



Provincial Perinatal Report

2000–2004

Reprinted August 2006

Abridged Version

TABLE OF CONTENTS

| | |
|---|----|
| ACKNOWLEDGEMENTS | 3 |
| EXECUTIVE SUMMARY | 4 |
| Highlights..... | 4 |
| Deliveries in Alberta | 4 |
| Maternal Indicators | 5 |
| Neonatal Indicators | 5 |
| Mortality and the Alberta Perinatal Mortality Study..... | 5 |
| DEFINITIONS | 6 |
| INTRODUCTION | 8 |
| Background – The Alberta Perinatal Health Program..... | 8 |
| Commitment to Supporting Research | 9 |
| Purpose of the Report..... | 10 |
| Objectives and Contents of the Report..... | 10 |
| How to Use this Report | 10 |
| Data Sources..... | 10 |
| Methodology and Limitations | 11 |
| DELIVERIES IN ALBERTA | 12 |
| Demographics of Women Delivering in Alberta | 12 |
| Total Deliveries | 12 |
| Parity | 13 |
| Maternal Age..... | 13 |
| Deliveries by Service Level | 15 |
| General Hospital Districts | 15 |
| Changes in obstetrical rural service..... | 16 |
| Where a woman delivers versus where she resides..... | 17 |
| Intra-provincial movement of women between health regions | 19 |
| MATERNAL INDICATORS – TOTAL POPULATION..... | 20 |
| Method of Delivery | 20 |
| Labour | 22 |
| Induced Labour | 22 |
| Epidural Analgesia | 23 |
| Episiotomy | 23 |
| Maternal Behaviours & Obstetrical Risk Factors..... | 24 |
| Antenatal Risk..... | 24 |
| Smoking | 25 |
| Alcohol..... | 25 |
| MATERNAL INDICATORS - SUBPOPULATIONS | 27 |
| Low Risk Primipara Subpopulation | 27 |
| NEONATAL INDICATORS – LIVE BORN | 28 |
| Gestational Age – Preterm Birth | 28 |
| Birth Weight | 30 |
| Multiple Births | 31 |
| MORTALITY | 32 |
| Perinatal, Neonatal & Maternal Mortality..... | 32 |
| Stillbirth | 33 |
| Neonatal Mortality | 36 |
| Investigations | 39 |
| Wigglesworth Classification | 39 |
| Maternal Mortality | 40 |
| REFERENCES | 45 |
| APPENDICES | 47 |

ACKNOWLEDGEMENTS

APHP Information Management Standing Committee Members

| | |
|---|--|
| Dr. Christine Newburn-Cook | University of Alberta |
| Dr. Harvey Ward | East Central Health |
| Dr. James Talbot | Capital Health Region |
| Dr. John Van Aerde | Capital Health Region |
| Dr. Nalini Singal | Calgary Health Region |
| Dr. Nestor Demianczuk | Capital Health |
| Dr. Stephen Wood | Calgary Health Region |
| Mr. Chris Bowdler | Alberta Perinatal Health Program |
| Ms. Chris Jenson Ross | Chinook Regional Health Authority |
| Ms. Corine Frick | Alberta Perinatal Health Program |
| Ms. Diane Gruber | Information Systems |
| Ms. Laura James | Chinook Regional Health Authority |
| Ms. Liz Spellen | Calgary Health Region |
| Ms. Nancy Bott (Co-Chair) | Alberta Perinatal Health Program |
| Ms. Nancy Reynolds | Research for Children |
| Ms. Noni Fraser-Lee | Capital Health |
| Ms. Sabrina Falvo-Miller | David Thompson Regional Health Authority |
| Ms. Tammie Bunnah | Alberta Perinatal Health Program |
| Ms. Xinjie Cui / Mr. Jonathan Robb (Co-Chair) | Alberta Health & Wellness |

APHP Provincial Report Working Group Members

| | |
|--|--|
| Dr. Christine Newburn-Cook | University of Alberta |
| Dr. John Van Aerde | Capital Health |
| Dr. Nestor Demianczuk | Capital Health |
| Mr. Chris Bowdler | Alberta Perinatal Health Program |
| Mr. Jeff Blackmer | Alberta Perinatal Health Program |
| Ms. Debbie Leitch | David Thompson Regional Health Authority |
| Ms. Elizabeth Francis | East Central Health |
| Ms. Grace Guyon | Alberta Perinatal Health Program |
| Ms. Karen Tofflemire | Alberta Perinatal Health Program / Decision Support Research Team |
| Ms. Liz Spellen | Calgary Health Region |
| Ms. Luella Klause | David Thompson Regional Health Authority |
| Ms. Nancy Bott (Chair) | Alberta Perinatal Health Program |
| Ms. Susan Schank | Palliser Health Region |
| Ms. Tammie Bunnah | Alberta Perinatal Health Program |
| Ms. Xinjie Cui / Mr. Jonathan Robb | Alberta Health & Wellness |

