cases divided by total population from which those arose. It is reported as a percent, for example, the percent of women giving birth in a specific health region, of all women in the region.

### Pulmonary Embolism *(see Severe Maternal Morbidity)*

## Appendix 1 – Definitions and Notes on Indicators (continued)

### Rate

"A rate is a measure of the frequency of occurrence of a phenomenon. In epidemiology, demography and vital statistics, a rate is an expression of the frequency with which an event occurs in a defined population; the use of rates rather than raw numbers is essential for comparison of experience between populations at different times, different places or among different classes of persons. The components of a rate are the numerator, the denominator, the specified time in which events occur and usually a multiplier, a power of 10, which converts the rate from an awkward fraction to a decimal or whole number". (A Dictionary of Epidemiology, 3rd Edition. John M. Last, Oxford University Press, 1995.)

***Early Neonatal Mortality Rate***

May be expressed mathematically as the formula:

$$= \frac{\text{Number of deaths among infants less than 7 days during a given period x 1000}}{\text{Total live births during that period}}$$

***Infant Mortality Rate***

May be expressed mathematically as the formula:

$$= \frac{\text{Number of deaths among infants under 1 year during a given period x 1000}}{\text{Total live births during that period}}$$

***Late Neonatal Mortality Rate***

May be expressed mathematically as the formula:

$$= \frac{\text{Number of deaths among infants between 7-27 days during a given period x 1000}}{\text{Total live births during that period}}$$

***Neonatal Mortality Rate***

May be expressed mathematically as the formula:

$$= \frac{\text{Number of deaths among infants less than 28 days during a given period x 1000}}{\text{Total live births during that period}}$$

***Neonatal Survival Rate***

May be expressed mathematically as the formula:

$$= \frac{\text{Number of total live births - total neonatal deaths x 1000}}{\text{Total live births during that period}}$$

***Perinatal Mortality Rate***

May be expressed mathematically as the formula:

$$= \frac{\text{Total stillbirths + total early neonatal deaths during a given period x 1000}}{\text{Total births during that period}}$$

***Post Neonatal Mortality Rate***

May be expressed mathematically as the formula:

$$= \frac{\text{Number of deaths among infants between 28 days to 1 year during a given period x 1000}}{\text{Total live births during that period}}$$

***Stillbirth Rate***

May be expressed mathematically as the formula:

$$= \frac{\text{Number of stillbirths during a given period x 1000}}{\text{Total births during that period}}$$

## Appendix 1 – Definitions and Notes on Indicators (continued)

**Resident Health Authority (HA)**
Refers to the Health Authority in which the patient resided at the time of delivery. Statistics relating to the patient's residence are determined via the Translation Master File (TMF). The TMF file is a comprehensive demographic mapping file, which consists of valid BC postal codes and their associated Health Authorities (HA). The geographic area to which a postal code belongs seldom changes over time but in cases where the postal code has changed, appropriate amendments have been made to reflect that postal code's associated HA for that particular year.

**Resident Health Service Delivery Area (HSDA)**
Refers to the Health Service Delivery Area in which the patient resided at the time of delivery. Statistics relating to the patient's residence are determined via the Translation Master File (TMF). The TMF file is a comprehensive demographic mapping file, which consists of valid BC postal codes and their associated Health Service Delivery Areas (HSDA). The geographic area to which a postal code belongs seldom changes over time but in cases where the postal code has changed, appropriate amendments have been made to reflect that postal code's associated HSDA for that particular year.

**Respiratory Distress Syndrome** ***(see Neonatal Morbidity)***

**Retained Placenta/Portions without Postpartum Hemorrhage** ***(see Postpartum Readmission)***

**Routine Postpartum Follow-Up**
***(see Postpartum Readmission)***

**Sepsis (newborn)** ***(see Neonatal Morbidity)***

**Septic Shock** ***(see Severe Maternal Morbidity)***

**Severe Maternal Morbidity**
Refers to a variety of severe, life-threatening conditions that may affect mothers as a consequence of labour and delivery. In this report, these conditions include anesthetic complications, postpartum hemorrhage (with transfusion or hysterectomy), antepartum hemorrhage with transfusion, eclampsia, pulmonary embolism, obstetric shock, and stroke. (See Appendix 2 for codes used to identify severe maternal morbidities for this report.

**Shock** ***(see Severe Maternal Morbidity)***

**Small-for-Gestational-Age (SGA)**
Term used to describe babies who are born weighing less than the usual amount for the number of weeks of pregnancy. SGA babies have birth weights below the 10th percentile of a gender specific weight versus gestational age plot.

**Smoking In Pregnancy (Risk)**
There is documentation that the patient smoked during the current pregnancy. If a patient smoked at any time during pregnancy, even if she quit during the pregnancy, she is categorized as a smoker in the current pregnancy.

**Spinal/Epidural Headache**
***(see Postpartum Readmission)***

**Spontaneous Vaginal Delivery**
The complete separation of an infant from the maternal body via the vaginal canal, without the use of forceps and/or vacuum to facilitate delivery.

**Stillbirth**
The complete expulsion or extraction from the maternal body after at least 20 weeks of gestation or after attaining a weight of at least 500 grams of a fetus in which at birth, there is no breathing, beating heart, pulsation of the umbilical cord or unmistakable movement of voluntary muscle. (Source: BC Vital Statistics)

**Stroke** ***(see Severe Maternal Morbidity)***

**Term Live Birth**
Live birth after 37 completed weeks of gestation.

**Total Births**
All live births and stillbirths in the province of British Columbia for the given year.

**Total Length of Stay (LOS)**
Length of hospital stay calculated from admission date/time to discharge date/time of patient. This category excludes those who delivered/were born at home with a BC Registered Midwife in attendance.

**Transient Tachypnea** ***(see Neonatal Morbidity)***

## Appendix 1 – Definitions and Notes on Indicators (continued)

### Uterine Dehiscence

An obstetric complication that involves a partial breakdown of the uterus at the site of a prior caesarean incision (scar).

### Uterine Rupture

An obstetric complication that involves a complete tear through the thickness of the uterine wall at the site of a prior caesarean incision (scar).

### Vaginal Birth After Caesarean (VBAC)

***Eligible*** – Mother had a previous C/Section delivery and documentation indicates that she is a candidate to attempt a vaginal delivery in the current pregnancy. In this report, VBAC eligibility includes women with a previous caesarean who, in the current pregnancy, are at term (≥37 weeks' gestation) with a singleton fetus in cephalic presentation at delivery.

***Attempted*** – Mother had a previous C/Section delivery and for the current pregnancy, a vaginal delivery was attempted. This field indicates the intent, not the outcome of the attempted VBAC.

***Successful*** – Mother had a previous C/Section delivery and for the current pregnancy, a vaginal delivery was attempted and was successful.

### Weight Gain in Pregnancy

Calculated using the difference between pre-pregnancy weight and weight at admission time for delivery episode of care (or last weight documented up to 7 days prior to delivery).