Alberta Medical Association Committee on Reproductive Care

| | |
|--------------------------------|---|
| Dr. Albert Aikerman | Neonatologist |
| Dr. Carolyn Lane (Chair) | General/Family Practice (Urban) |
| Dr. Cynthia Trevenen | Paediatric Pathologist |
| Dr. Dan Husband | General / Family Practice (Rural) |
| Dr. Duncan McCubbin | Obstetrics – Level 2 |
| Dr. Len Evenson | Obstetrical Consultant |
| Dr. Michael Awad | Alberta Section of Obstetricians and Gynaecologists |
| Dr. Phil Etches | Neonatal Consultant |
| Dr. Rebecca Simrose | Perinatologist |
| Dr. Reg Suave | Neonatal Followup |
| Ms Betty Jennissen | Alberta Perinatal Health Program |
| Ms Grace Guyon | Alberta Perinatal Health Program |
| Ms Heather Crosland | Alberta Association of Nurses |
| Ms Penny Salkeld | Alberta Association of Midwives |

EXECUTIVE SUMMARY

This is the first provincial report prepared by the Alberta Perinatal Health Program (APHP). The Program was established in July 2004 to provide an integrated provincial program whose vision is to achieve the optimal level of health for expectant mothers and their infants.

The primary purpose of this interim report is to provide information to health regions and those working in facilities delivering perinatal services. The report is derived from data from the provincial delivery record and the Alberta Study of Perinatal Mortality. Time trends and associations between key factors and outcomes are presented. This interim report provides the broader context section of the full report, which will include facility level data. The comprehensive, stakeholder report is expected to be released to facility designates in late spring 2006. The full report will provide health regions with comparative information for program planning and facilitate provincial bench marking for key indicators and services.

This report contains five main sections:

- I. Background information of the Alberta Perinatal Health Program
- II. Deliveries in Alberta by obstetrical service levels, which are unique to this report.
The report illustrates the movement of women between different levels of service.
- III. Maternal indicators
- IV. Neonatal indicators
- V. Perinatal, neonatal and maternal mortality including findings and discussion from the ongoing Alberta perinatal mortality study.

Highlights

Deliveries in Alberta

Rural obstetrics in Alberta has declined over time. In 2000, 82.7% (N=81) of facilities in Alberta had elective obstetric services, compared to 72.4% (N=71) in 2004. Lack of availability of care in a rural community means women must travel to give birth.

- For women residing in a rural hospital district without an obstetrical service, outflow from the hospital district is predictably close to 100%.
- Rural hospital districts with limited obstetrical service delivered only 22% of their population. As well as experiencing a high volume of outflow from the community, the hospitals in these communities also experience a 33% inflow from other communities.
- Rural hospital districts that have caesarean section capabilities deliver approximately 59% of their local population as well as 26% from other hospital districts (inflow).
- Urban communities with regional hospitals and communities with tertiary care centres delivered 96.5% and 98.6%, respectively of women who, reside in their community. Given the regionalized system of health care delivery it is not surprising that these communities have a high proportion of inflow from other communities 25.3 % (n=1951) and 13.5% (n = 3890) respectively.

As women are moving between hospital districts with different levels of service, this movement can be within a health region or between health regions. In 2004, approximately 6% of women having a residence in Alberta travelled to a different health region to give birth.

Maternal Indicators

- Between 2000 and 2004, the mean maternal age of women giving birth increased significantly from 28.2 years to 28.5 years. In addition to increasing age, the proportion of nulliparous women delivering in Alberta increased from 41.7% to 43.4% in 2004.
- The method of delivery for Alberta women has changed significantly with caesarean sections increasing from 19.9% to 25.3% in 2004. Nulliparous compared to multiparous women (28.2% vs. 22.9%, respectively) were more likely to have a caesarean section as were women 35-39 (34.0%) and over age 40 (43.1%) compared to women aged 20-24 (19.4%).
- Primary caesarean sections increased from 13.3% in 2000 to 15.9% in 2004. The repeat caesarean section also increased from 6.6% to 9.4% (2000 and 2004, respectively), with a decrease in vaginal births after caesarean section (VBAC) decreasing from 47.9% in 2000 to 32.6% in 2004. Success rates for VBAC have remained stable.

Neonatal Indicators

- Preterm birth rates ranged from 7.9% and 9.0% in Alberta between 2000 and 2004. The data suggests a “U” shaped distribution of preterm delivery and maternal age, with the lowest risk evident among women aged 25-29 (7.7%).
- Low birth weight rates in Alberta ranged from 6.1% in 2000 to 6.4% in 2004. The low birth weight is highest among women under age 20 (7.0%) and those over age 35 (7.8% to 9.6% at age ≥ 40 years).
- Multiple birth rates in Alberta have increased steadily over time. The multiple birth rate in 2000 was 3.0% and climbed to 3.4% in 2004.