## Appendix 2 – ICD-9 and ICD-10 Codes used for Selected Indicators

In the BC Perinatal Database Registry (BCPDR), diagnoses and procedures from fiscal 2000/2001 to 2003/2004 were coded using the International Classification of Diseases, Ninth Revision (ICD-9) and the Canadian Classification of Diagnostic, Therapeutic and Surgical Procedures (CCP). Beginning with discharges occurring during fiscal 2004/2005 and onwards, diagnoses and procedures were coded using International Statistical Classification of Diseases and Related Health Problems, Tenth Revision (ICD-10) and the Canadian Classification of Health Interventions (CCI). The table below lists the ICD-9 and ICD-10 codes used for selected indicators throughout the report.

| Selected Indicator | ICD-9 | ICD-10 | Notes |
|---|---|---|---|
| **Section 2.3 Weight Gain in Pregnancy** | | | |
| Pre-existing hypertension | 642 | O10, O11, O15 | |
| **Section 3.7 Vaginal Birth After Caesarean** | | | |
| Uterine rupture/dehiscence | 665.0 and 665.1 | O71 | In ICD9, it is difficult to differentiate between uterine rupture and uterine dehiscence |
| **Section 4.2 Severe Maternal Morbidity** | | | |
| Anesthetic complications | | O29, O74, O89 (excluding Spinal & Epidural headaches O29.4, O74.5 and O89.4) | As these conditions were only analyzed for fiscal years 2004/2005 to 2007/2008, only ICD-10 codes were used. |
| Postpartum hemorrhage (PPH) with transfusion | | PPH-O72002 to O72309 Transfusion – coded directly in the BCPDR (no ICD codes used) | |
| Postpartum hemorrhage (PPH) with hysterectomy | | IRM87LAGX, IRM89, 5MD60CB, 5MD60KE, 5MD60RC, 5MD60RD | |
| Antepartum hemorrhage with transfusion | | APH – O20003 to O20909, O45001 to O45909, O46001 to O46909, O67001 to O67909, O44101 to O44109, O69401 or O69409 Transfusion – coded directly in the BCPDR (no ICD codes used) | |
| Eclampsia | | O15 | |
| Pulmonary embolism | | O88 | |
| Shock | | O75.1 | |
| Stroke | | G45.9, I60 to I98 | |
| **Section 4.4 Readmissions to Hospital Post-Discharge** | | | |
| Postpartum hemorrhage | | O72204, O72104, O72004 | As these conditions were only analyzed for the fiscal year 2006/2007, only ICD-10 codes were used. |
| Postpartum puerperal sepsis | | O85004, O86204, O86804, O86104, O86404, O98804 | |
| Postpartum care and exam after delivery | | Z390 | |
| Infection of surgical wound (postpartum) | | O86004 | |
| Routine postpartum follow-up | | Z392 | |
| Hypertension (postpartum) | | O13004, O14004, O10004, O16004, O15204 | |
| Other specified surgical follow-up care | | Z488 | |
| Other specified diseases/conditions complicating postpartum period | | O99804 | |
| Spinal/epidural headache | | O89404, O74504 | |
| Retained placenta/portions without postpartum hemorrhage | | O73004, O73104 | |
| **Section 5.2 Neonatal morbidity** | | | |
| Sepsis (neonatal) | 771.8 | P36 | |
| Intracranial hemorrhage (neonatal) | | P10, P52 | |
| Respiratory distress syndrome (neonatal) | | P22.0 | |
| Transient tachypnea | | P22.1 | |
| Other respiratory morbidity (neonatal) | | A48.1, J00 to J94.9, P22.0 to P28.9, Q30.0 to Q34.9, Q79.1, R09.1, Z90.2 | |
| **Section 5.3 Congenital anomalies** | | | |
| Congenital anomaly | ≥740.0 and ≤759.9 or 756.6 or ≥748.0 and ≤748.9 | G90.1 or P29.3 or ≥Q00.0 and ≤Q99.9 | |

## Appendix 3 – British Columbia Perinatal Database Information Resources

Multiple reports can be accessed and various methods can be used to obtain BCPDR data in order to conduct analysis on perinatal processes and outcomes in British Columbia:

- **Hospital Reports –** these are hospital-specific, pre-programmed reports, which can be run at all locations where the database is installed. Other participating sites, where the database is not installed, may obtain their specific hospital reports from the BCPDR central office.
- **Ad hoc Reports –** the database can be used to answer specific requests through user-defined queries. These queries can be developed and run at the hospital installation sites or at the BCPDR central office.
- **BC Facility Comparison Reports –** these reports are created annually and allow the individual facility to compare and benchmark selected maternal and newborn events and outcomes with provincial and similar sized sites.
- **Perinatal Database Reporting Tool –** The Perinatal Reporting Tool is an interactive CD, which has been designed to allow health care providers, administrators and data analysts access to summarized data sets extracted from the BC Perinatal Database Registry and is updated yearly. The PRT can be used for analysis of population based and comparative reporting between institutions, Health Authorities and against provincial totals for some of the most common and/or important practices and health outcomes related to perinatal care.
- **Specific Requests for Data –** clients, health care professionals, researchers etc., may request specific data via the web at www.bcrcp.ca. See Appendix 11.

## Appendix 4 – Health Authorities, Health Service Delivery Areas and Institutions*

| Health Authority | Health Service Delivery Area | Institution Name | Hospital Code Number |
|---|---|---|---|
| Fraser | Fraser East | Abbotsford Regional Hospital and Cancer Centre | 609 |
| | | Chilliwack General Hospital | 601 |
| | | Fraser Canyon Hospital (Hope) | 606 |
| | | Matsqui-Sumas-Abbotsford General Hospital | 603 |
| | | Mission Memorial Hospital | 602 |
| | Fraser North | Burnaby Hospital | 130 |
| | | Eagle Ridge Hospital & Health Care Centre (Port Moody) | 136 |
| | | Ridge Meadows Hospital & Health Care Centre (Maple Ridge) | 604 |
| | | Royal Columbian Hospital (New Westminster) | 109 |
| | Fraser South | Delta Hospital | 134 |
| | | Langley Memorial Hospital | 115 |
| | | Peace Arch District Hospital (White Rock) | 131 |
| | | Surrey Memorial Hospital | 116 |
| Interior | East Kootenay | Creston Valley Hospital | 654 |
| | | East Kootenay Regional Hospital (Cranbrook) | 756 |
| | | Elk Valley Hospital (Fernie) | 753 |
| | | Golden and District General Hospital | 409 |
| | | Invermere and District Hospital | 755 |
| | | Kimberley and District Hospital | 752 |
| | | Sparwood Health Centre | 754 |
| | Kootenay Boundary | Arrow Lakes Hospital (Nakusp) | 655 |
| | | Boundary Hospital (Grand Forks) | 803 |
| | | Castlegar and District Community Health Centre | 804 |
| | | Kootenay Boundary Regional Hospital (Trail) | 801 |
| | | Kootenay Lake Hospital (Nelson) | 651 |
| | | Slocan Community Health Centre (New Denver) | 652 |
| | | Victorian Community Health Centre of Kaslo | 653 |
| | Okanagan | Enderby & District Memorial Hospital | 306 |
| | | Kelowna General Hospital | 302 |
| | | Penticton Regional Hospital | 303 |
| | | Princeton General Hospital | 305 |
| | | South Okanagan General Hospital (Oliver) | 309 |
| | | Summerland Memorial Health Centre | 308 |
| | | Vernon Jubilee Hospital | 301 |
| | Thompson Cariboo Shuswap | 100 Mile District General Hospital | 708 |
| | | Ashcroft and District General Hospital | 408 |
| | | Cariboo Memorial Hospital (Williams Lake) | 406 |
| | | Dr. Helmcken Memorial Hospital (Clearwater) | 419 |
| | | Lillooet Hospital and Health Centre | 417 |
| | | Nicola Valley Health Centre (Merritt) | 403 |
| | | Queen Victoria Hospital (Revelstoke) | 402 |
| | | Royal Inland Hospital (Kamloops) | 401 |
| | | Shuswap Lake General Hospital (Salmon Arm) | 404 |
| | | St. Bartholomew's Hospital (Lytton) | 405 |

*For a list of the level of services provided at BC hospitals, refer to the BCPHP website at www.bcphp.ca/publications
Refer to document: BC Deliveries By Maternal Residence Tables

## Appendix 4 – Health Authorities, Health Service Delivery Areas and Institutions* (continued)

| Health Authority | Health Service Delivery Area | Institution Name | Hospital Code Number |
|---|---|---|---|
| Northern Health | Northeast | Chetwynd General Hospital | 716 |
| | | Dawson Creek and District Hospital | 704 |
| | | Fort Nelson General Hospital | 714 |
| | | Fort St. John General Hospital | 701 |
| | Northern Interior | G.R. Baker Memorial Hospital (Quesnel) | 705 |
| | | Lakes District Hospital and Health Centre (Burns Lake) | 707 |
| | | MacKenzie and District Hospital | 715 |
| | | McBride and District Hospital | 713 |
| | | The University Hospital of Northern British Columbia (Prince George) | 703 |
| | | St. John Hospital (Vanderhoof) | 702 |
| | | Stuart Lake Hospital (Fort St. James) | 717 |
| | Northwest | Bulkley Valley District Hospital (Smithers) | 903 |
| | | Kitimat General Hospital | 917 |
| | | Mills Memorial Hospital (Terrace) | 912 |
| | | Prince Rupert Regional Hospital | 902 |
| | | Northern Haida Gwaii Hospital and Health Centre (Masset) | 918 |
| | | Queen Charlotte Islands General Hospital (Village of Queen Charlotte) | 907 |
| | | Stewart General Hospital | 910 |
| | | Wrinch Memorial Hospital (Hazelton) | 901 |
| Vancouver Coastal | North Shore/ Coast Garibaldi | Bella Coola General Hospital | 906 |
| | | Lions Gate Hospital (North Vancouver) | 112 |
| | | Powell River General Hospital | 111 |
| | | R.W. Large Memorial Hospital (Bella Bella) | 904 |
| | | Squamish General Hospital | 128 |
| | | St. Mary's Hospital (Sechelt) | 113 |
| | Richmond | The Richmond Hospital | 121 |
| | Vancouver | Mount Saint Joseph Hospital | 106 |
| | | St. Paul's Hospital | 102 |
| | | Vancouver General Hospital | 101 |
| Vancouver Island | Central Vancouver Island | Cowichan District Hospital (Duncan) | 203 |
| | | Ladysmith Community Health Centre | 506 |
| | | Nanaimo Regional General Hospital | 501 |
| | | Tofino General Hospital | 854 |
| | | West Coast General Hospital (Port Alberni) | 851 |
| | North Vancouver Island | Campbell River and District General Hospital | 508 |
| | | Port Alice Hospital | 859 |
| | | Port Hardy Hospital | 510 |
| | | Port McNeill and District Hospital | 511 |
| | | Cormorant Island Community Health Centre (Alert Bay) | 507 |
| | | St. Joseph's General Hospital (Comox) | 502 |
| | South Vancouver Island | The Lady Minto Gulf Islands Hospital (Salt Spring Island) | 206 |
| | | Saanich Peninsula Hospital (Saanichton) | 217 |
| | | Victoria General Hospital | 202 |
| PHSA | Provinical Health Services Authority | BC Women's Hospital and Health Centre | 104 |

*For a list of the level of services provided at BC hospitals, refer to the BCPHP website at www.bcphp.ca/publications
Refer to document: BC Deliveries By Maternal Residence Tables

## Appendix 5 – Birth Weight and Gestational Age Charts for British Columbia Population for Singleton Males (1981-2000)

| Descriptive Statistics for Singleton Males | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Weeks of Gestation | Number of Cases | Lower 95% Conf. Limit | Mean | Upper 95% Conf. Limit | Standard Deviation | Skewness | Percentile (Raw) | | | | | | |
| | | | | | | | 3rd | 5th | 10th | Median | 90th | 95th | 97th |
| 20 | 57 | 383.90 | 423.12 | 462.35 | 147.84 | 1.97 | 265 | 275 | 290 | 380 | 590 | 800 | 885 |
| 21 | 81 | 411.37 | 478.27 | 545.17 | 302.54 | 7.39 | 320 | 340 | 360 | 430 | 550 | 620 | 650 |
| 22 | 137 | 509.98 | 535.01 | 560.05 | 148.18 | 2.39 | 360 | 375 | 400 | 520 | 675 | 757 | 800 |
| 23 | 162 | 584.24 | 604.34 | 624.44 | 129.55 | 1.44 | 380 | 400 | 460 | 600 | 710 | 800 | 900 |
| 24 | 231 | 710.61 | 735.53 | 760.44 | 192.19 | 2.94 | 500 | 520 | 590 | 710 | 870 | 1,000 | 1,310 |
| 25 | 237 | 793.79 | 812.41 | 831.02 | 145.49 | 1.95 | 580 | 600 | 640 | 810 | 937 | 1,020 | 1,060 |
| 26 | 313 | 909.42 | 933.16 | 956.90 | 213.46 | 1.17 | 550 | 620 | 700 | 920 | 1,150 | 1,295 | 1,370 |
| 27 | 326 | 1,035.57 | 1,061.80 | 1,088.02 | 240.67 | 2.12 | 630 | 700 | 809 | 1,045 | 1,300 | 1,375 | 1,492 |
| 28 | 457 | 1,212.63 | 1,244.87 | 1,277.11 | 350.73 | 2.24 | 680 | 780 | 930 | 1,200 | 1,540 | 1,790 | 2,009 |
| 29 | 479 | 1,373.65 | 1,407.64 | 1,441.62 | 378.57 | 3.52 | 850 | 925 | 1,049 | 1,380 | 1,690 | 1,910 | 2,100 |
| 30 | 671 | 1,591.72 | 1,631.47 | 1,671.22 | 524.42 | 1.97 | 880 | 990 | 1,160 | 1,550 | 2,060 | 2,905 | 3,260 |
| 31 | 737 | 1,733.17 | 1,765.98 | 1,798.80 | 453.79 | 1.98 | 1,040 | 1,135 | 1,300 | 1,730 | 2,130 | 2,380 | 2,975 |
| 32 | 1,323 | 1,951.36 | 1,974.07 | 1,996.78 | 421.03 | 0.93 | 1,235 | 1,340 | 1,520 | 1,950 | 2,410 | 2,669 | 2,940 |
| 33 | 1,642 | 2,159.62 | 2,179.57 | 2,199.53 | 412.28 | 0.78 | 1,450 | 1,559 | 1,700 | 2,160 | 2,630 | 2,880 | 3,077 |
| 34 | 3,143 | 2,396.59 | 2,411.70 | 2,426.81 | 431.98 | 0.58 | 1,637 | 1,760 | 1,900 | 2,381 | 2,900 | 3,160 | 3,335 |
| 35 | 4,721 | 2,603.65 | 2,616.22 | 2,628.78 | 440.41 | 0.44 | 1,835 | 1,944 | 2,116 | 2,600 | 3,155 | 3,375 | 3,515 |
| 36 | 11,433 | 2,879.96 | 2,888.48 | 2,897.00 | 464.78 | 0.36 | 2,060 | 2,180 | 2,340 | 2,863 | 3,480 | 3,690 | 3,835 |
| 37 | 21,134 | 3,096.64 | 3,102.82 | 3,108.99 | 457.83 | 0.20 | 2,280 | 2,390 | 2,560 | 3,085 | 3,680 | 3,870 | 4,010 |
| 38 | 57,855 | 3,327.10 | 3,330.75 | 3,334.39 | 447.69 | 0.21 | 2,525 | 2,637 | 2,790 | 3,311 | 3,900 | 4,090 | 4,220 |
| 39 | 87,266 | 3,484.89 | 3,487.82 | 3,490.75 | 441.36 | 0.20 | 2,696 | 2,800 | 2,948 | 3,470 | 4,050 | 4,231 | 4,360 |
| 40 | 157,563 | 3,631.98 | 3,634.20 | 3,636.43 | 450.37 | 0.19 | 2,830 | 2,928 | 3,080 | 3,620 | 4,215 | 4,400 | 4,520 |
| 41 | 67,662 | 3,768.60 | 3,772.06 | 3,775.51 | 458.34 | 0.15 | 2,948 | 3,046 | 3,201 | 3,760 | 4,360 | 4,540 | 4,670 |
| 42 | 22,931 | 3,818.51 | 3,824.70 | 3,830.88 | 477.55 | 0.10 | 2,948 | 3,060 | 3,232 | 3,813 | 4,440 | 4,621 | 4,750 |
| 43 | 2,032 | 3,841.95 | 3,863.08 | 3,884.21 | 485.75 | 0.12 | 2,977 | 3,090 | 3,260 | 3,856 | 4,480 | 4,677 | 4,800 |
| 44 | 255 | 3,747.81 | 3,812.22 | 3,876.62 | 522.26 | 0.11 | 2,807 | 2,948 | 3,175 | 3,770 | 4,550 | 4,734 | 4,904 |