Mortality and the Alberta Perinatal Mortality Study

- Stillbirth, neonatal and maternal mortality rates have remained stable between 2000 and 2004
- In 2004, over $\frac{3}{4}$ of stillbirths (78.5%) and neonatal deaths (85.2%) were preterm (<37 weeks gestation).
- In 2004, over $\frac{3}{4}$ of stillbirths (78.2%) and neonatal deaths (83.2%) were low birth weight (<2500 grams)
- The key issues identified in case reviews for 2003 and 2004 include:
 - fetal surveillance in labour
 - maternal obesity
 - preterm births
 - undiagnosed pregnancy
 - lack of attendance and/or compliance with recommended care
 - preconceptual counselling and
 - maternal mortality.

DEFINITIONS

Alcohol Use: An indication of alcohol use recorded as alcohol consumption of either >1 drink/day or >3 drinks/one occasion during any point of pregnancy, as indicated on the antenatal risk scoring assessment. The rate of alcohol use was calculated as number consuming alcohol / number of women with risk scoring completed x 100.

Antenatal Risk Assessment: The antenatal risk factors reported in this report are captured from the Antepartum risk assessment tool as Part I of the provincial delivery record. A total score is calculated from weighted values assigned to each risk factor. Categories of low, moderate and high risk are derived from the total score. Rates are calculated as the number of women per risk category / number of women with risk scoring completed x 100.

APGAR Scores: APGAR is an acronym for an assigned score given to the newborn at one and five-minute intervals after birth as an assessment of the newborns adaptation to life. The score is an assessment based on **A**ctivity (muscle tone), **P**ulse, **G**rimace (reflex irritability), **A**ppearance (skin colour) and **R**espiration.

Assisted Conception: An indication of assisted conception use signified that the pregnancy was a result of assisted conception. Data were available from January 1, 2002 for Northern Alberta hospital sites only. No data were available for southern hospital sites.

Birth Weight: Birth weight for infants is recorded in grams. Low birth weight infants are defined as weighing less than 2500 grams.

Caesarean Section (C-section): An incision through the abdominal and uterine walls for delivery of a foetus.

Early Neonatal Death (END): Death of infant prior to 7 days of age.

Epidural Analgesia: A method of pain relief consisting of continuous bathing of lumbar or thoracic nerve roots within the epidural space with an injected aesthetic solution.

Episiotomy: Surgical incision into the perineum and vagina to facilitate delivery.

Forceps Delivery: The extraction of a foetus from the maternal passages by application of forceps to the child's head.

General Hospital District (GHD): Geographical "General Hospital Districts" (GHDs) are developed to identify clinical catchment areas for each acute care facility in the province regardless of whether they provide obstetrical service or not. These GHDs are developed by examining CIHI reporting boundaries, reviewing the pattern of hospital utilization for all admissions over a ten-year time frame and confirming or modifying the boundary.

Gestational Age: Gestational age was recorded as completed weeks at delivery. Preterm birth is defined as birth at <37 weeks gestation.

Gestational Diabetes: Diabetes mellitus with onset or first recognition during pregnancy; this category does not include women with pre-existing diabetes before becoming pregnant.

Gestational Hypertension: A high arterial blood pressure (140/90 or greater) with onset during pregnancy. The gestational hypertension data in this report comes from data recorded on the antepartum risk assessment and is calculated as the number of women with gestational hypertension/ number of women with risk scoring completed x 100.

Grand Multiparity: having completed the fifth to ninth pregnancy to the stage of viability.

Group B Streptococcus (GBS): A bacteria which can cause maternal infection of the uterus, placenta and urinary tract and infection in the infant that can be localized or involving the infant's entire body. The Society of Obstetricians and Gynaecologists of Canada recommend offering all women screening for group B streptococcal disease at 35 to 37 weeks gestation with culture done from one swab first to the vagina then to the rectal area. Reported are rates of positive maternal group B streptococcus.

Induced Labour: The initiation of labour prior to spontaneous onset for the purpose of accomplishing delivery, including medical agents, surgical or combined means.

Late Neonatal Death (LND): death of infant between 7 and 28 completed days of age.

Live Birth: The complete expulsion or extraction from the mother, irrespective of the duration of the pregnancy, of a foetus in which, after expulsion or extraction, 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. (Alberta Vital Statistics Act, RSA 1980 cV-4 s1).

Low Risk Primipara Subpopulation (LRP): Women who delivered their first live born infant who had an antepartum risk score of less than 3, gestational age of greater than or equal to 35 weeks, singleton pregnancy with a cephalic presentation and not admitted for an elective caesarean. It is of note that one of the inclusion criteria for this subpopulation is a total antepartum risk score of <3 therefore women for which the antepartum risk score was not completed are excluded from this subpopulation.