Source: BC Vital Statistics Agency

## Appendix 6 – Birth Weight and Gestational Age Charts for British Columbia Population for Singleton Females (1981-2000)

| Descriptive Statistics for Singleton Females | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Weeks of Gestation | Number of Cases | Lower 95% Conf. Limit | Mean | Upper 95% Conf. Limit | Standard Deviation | Skewness | Percentile (Raw) | | | | | | |
| | | | | | | | 3rd | 5th | 10th | Median | 90th | 95th | 97th |
| 20 | 37 | 357.88 | 461.30 | 564.71 | 310.17 | 2.79 | 200 | 200 | 260 | 380 | 850 | 1,500 | 1,500 |
| 21 | 83 | 415.74 | 444.61 | 473.49 | 132.25 | 1.92 | 280 | 300 | 320 | 420 | 570 | 728 | 810 |
| 22 | 98 | 478.67 | 497.56 | 516.46 | 94.25 | 0.29 | 310 | 360 | 400 | 495 | 630 | 670 | 700 |
| 23 | 139 | 551.05 | 567.79 | 584.53 | 99.83 | 0.31 | 415 | 440 | 454 | 560 | 700 | 765 | 800 |
| 24 | 183 | 652.76 | 682.59 | 712.42 | 204.52 | 4.81 | 410 | 490 | 520 | 655 | 840 | 907 | 975 |
| 25 | 171 | 767.54 | 804.52 | 841.50 | 244.97 | 2.82 | 454 | 540 | 600 | 780 | 964 | 1,070 | 1,389 |
| 26 | 276 | 873.74 | 911.11 | 948.48 | 315.37 | 4.50 | 540 | 570 | 685 | 873 | 1,100 | 1,260 | 1,370 |
| 27 | 278 | 988.27 | 1,014.61 | 1,040.95 | 223.10 | 0.63 | 555 | 660 | 740 | 1,010 | 1,260 | 1,370 | 1,480 |
| 28 | 369 | 1,168.98 | 1,215.36 | 1,261.74 | 453.08 | 3.05 | 705 | 755 | 850 | 1,160 | 1,500 | 1,860 | 2,800 |
| 29 | 353 | 1,281.94 | 1,325.32 | 1,368.70 | 414.39 | 2.40 | 700 | 770 | 930 | 1,295 | 1,640 | 1,830 | 2,320 |
| 30 | 494 | 1,579.02 | 1,628.96 | 1,678.89 | 564.89 | 1.87 | 880 | 940 | 1,150 | 1,520 | 2,280 | 3,005 | 3,340 |
| 31 | 560 | 1,641.78 | 1,680.63 | 1,719.48 | 468.03 | 1.91 | 980 | 1,083 | 1,235 | 1,645 | 2,046 | 2,517 | 2,880 |
| 32 | 1,055 | 1,862.63 | 1,890.12 | 1,917.60 | 455.02 | 1.06 | 1,110 | 1,247 | 1,401 | 1,843 | 2,381 | 2,693 | 2,980 |
| 33 | 1,325 | 2,087.82 | 2,111.82 | 2,135.83 | 445.38 | 0.72 | 1,315 | 1,440 | 1,620 | 2,080 | 2,600 | 2,900 | 3,180 |
| 34 | 2,377 | 2,308.51 | 2,326.38 | 2,344.26 | 444.53 | 0.66 | 1,570 | 1,670 | 1,820 | 2,300 | 2,852 | 3,130 | 3,374 |
| 35 | 3,824 | 2,527.88 | 2,541.97 | 2,556.07 | 444.59 | 0.39 | 1,740 | 1,885 | 2,020 | 2,521 | 3,090 | 3,317 | 3,487 |
| 36 | 9,450 | 2,782.68 | 2,792.06 | 2,801.43 | 464.90 | 0.30 | 1,950 | 2,075 | 2,250 | 2,770 | 3,400 | 3,600 | 3,750 |
| 37 | 18,260 | 2,988.23 | 2,994.70 | 3,001.16 | 445.44 | 0.29 | 2,183 | 2,305 | 2,460 | 2,977 | 3,550 | 3,750 | 3,895 |
| 38 | 51,757 | 3,206.86 | 3,210.61 | 3,214.36 | 435.07 | 0.25 | 2,435 | 2,530 | 2,680 | 3,193 | 3,770 | 3,941 | 4,080 |
| 39 | 82,769 | 3,351.27 | 3,354.16 | 3,357.05 | 424.44 | 0.23 | 2,600 | 2,695 | 2,835 | 3,340 | 3,900 | 4,080 | 4,196 |
| 40 | 155,547 | 3,483.26 | 3,485.41 | 3,487.55 | 432.38 | 0.20 | 2,720 | 2,807 | 2,950 | 3,470 | 4,040 | 4,220 | 4,337 |
| 41 | 66,228 | 3,606.69 | 3,610.06 | 3,613.43 | 442.37 | 0.22 | 2,815 | 2,920 | 3,062 | 3,600 | 4,180 | 4,350 | 4,480 |
| 42 | 21,306 | 3,652.96 | 3,659.10 | 3,665.24 | 457.18 | 0.19 | 2,840 | 2,940 | 3,090 | 3,650 | 4,245 | 4,430 | 4,545 |
| 43 | 1,853 | 3,681.13 | 3,703.54 | 3,725.94 | 491.73 | 0.17 | 2,800 | 2,892 | 3,090 | 3,710 | 4,330 | 4,540 | 4,650 |
| 44 | 153 | 3,610.57 | 3,692.87 | 3,775.17 | 515.26 | 0.18 | 2,736 | 2,863 | 3,025 | 3,660 | 4,309 | 4,706 | 4,763 |

Source: BC Vital Statistics Agency

## Appendix 7 – Birth Weight and Gestational Age Charts for British Columbia Population for Multiple Births (1981-2000)

| Weeks of Gestation | Number of Cases | Birth Weight (grams) | | | Standard Deviation | Skewness | Percentiles (Raw) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Lower 95% Conf. Limit | Mean | Upper 95% Conf. Limit | | | 3rd | 5th | 10th | Median | 90th | 95th | 97th |
| 20 | 22 | 308.94 | 354.50 | 400.06 | 102.76 | 1.38 | 229 | 245 | 255 | 328 | 475 | 535 | 650 |
| 21 | 37 | 383.02 | 409.57 | 436.12 | 79.63 | 0.62 | 280 | 280 | 320 | 410 | 530 | 580 | 580 |
| 22 | 62 | 458.27 | 487.18 | 516.08 | 113.82 | 0.05 | 245 | 270 | 360 | 480 | 640 | 665 | 700 |
| 23 | 80 | 524.03 | 545.56 | 567.10 | 96.77 | 0.20 | 375 | 380 | 425 | 545 | 656 | 710 | 737 |
| 24 | 111 | 609.10 | 633.19 | 657.28 | 128.06 | 1.13 | 400 | 420 | 495 | 630 | 750 | 800 | 820 |
| 25 | 110 | 699.53 | 732.64 | 765.74 | 175.18 | 1.93 | 440 | 482 | 555 | 705 | 895 | 940 | 960 |
| 26 | 134 | 814.64 | 846.46 | 878.28 | 186.21 | 0.93 | 480 | 600 | 640 | 845 | 1,020 | 1,130 | 1,150 |
| 27 | 142 | 962.21 | 995.64 | 1,029.07 | 201.50 | 0.66 | 624 | 690 | 780 | 980 | 1,200 | 1,340 | 1,390 |
| 28 | 243 | 1,110.52 | 1,139.31 | 1,168.10 | 227.84 | 1.11 | 700 | 800 | 879 | 1,160 | 1,361 | 1,445 | 1,502 |
| 29 | 205 | 1,243.66 | 1,275.90 | 1,308.13 | 234.07 | −0.04 | 800 | 860 | 1,000 | 1,290 | 1,620 | 1,655 | 1,730 |
| 30 | 282 | 1,396.77 | 1,426.41 | 1,456.06 | 252.91 | 0.79 | 940 | 1,005 | 1,117 | 1,434 | 1,690 | 1,800 | 1,843 |
| 31 | 348 | 1,541.85 | 1,570.10 | 1,598.36 | 267.97 | 0.02 | 1,050 | 1,115 | 1,240 | 1,575 | 1,900 | 2,000 | 2,040 |
| 32 | 658 | 1,730.86 | 1,755.46 | 1,780.05 | 321.33 | 0.06 | 1,120 | 1,225 | 1,370 | 1,769 | 2,155 | 2,290 | 2,353 |
| 33 | 811 | 1,912.76 | 1,934.63 | 1,956.49 | 317.26 | −0.09 | 1,310 | 1,420 | 1,540 | 1,950 | 2,300 | 2,400 | 2,495 |
| 34 | 1,243 | 2,096.75 | 2,115.74 | 2,134.73 | 341.22 | −0.18 | 1,420 | 1,546 | 1,690 | 2,127 | 2,510 | 2,660 | 2,743 |
| 35 | 1,521 | 2,263.61 | 2,281.30 | 2,298.98 | 351.59 | −0.22 | 1,600 | 1,673 | 1,835 | 2,285 | 2,720 | 2,835 | 2,930 |
| 36 | 2,403 | 2,479.15 | 2,494.67 | 2,510.19 | 387.91 | 0.00 | 1,775 | 1,880 | 2,020 | 2,495 | 2,970 | 3,111 | 3,210 |
| 37 | 3,245 | 2,661.85 | 2,675.31 | 2,688.78 | 391.27 | 0.03 | 1,950 | 2,040 | 2,190 | 2,673 | 3,160 | 3,315 | 3,407 |
| 38 | 3,678 | 2,810.85 | 2,823.56 | 2,836.28 | 393.28 | −0.01 | 2,100 | 2,200 | 2,345 | 2,810 | 3,320 | 3,464 | 3,550 |
| 39 | 1,813 | 2,906.44 | 2,925.61 | 2,944.78 | 416.19 | 0.00 | 2,155 | 2,268 | 2,400 | 2,920 | 3,459 | 3,610 | 3,720 |
| 40 | 1,071 | 2,979.06 | 3,006.72 | 3,034.39 | 461.47 | 0.02 | 2,126 | 2,260 | 2,438 | 3,000 | 3,596 | 3,800 | 3,910 |
| 41 | 186 | 3,050.02 | 3,124.61 | 3,199.20 | 515.62 | −0.25 | 2,100 | 2,210 | 2,485 | 3,155 | 3,780 | 3,990 | 4,100 |
| 42 | 69 | 2,978.33 | 3,078.22 | 3,178.11 | 415.81 | 0.22 | 2,381 | 2,450 | 2,590 | 3,062 | 3,622 | 3,799 | 3,827 |
| 43 | 4 | 2,359.31 | 2,863.00 | 3,366.69 | 316.54 | −0.44 | 2,466 | 2,466 | 2,466 | 2,892 | 3,203 | 3,203 | 3,203 |