Maternal Age: Maternal age ascertained at the time of delivery, recorded in years.

DEFINITIONS

Maternal Mortality: Death of a woman known to be pregnant or within 90 days of delivery or termination of a pregnancy, irrespective of the duration of or site of the pregnancy, classified according to the Council on Medical Service American Medical Association A guide for maternal death studies. Committee on Maternal and Child Care, 1964 as:

- **Direct:** Resulting from complications of pregnancy, childbirth or the puerperium, which include interventions, omissions, incorrect treatment, or from a chain of events resulting from any of the above.
- **Indirect:** Resulting from previous existing disease, or disease developing during pregnancy, (not a direct effect of the pregnancy) which was obviously aggravated by the physiologic effects of pregnancy and caused the death.
- **Non-Related Deaths:** Resulting from causes not related to the pregnancy or to its complications or management.

Multiparous: having completed more than one pregnancy to the stage of viability. The multipara rate is the total number of multipara women expressed as a proportion of all delivering women.

Multiple Birth: A multiple birth is identified as multiple gestation pregnancy, including twins, triplets and quadruplets.

Neonatal Death (NND): death of an infant before 28 days of age including early and late neonatal deaths.

Nulliparous: A woman who has not delivered once of a foetus or foetuses who reached the stage of viability. The nulliparous rate is the total number of nulliparous women expressed as a proportion of all delivering women. In this report the terms nulliparous and primiparous are referring to the same population of women with the nulliparous being used to describe antepartum events / conditions and primiparous used when describing outcomes or post delivery events

Perinatal Death (PND): include stillbirths and early neonatal deaths.

Pre-pregnancy diabetes (diabetes mellitus): A chronic syndrome of impaired carbohydrate, protein and fat metabolism owing to insufficient secretion of insulin or to target tissue insulin resistance. It occurs in two major forms: Type 1 diabetes mellitus and Type 2 diabetes mellitus (Dorland, 2000). Diabetes is indicated in the APHP data set as pre-pregnancy diabetes controlled by diet, pre-pregnancy diabetes controlled by insulin and pre-pregnancy diabetes with retinopathy. Diabetes is calculated as the number of women with diabetes/number of women with risk scoring completed x 100.

Primigravida: A woman pregnant for the first time.

Primiparous: Bearing or having borne only one child. In this report the terms nulliparous and primiparous are referring to the same population of women with the nulliparous being used to describe antepartum events / conditions and primiparous used when describing outcomes or post delivery events.

Service Level: Level of obstetrical service available in each hospital district is defined as follows:

- Level O – Acute care hospital offering no obstetrical service
- Level A – Acute care hospital with obstetrical service but no caesarean section capability
- Level B – Acute care hospital with obstetrical service and caesarean section capability
- Level C – Acute care hospital with access to obstetricians/paediatricians
- Level D – Metro Edmonton/Calgary with access to tertiary care centre

Service levels have been developed consistent with those described by Iglesias et al. to facilitate population based analysis of outcomes of women and infants in Alberta according to the level of obstetrical service in the community in which they reside.

Smoking: An indication of smoking signified that a woman smoked at any point during her pregnancy, as recorded on the antenatal risk scoring form. The rate of smoking was calculated as number smoking / number of women with risk scoring completed x 100.

Spontaneous Vaginal Delivery (SVD): An unassisted delivery of an infant through the normal openings of the uterus and vagina.

Stillbirth (SB): refer to births with the complete expulsion or the extraction from the mother after at least 20 weeks pregnancy, or after attaining a weight of 500 grams or more, of a foetus in which, after the expulsion or the extraction, there is no breathing, beating of the heart, pulsation of the umbilical cord or unmistakable movement of voluntary muscle (Alberta Vital Statistics Act, RHA 1980,cV-4 s1). A fetal death is registered as a stillbirth in Alberta if delivery occurs at or after 20 weeks of pregnancy or if the fetal weight is 500 grams or greater.

Vacuum Extraction: The use of a suction cup connected to a vacuum device, to facilitate delivery.

VBAC Subpopulation: Women with one prior caesarean, greater than or equal to 35 weeks gestation, cephalic presentation, and singleton pregnancy.

Vaginal Breech Delivery: Extraction or expulsion of the infant from the uterus in breech presentation; i.e., when the buttocks of the foetus are presented in labour. Includes spontaneous, assisted and extracted breech deliveries.

INTRODUCTION

This section describes the Alberta Perinatal Health Program (APHP), the commitment the APHP has to providing timely reports to its stakeholders, and commitment to supporting research. This section also outlines the purpose, objectives and methodology of this report.

Background – The Alberta Perinatal Health Program

The Alberta Perinatal Health Program (APHP) was established in July 2004. The Program vision is to achieve the optimal level of health for expectant mothers and their infants. The APHP is being delivered through a Tripartite Partnership between Capital Health, Calgary Health Region and the Alberta Medical Association (AMA) and is grant funded through Alberta Health and Wellness.