Source: BC Vital Statistics Agency

## Appendix 8 – Live Births, Deaths, Marriages, and Stillbirths for British Columbia, 1950-2007

| Year | Mid-Year Population | Live Births | | Deaths | | Marriages | | Stillbirths | |
|---|---|---|---|---|---|---|---|---|---|
| | | Number | Rate | Number | Rate | Number | Rate | Number | Rate |
| 1950 | 1,137,000 | 27,116 | 23.85 | 11,581 | 10.19 | 11,110 | 9.77 | 369 | 13.43 |
| 1951 | 1,165,210 | 28,077 | 24.10 | 11,638 | 9.99 | 11,272 | 9.67 | 365 | 12.83 |
| 1952 | 1,205,000 | 29,827 | 24.75 | 12,080 | 10.02 | 11,081 | 9.20 | 375 | 12.42 |
| 1953 | 1,248,000 | 31,746 | 25.44 | 12,218 | 9.79 | 11,298 | 9.05 | 375 | 11.67 |
| 1954 | 1,295,000 | 32,946 | 25.44 | 12,414 | 9.59 | 10,991 | 8.49 | 373 | 11.19 |
| 1955 | 1,342,000 | 34,138 | 25.44 | 12,816 | 9.55 | 11,011 | 8.20 | 381 | 11.04 |
| 1956 | 1,398,464 | 36,241 | 25.91 | 13,415 | 9.59 | 11,950 | 8.55 | 413 | 11.27 |
| 1957 | 1,482,000 | 38,744 | 26.14 | 13,711 | 9.25 | 12,620 | 8.52 | 422 | 10.77 |
| 1958 | 1,538,000 | 39,577 | 25.73 | 13,741 | 8.93 | 12,094 | 7.86 | 414 | 10.35 |
| 1959 | 1,567,000 | 39,971 | 25.51 | 14,336 | 9.15 | 11,910 | 7.60 | 404 | 10.01 |
| 1960 | 1,602,000 | 40,116 | 25.04 | 14,696 | 9.17 | 11,203 | 6.99 | 437 | 10.78 |
| 1961 | 1,629,100 | 38,591 | 23.69 | 14,403 | 8.84 | 10,935 | 6.71 | 410 | 10.51 |
| 1962 | 1,660,000 | 38,128 | 22.97 | 14,912 | 8.98 | 11,196 | 6.74 | 377 | 9.79 |
| 1963 | 1,699,000 | 37,478 | 22.06 | 15,029 | 8.85 | 11,677 | 6.87 | 476 | 12.54 |
| 1964 | 1,745,000 | 35,897 | 20.57 | 16,051 | 9.20 | 12,158 | 6.97 | 485 | 13.33 |
| 1965 | 1,797,000 | 33,669 | 18.74 | 15,784 | 8.78 | 13,639 | 7.59 | 447 | 13.10 |
| 1966 | 1,873,674 | 32,502 | 17.35 | 16,290 | 8.69 | 14,682 | 7.84 | 409 | 12.43 |
| 1967 | 1,945,000 | 32,899 | 16.91 | 16,170 | 8.31 | 16,026 | 8.24 | 422 | 12.66 |
| 1968 | 2,003,000 | 33,687 | 16.82 | 16,828 | 8.40 | 16,914 | 8.44 | 433 | 12.69 |
| 1969 | 2,060,000 | 35,383 | 17.18 | 17,377 | 8.44 | 18,284 | 8.88 | 468 | 13.05 |
| 1970 | 2,128,000 | 36,861 | 17.32 | 17,020 | 8.00 | 20,020 | 9.41 | 407 | 10.92 |
| 1971 | 2,184,620 | 34,852 | 15.95 | 17,783 | 8.14 | 20,389 | 9.33 | 442 | 12.52 |
| 1972 | 2,241,400 | 34,563 | 15.42 | 18,021 | 8.04 | 20,659 | 9.22 | 356 | 10.20 |
| 1973 | 2,302,400 | 34,352 | 14.92 | 18,095 | 7.86 | 21,303 | 9.25 | 339 | 9.77 |
| 1974 | 2,375,700 | 35,450 | 14.92 | 19,177 | 8.07 | 21,734 | 9.15 | 364 | 10.16 |
| 1975 | 2,433,200 | 36,281 | 14.91 | 19,151 | 7.87 | 21,824 | 8.97 | 414 | 11.28 |
| 1976 | 2,466,610 | 35,848 | 14.53 | 18,788 | 7.62 | 21,536 | 8.73 | 361 | 9.97 |
| 1977 | 2,493,800 | 36,691 | 14.71 | 18,021 | 7.23 | 21,156 | 8.48 | 330 | 8.91 |
| 1978 | 2,530,100 | 37,231 | 14.72 | 19,057 | 7.53 | 21,388 | 8.45 | 331 | 8.81 |
| 1979 | 2,571,200 | 38,432 | 14.95 | 19,204 | 7.47 | 22,087 | 8.59 | 313 | 8.08 |
| 1980 | 2,640,100 | 40,104 | 15.19 | 19,371 | 7.34 | 23,830 | 9.03 | 316 | 7.82 |
| 1981 | 2,744,470 | 41,679 | 15.19 | 19,857 | 7.24 | 24,694 | 9.00 | 371 | 8.82 |
| 1982 | 2,787,700 | 42,942 | 15.40 | 20,704 | 7.43 | 23,831 | 8.55 | 317 | 7.33 |
| 1983 | 2,813,800 | 43,047 | 15.30 | 19,895 | 7.07 | 23,692 | 8.42 | 310 | 7.15 |
| 1984 | 2,847,700 | 44,040 | 15.47 | 20,781 | 7.30 | 23,394 | 8.22 | 303 | 6.83 |
| 1985 | 2,990,000 | 42,989 | 14.38 | 21,131 | 7.07 | 22,270 | 7.45 | 333 | 7.69 |
| 1986 | 3,004,104 | 41,711 | 13.88 | 21,009 | 6.99 | 21,845 | 7.27 | 308 | 7.33 |
| 1987 | 3,050,160 | 41,611 | 13.64 | 21,618 | 7.09 | 23,417 | 7.68 | 291 | 6.94 |
| 1988 | 3,115,357 | 42,861 | 13.76 | 22,357 | 7.18 | 24,519 | 7.87 | 295 | 6.84 |
| 1989 | 3,197,880 | 43,587 | 13.63 | 22,786 | 7.13 | 25,181 | 7.87 | 324 | 7.38 |
| 1990 | 3,290,814 | 45,347 | 13.78 | 23,415 | 7.12 | 25,225 | 7.67 | 298 | 6.53 |
| 1991 | 3,373,464 | 45,345 | 13.44 | 23,820 | 7.06 | 23,667 | 7.02 | 298 | 6.53 |
| 1992 | 3,468,445 | 46,010 | 13.27 | 24,463 | 7.05 | 23,762 | 6.85 | 298 | 6.44 |
| 1993 | 3,567,406 | 45,928 | 12.87 | 25,603 | 7.18 | 23,479 | 6.58 | 292 | 6.32 |
| 1994 | 3,675,699 | 46,819 | 12.74 | 25,830 | 7.03 | 23,776 | 6.47 | 312 | 6.62 |
| 1995 | 3,777,004 | 46,683 | 12.36 | 26,225 | 6.94 | 23,636 | 6.26 | 350 | 7.44 |
| 1996 | 3,874,276 | 45,953 | 11.86 | 27,391 | 7.07 | 22,880 | 5.91 | 292 | 6.31 |
| 1997 | 3,948,544 | 44,392 | 11.24 | 27,263 | 6.90 | 21,883 | 5.54 | 335 | 7.49 |
| 1998 | 3,983,077 | 42,868 | 10.76 | 27,808 | 6.98 | 21,778 | 5.47 | 278 | 6.44 |
| 1999 | 4,011,342 | 41,740 | 10.41 | 27,888 | 6.95 | 21,629 | 5.39 | 313 | 7.44 |
| 2000 | 4,039,198 | 40,495 | 10.03 | 27,350 | 6.77 | 22,094 | 5.47 | 311 | 7.62 |
| 2001 | 4,078,447 | 40,385 | 9.90 | 28,237 | 6.92 | 20,573 | 5.04 | 301 | 7.40 |
| 2002 | 4,115,413 | 39,900 | 9.70 | 28,714 | 6.98 | 21,262 | 5.17 | 309 | 7.68 |
| 2003 | 4,155,370 | 40,306 | 9.70 | 29,155 | 7.02 | 21,986 | 5.29 | 311 | 7.66 |
| 2004 | 4,203,807 | 40,334 | 9.59 | 29,722 | 7.07 | 22,086 | 5.25 | 282 | 6.94 |
| 2005 | 4,260,246 | 40,658 | 9.54 | 30,092 | 7.06 | 22,639 | 5.31 | 314 | 7.66 |
| 2006 | 4,320,255 | 41,673 | 9.65 | 30,536 | 7.07 | 23,517 | 5.44 | 335 | 7.97 |
| 2007 | 4,380,256 | 43,517 | 9.93 | 31,105 | 7.10 | 22,961 | 5.24 | 350 | 7.98 |

Source: BC Vital Statistics Agency

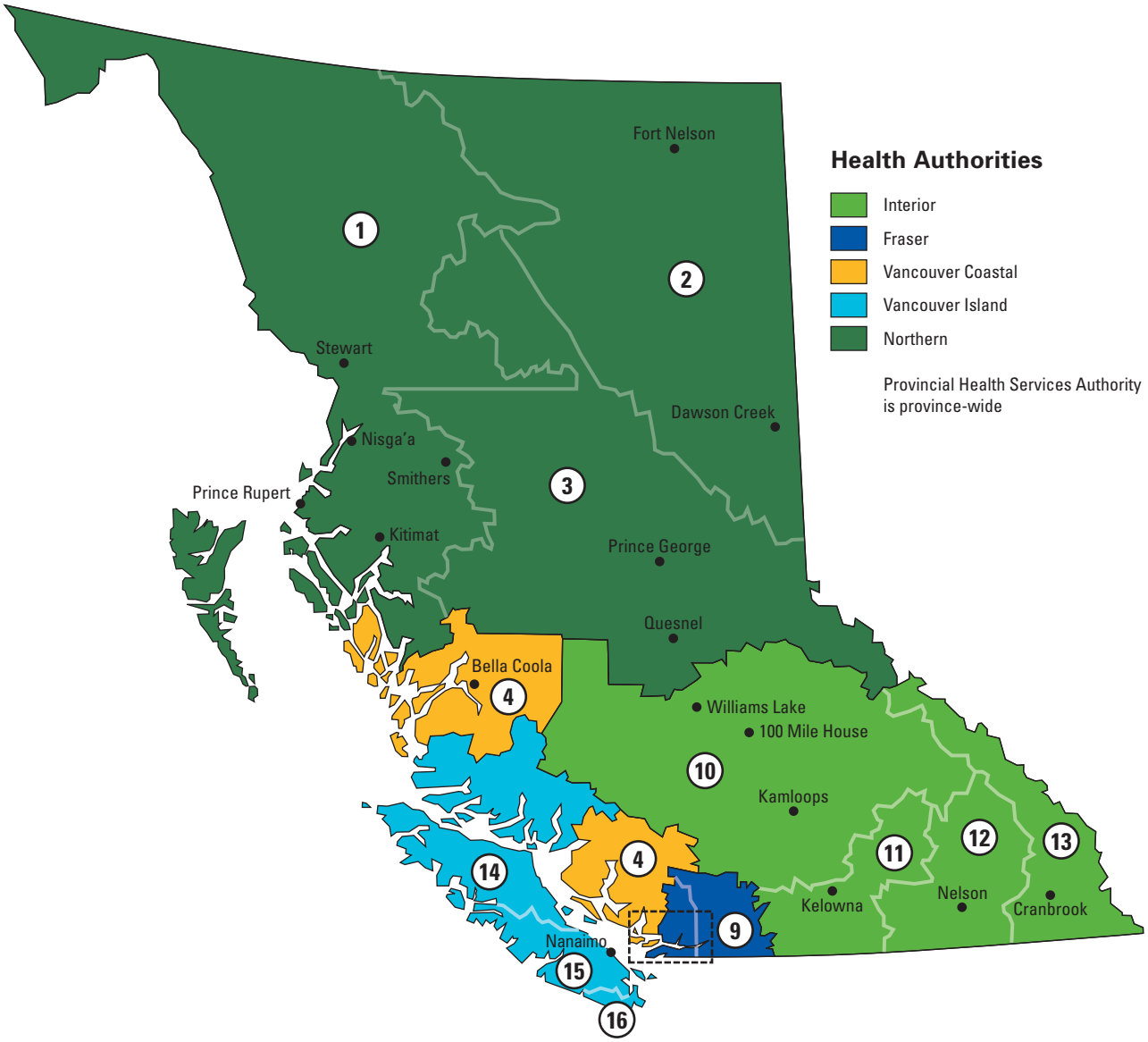
Notes: Rates shown for live births, deaths and marriages are crude rates per 1,000 population.
Stillbirth rate is per 1,000 total births (live births plus stillbirths).
The definition of a stillbirth was revised in 1963 and 1986 (see glossary).
Population information from BC Stats, Ministry of Labour and Citizens' Services.
Above information includes late registrations and amendments.
Gender unknown included. Non-residents are excluded from all data except marriages.

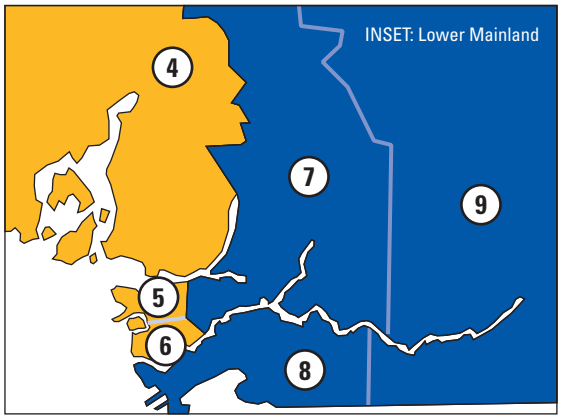
## Appendix 9 – Infant Mortality for British Columbia and Canada, 1965-2007

| Year | British Columbia Age at Death (in Days) | | | | | | | Total | | Canada |
|---|---|---|---|---|---|---|---|---|---|---|
| | 0-6 Days | | 0-27 Days | | 28-364 Days | | N.S. | | | |
| | Number | Rate | Number | Rate | Number | Rate | | Number | Rate | Rate |
| 1965 | 415 | 12.33 | 453 | 13.45 | 227 | 6.74 | 3 | 683 | 20.29 | 24.0 |
| 1966 | 435 | 13.38 | 494 | 15.20 | 263 | 8.09 | 4 | 761 | 23.41 | 23.1 |
| 1967 | 429 | 13.04 | 470 | 14.29 | 218 | 6.63 | 1 | 689 | 20.94 | 22.0 |
| 1968 | 375 | 11.13 | 438 | 13.00 | 214 | 6.35 | 4 | 656 | 19.47 | 21.0 |
| 1969 | 329 | 9.30 | 374 | 10.57 | 199 | 5.62 | – | 573 | 16.19 | 19.0 |
| 1970 | 369 | 10.01 | 416 | 11.29 | 193 | 5.24 | 2 | 611 | 16.58 | 19.0 |
| 1971 | 409 | 11.74 | 450 | 12.91 | 185 | 5.31 | – | 635 | 18.22 | 17.5 |
| 1972 | 322 | 9.32 | 373 | 10.79 | 195 | 5.64 | 1 | 569 | 16.46 | 17.0 |
| 1973 | 317 | 9.23 | 363 | 10.57 | 185 | 5.39 | 3 | 551 | 16.04 | 16.0 |
| 1974 | 310 | 8.74 | 348 | 9.82 | 196 | 5.53 | 2 | 546 | 15.40 | 15.0 |
| 1975 | 278 | 7.66 | 321 | 8.85 | 169 | 4.66 | 1 | 491 | 13.53 | 14.3 |
| 1976 | 292 | 8.15 | 324 | 9.04 | 152 | 4.24 | 2 | 478 | 13.33 | 13.5 |
| 1977 | 246 | 6.70 | 276 | 7.52 | 200 | 5.45 | – | 476 | 12.97 | 12.4 |
| 1978 | 245 | 6.58 | 286 | 7.68 | 178 | 4.78 | – | 464 | 12.46 | 12.0 |
| 1979 | 196 | 5.10 | 239 | 6.22 | 167 | 4.35 | – | 406 | 10.56 | 10.9 |
| 1980 | 188 | 4.69 | 235 | 5.86 | 186 | 4.64 | – | 421 | 10.50 | 10.4 |
| 1981 | 232 | 5.57 | 259 | 6.21 | 140 | 3.36 | 3 | 402 | 9.65 | 9.6 |
| 1982 | 217 | 5.05 | 251 | 5.85 | 150 | 3.49 | – | 401 | 9.34 | 9.1 |
| 1983 | 193 | 4.48 | 212 | 4.92 | 145 | 3.37 | 2 | 359 | 8.34 | 8.5 |
| 1984 | 184 | 4.18 | 205 | 4.65 | 150 | 3.41 | 1 | 356 | 8.08 | 8.1 |
| 1985 | 180 | 4.19 | 198 | 4.61 | 133 | 3.09 | – | 331 | 7.70 | 8.0 |
| 1986 | 164 | 3.93 | 195 | 4.68 | 147 | 3.52 | – | 342 | 8.20 | 7.9 |
| 1987 | 158 | 3.80 | 194 | 4.66 | 160 | 3.85 | – | 354 | 8.51 | 7.3 |
| 1988 | 191 | 4.46 | 220 | 5.13 | 136 | 3.17 | – | 356 | 8.31 | 7.2 |
| 1989 | 186 | 4.27 | 215 | 4.93 | 138 | 3.17 | – | 353 | 8.10 | 7.3 |
| 1990 | 183 | 4.04 | 221 | 4.87 | 112 | 2.47 | – | 333 | 7.34 | 6.8 |
| 1991 | 140 | 3.09 | 164 | 3.62 | 126 | 2.78 | – | 290 | 6.40 | 6.4 |
| 1992 | 153 | 3.33 | 173 | 3.76 | 104 | 2.26 | – | 277 | 6.02 | 6.1 |
| 1993 | 121 | 2.63 | 139 | 3.03 | 110 | 2.40 | – | 249 | 5.42 | 6.3 |
| 1994 | 175 | 3.74 | 198 | 4.23 | 90 | 1.92 | – | 288 | 6.15 | 6.3 |
| 1995 | 158 | 3.38 | 181 | 3.88 | 94 | 2.01 | – | 275 | 5.89 | 6.1 |
| 1996 | 133 | 2.89 | 160 | 3.48 | 68 | 1.48 | – | 228 | 4.96 | 5.6 |
| 1997 | 125 | 2.82 | 146 | 3.29 | 56 | 1.26 | – | 202 | 4.55 | 5.5 |
| 1998 | 94 | 2.19 | 114 | 2.66 | 60 | 1.40 | – | 174 | 4.06 | 5.3 |
| 1999 | 87 | 2.08 | 108 | 2.59 | 51 | 1.22 | – | 159 | 3.81 | 5.3 |
| 2000 | 84 | 2.07 | 105 | 2.59 | 45 | 1.11 | – | 150 | 3.70 | 5.3 |
| 2001 | 103 | 2.55 | 126 | 3.12 | 36 | 0.89 | – | 162 | 4.01 | 5.2 |
| 2002 | 98 | 2.46 | 126 | 3.16 | 54 | 1.35 | – | 180 | 4.51 | 5.4 |
| 2003 | 104 | 2.58 | 120 | 2.98 | 47 | 1.17 | – | 167 | 4.14 | 5.3 |
| 2004 | 108 | 2.68 | 122 | 3.02 | 49 | 1.21 | – | 171 | 4.24 | 5.3 |
| 2005 | 104 | 2.56 | 124 | 3.05 | 50 | 1.23 | – | 174 | 4.28 | 5.4 |
| 2006 | 83 | 1.99 | 118 | 2.83 | 50 | 1.20 | – | 168 | 4.03 | * |
| 2007 | 99 | 2.27 | 115 | 2.64 | 57 | 1.31 | – | 172 | 3.95 | * |

Source: BC Vital Statistics Agency
Notes: Rates per 1,000 live births in the specified year.
N.S. – Not stated. Above information includes late registrations and amendments.
Canadian rates from Statistics Canada. *Rates were not available. Non-residents are excluded.