The APHP is engaged in a reciprocal relationship with all health regions through a Partnership Accord, which provides a structure for all health regions to have input into decisions, business planning and implementation of program strategies. While the APHP does not provide direct patient services; the APHP program staff value and strive for positive relationships with their key partners, namely the regional health authorities, and health professionals.

APHP recognizes the need for collaboration with perinatal care providers in the province. This collaboration assists APHP to optimize evidence based perinatal services and the data collection. These initiatives support quality improvement activities, educational strategies, and information management to facilitate the monitoring, analysis and reporting of perinatal outcomes.

Prior to the establishment of the APHP, there were three perinatal programs in Alberta responsible for the collection and reporting of perinatal data, namely the:

- Committee on Reproductive Care of the Alberta Medical Association,
- Northern & Central Alberta Perinatal Outreach Program, and
- Southern Alberta Perinatal Outreach Program.

Historically, all three programs operated independently, and utilized different databases for reporting. With the establishment of the Alberta Perinatal Health Program, the functions of the above-mentioned programs fall under the APHP. Since its inception, the APHP has developed an Information Management (IM) Strategic Plan to manage existing data, to develop one comprehensive provincial database and expand the data collection. The comprehensive database will support the expanded mandate of the APHP, and will seek to accommodate new interfaces consistent with current or planned information management / technology activities within the health regions.

The production of the first annual *Provincial Perinatal Report* demonstrates the collaborative effort among the health regions in Alberta, the Alberta Perinatal Health Program and the Alberta Medical Association to work toward optimal perinatal outcomes for mothers and babies.

Commitment to Supporting Research

The APHP supports the use of data in its custody for the purpose of research, with a view to achieving optimal health for mothers and infants in Alberta. The Data Process Working Group of the Information Management (IM) Standing Committee was established to review and approve data requests that require access to individually identifiable records, requests that require data matching to other databases and/or other data requests that the APHP IM team feel appropriate.

The purpose of the process is to ensure that the question is understood, and that the request complies with data privacy and confidentiality policies of the APHP. The following is a list of research projects supported by the APHP since the inception of the program in July 2004.

| Study Name | Investigators |
|---|--|
| What Factors Influence Rural Women's Choices: Giving Birth in Rural Alberta and Ontario | Dr. J. Medves, Dr. B. O'Brien |
| Is it Dangerous to Deliver in July? | Dr. S. Chandra, S. Federkeil |
| Macrosomic Births in Alberta (1993-2003): Trends, Determinants and Outcomes | Dr. C. Newburn-Cook, J. Jaipal, Dr. N. Demianczuk, Dr. B. O'Brien, N. Fraser-Lee |
| Heterogeneity of Preterm Birth: Risk Factors for Preterm SGA Births vs. Preterm AGA Births | Dr. C. Newburn-Cook |
| Intrauterine Insemination with Donor Versus Partner Sperm and the Risk of Adverse Obstetrical and Neonatal Outcomes | Dr. S. Chandra, M. Pratt |
| Relationship Between Perinatal and Infant Factors and Weight Status of Children in the Calgary Health Region at Four/Five Years of Age | D. McNeil, Dr. S. Tough, Dr. R. Sauve, F. Bandali, M. Best, K. Hall |
| Biomarkers for Maternal Drug and Alcohol Use in Meconium: The Association Between Level of Biomarker in Meconium and Child Development | Dr. S. Tough |
| A Prospective Matched Cohort Regional Study of Child Outcome After Trauma During Pregnancy | Dr. T. Lacaze |
| Folic Acid Fortification and Its' Effect on Adverse Obstetrical Outcomes | Dr. S. Chandra, A. Kim |
| Use of Morbidity Assessment Index for Newborns to Measure Whether Maternal Membrane Status Prior to the Onset of Preterm Labour Impacts on the Outcome of Babies Delivered After 32 Weeks Gestation | Dr. T. Lacaze |
| Caesarean Section and the Risk of Subsequent Stillbirth | Dr. S. Wood, Dr. S. Ross, Dr. R. Sauve |
| Stillbirth and Perinatal Mortality in Twins and Triplets: Is there an Optimal Time for Delivery? | Dr. S. Wood, Dr. R. Sauve, Dr. S. Ross |
| The Impact of Older Maternal Age on the Risk of Spontaneous Preterm Birth: A Population-Based Study in Northern and Central Alberta | S. Hassan |
| Foetal Position in Labour and the Likelihood of Subsequent Successful Vaginal Births after Caesarean Section | Dr. S. Wood |
| Relationship in the Timing of Successive Term Labours | Dr. S. Wood, Dr. S. Ross |
| Caesarean Section Rate of Neonatal Size Amongst Gestational Diabetic Mothers in Calgary | Dr. S. Pederson, Dr. L. Donovan, Dr. S. Wood, D. McNeil |

Purpose of the Report

The primary purpose of this report is to provide information to health regions and those providing perinatal services. The information contained herein can be used to inform strategic planning, and support quality improvement and educational activities.

Objectives and Contents of the Report

The four main objectives of this report are:

1. To describe perinatal health indicators by Health Regions (N=9), and/or service level (N=5). (Designated service levels of obstetrical care developed for the purpose of this report are based on the work of Iglesias et al., 2005.). Maternal and neonatal information are provided for hospital site of birth and by population.
2. To describe the obstetrical outcomes and service utilization in Alberta by population, including inflow and outflow among communities that provide varying levels of obstetrical service.
3. To describe trending for selected variables over a 5-year time period (2000-2004),
4. Report on the ongoing study of perinatal mortality in Alberta.

How to Use this Report

This report is intended to provide supplemental information to accompany facility level data which will be released to facility designates. It can also be used as a stand alone document to better understand perinatal health in Alberta. This report provides details of perinatal health indicators in Alberta at a provincial level. The intention is to provide background and context for variables being examined in this report and to give an overview of time trends over a five-year period. It is not intended to provide an in-depth analysis of provincial data. As the Alberta Perinatal Health Program grows and databases are integrated and expanded, the long-range goal is to examine variables from a population health perspective, as well as at the individual facility level.

Data Sources

Data for this report consists of pregnancy and birth data collected from all hospital facilities where women delivered and from Registered Midwives in Alberta for the calendar years 2000 through 2004. Data are collected from the provincial delivery record and the perinatal mortality data, with some “paper forms” and some basic “electronic” interfaces.

Methodology and Limitations

- All births occurring at the participating hospitals are included in the hospital specific data regardless of place of residence (Alberta, out of province or unknown).
- Only Alberta residents are included in the population based data (maternal residence).
- Midwife attended hospital births are captured in the hospital site-specific data.
- Midwife attended home birth data are collected from Registered Midwives throughout Alberta. For the population based reporting women are mapped back to the community in which they reside and reported in that hospital's district data.
- Alberta residents were assigned to a hospital district based on the postal code of the mother at the time of delivery.
- Population based data for hospitals that provide service to a large number of out-of- province residents (e.g. Lloydminster) may not accurately reflect the activity in the true catchment area for that facility.
- Numbers reported may be slightly different than numbers presented in other provincial reports due to definitions and/or data sources utilized.
- Statistical analyses are mainly descriptive, including frequencies, rates, percentages, and means. To compare categorical data, Pearson Chi-square tests and tests for linear trend were used. Continuous data were analyzed using t-tests or Analysis of Variance (ANOVA) tests. A p-value of <0.05 was considered significant.
- With rare events (such as mortality), or detailed breakdowns (such as birth weight groupings), rates or percentages are based on small numbers, which reduces their statistical reliability. **Caution should always be exercised in interpreting these results.**
- Caution should be used with interpreting variables ascertained from antenatal risk scoring, particularly when using the total score for decision making related to assessment of risk. The individual risk factors that contribute to the total score are most important when using the tool for clinical decision-making. Generalized categories of low moderate and higher risk derived from total scores have been used for reporting and surveillance.
- All mortality data are recorded at hospital of birth.
- Every attempt has been made to include all perinatal and maternal mortality cases occurring in Alberta regardless of place of residence.

DELIVERIES IN ALBERTA

This section describes the women giving birth in Alberta and examines the obstetrical services these women are using. This section provides a unique look at the movement of women between levels of service that are defined specifically for this report.

Demographics of Women Delivering in Alberta

Total Deliveries

In 2004, there were 40,888 women delivering within a health care facility (including birth before admission, such as en route to hospital), or had a midwife attended home birth including births to women that resided outside of Alberta. Figure 1.1 depicts the distribution of these births by hospital/town in which the birth occurred.

Crude birth rates, which describe the number of live births per 1,000 women in a given year, have decreased in Alberta and Canada over the past century (Statistics Canada, 2003). The crude birth rate in Alberta declined from 1988 (60.6 live births per 1,000 women aged 15-49), although the rate stabilized from 2000 to 2002. The 2002 rate was 46.0 (Alberta Health and Wellness, 2004). However, the number of absolute births occurring in Alberta has increased linearly over the five year time frame from 37,532 births in 2000 to 41,320 in 2004 (live births), with the greatest increase occurring between 2002 and 2003 (see figure 1.2).

Women from out-of-province that deliver in Alberta facilities are included in this report. In 2004, 445 women that were out-of-province residents delivered in Alberta (excluding Saskatchewan residents delivering at the Lloydminster hospital).

Figure 1.1 Health Care Facility Births, 2004.