## Appendix 10 – Health Authorities and Health Service Delivery Areas




**Based on a map prepared by:** BC STATS, June 2003

### Health Service Delivery Areas

1. Northwest
2. Northeast
3. Northern Interior
4. Coastal
5. Vancouver
6. Richmond
7. Fraser North
8. Fraser South
9. Fraser East
10. Thompson Cariboo Shuswap
11. Okanagan
12. Kootenay Boundary
13. East Kootenay
14. North Vancouver Island
15. Central Vancouver Island
16. South Vancouver Island

*Note: Nisga'a is a separate governance health board.*

## Appendix 11 – British Columbia Perinatal Database Registry Information Request Form

Fields marked with * are required

### Requester Information Request#:

* Name:
* Profession: --- Please Select ---
* Health Authority: --- Please Select ---
Organization:
Address:
* Telephone #: - - Local Fax #: - -
* Email Address:

### Data Request

* Purpose: (Briefly describe the purpose for which the data is being requested. How will this information be used?)

* Data: (Describe the data requirements. Include fields, selection requirements, exclusion criteria as required. A list of data fields is available at the BCRCP website)

* Time Period: From: Day - Month - Year To: Day - Month - Year

* Frequency of data request:

(•) One time Only ( ) Annually ( ) Other

* Date required by: Day - Month - Year

* Format of output: -- Please Select --

Special Instructions:

Submit Clear All Cancel

The website for the BC Perinatal Database Registry Information For Request form is: www.bcrcp.ca

## References


1 Society of Obstetricians and Gynaecologists of Canada (2008). *Joint policy statement on normal childbirth.* Journal of Obstetrics and Gynaecology Canada 30 (12), pp. 1163-1165.

2 Maternity Care Working Party (2007). *Making Normal Birth a Reality: Consensus Statement from the Maternity Care Working Party.* Royal College of Obstetricians and Gynaecologists, United Kingdom. Available online at www.rcog.org.uk/womens-health/clinical-guidance/making-normal-birth-reality

3 British Columbia Perinatal Health Program. *Caesarean Birth Task Force Report 2008.* Vancouver, BC. February 2008.

4 What Mothers Say: *The Canadian Maternity Experiences Survey (2009),* available online at www.phac-aspc.gc.ca/rhs-ssg/pdf/survey-eng.pdf

5 *Canadian Perinatal Health Report (2008),* available online at www.phac-aspc.gc.ca/publicat/2008/cphr-rspc/index-eng.php

6 *Institute of Medicine, Food and Nutrition Board, Committee on Nutritional Status During Pregnancy, part I: Nutritional Status and Weight Gain.* National Academy Press, Washington DC 2000.

7 Viswanathan M, Siega-Riz Am, Moos MK, et al. *Outcomes of maternal weight gain.* Evid Rep Technol Assess 2008;1.

8 Aagaard Nohr, Ellen. *Consequences of Gestational Weight Gain: Outcomes for the Mother and Child.* Presentation for IOM workshop on GWG Guidelines. June 2008.

9 Crane, Joan M.G. MD, Joanne White, MD, Phil Murphy, BSc, MSc, Lorraine Burrage, BN, MSc, Donna Hutchens, RN, BN. *The Effect of Gestational Weight Gain by Body Mass Index on Maternal and Neonatal Outcomes.* JOGC. January 2009.

10 Roberts G, Nanson J. Best Practices: Fetal Alcohol Syndrome/Fetal Alcohol Effects and the Effects of Other Substance Use During Pregnancy. Ottawa: Canada's Drug Strategy Division, Health Canada; 2000. www.phac-aspc.gc.ca/fasd-etcaf/pdf/03-bestpractices_e.pdf#64

11 Coker, A., Sanderson, M. and Dong, B. (2004). *Partner violence during pregnancy and risk of adverse pregnancy outcomes.* Paediatric and Perinatal Epidemiology 18 (4), 260-269.

12 Society of Obstetricians and Gynaecologists of Canada (2005) *Intimate partner violence consensus statement.* Journal of Obstetricians and Gyanecologists of Canada 157, 365-388. Available online at www.sogc.org/guidelines/public/157E-CPG-April2005.pdf

13 *Canadian Perinatal Surveillance System Fact Sheet on Physical Abuse during Pregnancy (2004).* Available online at www.phac-aspc.gc.ca/rhs-ssg/factshts/abuseprg-eng.php

14 www.canadianmidwives.org/midwife.htm accessed July15, 2009

15 Robson, M.S. (2001). *Can we reduce the caesarean section rate?* Best Practice and Research Clinical Obstetrics and Gynaecology 15 (1), pp. 179-194.

16 British Columbia Perinatal Health Program. *Preterm Birth in British Columbia,* Vancouver, BC. March 2008.

17 Society of Obstetricians and Gynaecologists of Canada (2005). *Guidelines for vaginal birth after previous Caesarean.* International Journal of Gynaecology and Obstetrics 89 (3), pp. 319-331.

18 For instance, see Robson, M.S. (2001). *Can we reduce the caesarean section rate?* Best Practice and Research Clinical Obstetrics and Gynaecology 15 (1), pp. 179-194, where the same trend was found among women living in the United Kingdom; and see McCarthy, F.P., Rigg, L., Cady, L., and Cullinane, F. (2007) *A new way of looking at caesarean section births.* Australian and New Zealand Journal of Obstetrics and Gynaecology 47, pp. 316-320, where the same trend was found among women living in Australia.

19 For more information, see Health Canada (2004). *Special Report on Maternal Mortality and Severe Morbidity in Canada – Enhanced Surveillance: The Path to Prevention,* p. 7, available online at www.phac-aspc.gc.ca/rhs-ssg/srmm-rsmm/pdf/mat_mortality_e.pdf.

20 The BC Perinatal Health Program produced a special report, *Maternal Mortality in British Columbia,* in 2008. It is available online at www.bcphp.ca//sites/bcrcp/files/publications/BCPHP_MortalityReport.pdf

21 SOGC (2000) Management of twin pregnancies, Part II www.sogc.org/guidelines/public/93E-CONS2-August2000.pdf

22 Society of Gynaecologists and Obstetricians of Canada (2007). *Postpartum maternal and newborn discharge.* Journal of Obstetrics and Gynaecology Canada 29 (4), pp. 257-259.

23 Breastfeeding Committee for Canada (2006). *Breastfeeding Definitions and Data Collection Periods.* Available online at www.breastfeedingcanada.ca/html/documents.html

## LEGEND

### Health Authority (HA)

| | |
|---|---|
| **FHA** | Fraser HA |
| **IHA** | Interior HA |
| **NHA** | Northern HA |
| **VCHA** | Vancouver Coastal HA |
| **VIHA** | Vancouver Island HA |
| **PHSA** | Provincial Health Services Authority |

### Health Service Delivery Area (HSDA)

| | |
|---|---|
| **FE** | Fraser East |
| **FN** | Fraser North |
| **FS** | Fraser South |
| **EK** | East Kootenay |
| **KB** | Kootenay Boundary |
| **OK** | Okanagan |
| **TCS** | Thompson Cariboo Shuswap |
| **NE** | Northeast |
| **NI** | Northern Interior |
| **NW** | Northwest |
| **CST** | Coastal |
| **RICH** | Richmond |
| **VANC** | Vancouver |
| **CVI** | Central Vancouver Island |
| **NVI** | North Vancouver Island |
| **SVI** | South Vancouver Island |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