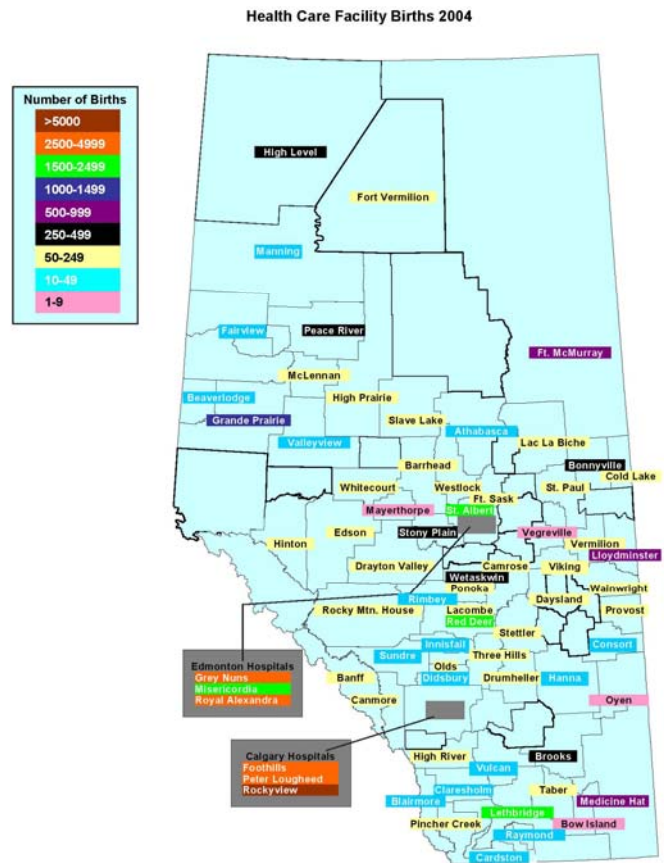
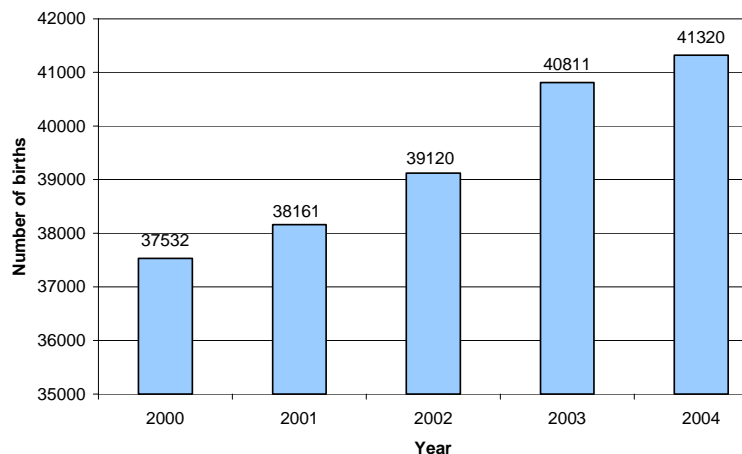


Figure 1.2 Total live births, Alberta, 2000–2004.



Parity

Parity has been shown in the literature to be related to many aspects of a pregnancy and birth outcomes. In large, population based studies, investigations into the obstetric risks associated with high-order parity have revealed that increasing parity is associated with a significant risk of stillbirth. However, it must be taken into consideration that maternal age does have an independent effect on foetal and maternal outcomes within the parity groups (Heffner, 2005). On the other end of the spectrum, nulliparity has also been associated with pregnancy risks. Nulliparity has been associated with an increased risk of preterm delivery and caesarean section (Abu-Hejja, Rasheed, & el Qaraan, 1998).

In 2004, 17,703 pregnant women in Alberta (43.3%) were nulliparous. The proportion of nulliparous women increased over the years from 41.7% in 2000 to 43.4% in 2004 ($p < 0.001$) (figure 1.3).

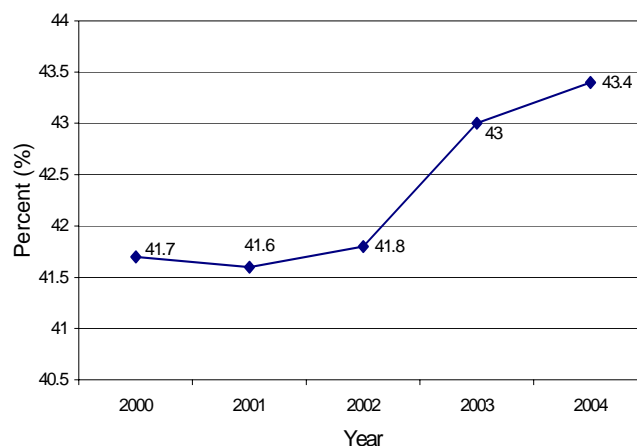
Associations between parity and maternal and neonatal indicators (such as caesarean section and preterm delivery) will be presented in subsequent sections.

Maternal Age

Mean maternal age for pregnant women is increasing in most developed countries as more women delay parenting. This delay has been attributed to socioeconomic reasons and use of assisted reproductive technology which allows older women to conceive and experience childbirth (Tough et al., In Press, a). In 2000, 14.5% of births in Canada were to women aged 35 and older (Health Canada, 2003).

Advanced maternal age has been associated with poor maternal and fetal outcomes. Medical risks of delayed childbearing include high blood pressure, preeclampsia, gestational diabetes, chromosomal abnormalities, and low birth weight newborns. Additional risks for this group include stillbirth and unexplained foetal death, preterm delivery, and increased risk of operative delivery (Berkowitz, Skovron, Lapinski, & Berkowitz, 1990; Tough et al., 2002).

Figure 1.3 Percent of pregnant women who are nulliparous, Alberta, 2000–2004.



Teenage pregnancies have also been associated with adverse maternal and infant outcomes, including preterm and growth restricted infants. Teen pregnancies may be characterized by delayed entry into prenatal care and lower rates of prenatal care. While socio-demographic factors can influence the outcomes of teenage pregnancies, biologic immaturity of mothers may also play a role in adverse outcomes (Fraser, Brockert, & Ward, 1995). Since 1991, the proportion of live births to teenage mothers in Canada has declined (Health Canada, 2003).

Table 1.1 presents the maternal age distribution of women giving birth in Alberta for the years 2000-2004. In 2004, approximately 5% of women were under the age of 20 years, while 14.5% were 35 years of age, or older. The maternal age distribution has not changed largely over this five-year period, although there is small decrease in women under the age of 19 giving birth and a slight increase in women over the age of 30 delivering. Although the proportion of women aged 35 or older has not increased greatly since 2000, the mean maternal age has increased significantly ($p < 0.001$) between 2000 and 2004 (figure 1.4). Additionally, the mean age of women at first birth has increased significantly ($p < 0.001$), as can be seen in figure 1.3, showing the mean age of primiparous women in 2000 being 26.3 years increasing to 26.8 years in 2004.

Associations between maternal age and maternal and neonatal indicators (such as caesarean section and low birth weight) will be presented in subsequent sections.

Figure 1.4 Mean maternal age at delivery, all women and primiparous women, Alberta, 2000-2004

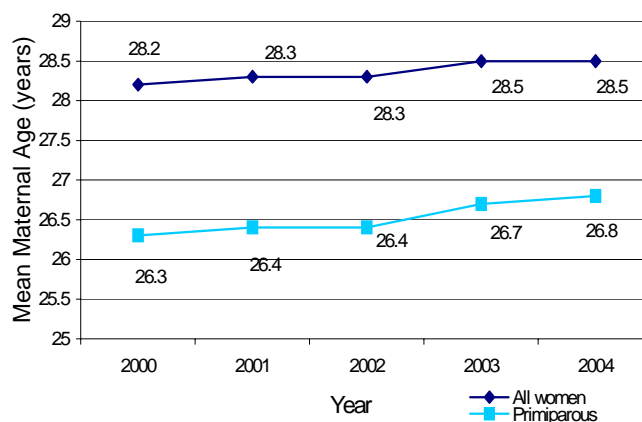


Table 1.1 Maternal age, Alberta, 2000–2004.

| Age (yrs) | Year n (%) | | | | |
|--------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | 2000 | 2001 | 2002 | 2003 | 2004 |
| <15 | 19 (0.1) | 21 (0.1) | 17 (0.0) | 14 (0.0) | 19 (0.0) |
| 15-17 | 771 (2.1) | 741 (2.0) | 641 (1.7) | 609 (1.5) | 641 (1.6) |
| 18-19 | 1730 (4.7) | 1631 (4.3) | 1650 (4.3) | 1564 (3.9) | 1534 (3.8) |
| 20-24 | 7610 (20.6) | 7685 (20.5) | 7968 (20.6) | 8231 (20.4) | 8101 (19.8) |
| 25-29 | 11452 (31.0) | 11549 (30.8) | 11958 (30.9) | 12498 (31.0) | 12884 (31.6) |
| 30-34 | 10016 (27.1) | 10432 (27.8) | 10885 (28.2) | 11438 (28.4) | 11690 (28.6) |
| 35-39 | 4599 (12.4) | 4643 (12.4) | 4706 (12.2) | 4918 (12.2) | 4954 (12.2) |
| ≥40 | 783 (2.1) | 830 (2.2) | 836 (2.2) | 1015 (2.5) | 993 (2.4) |
| Total | 36980 (100.0) | 37532 (100.0) | 38661 (100.0) | 40287 (100.0) | 40816 (100.0) |

$p < 0.001$

Deliveries by Service Level

General Hospital Districts

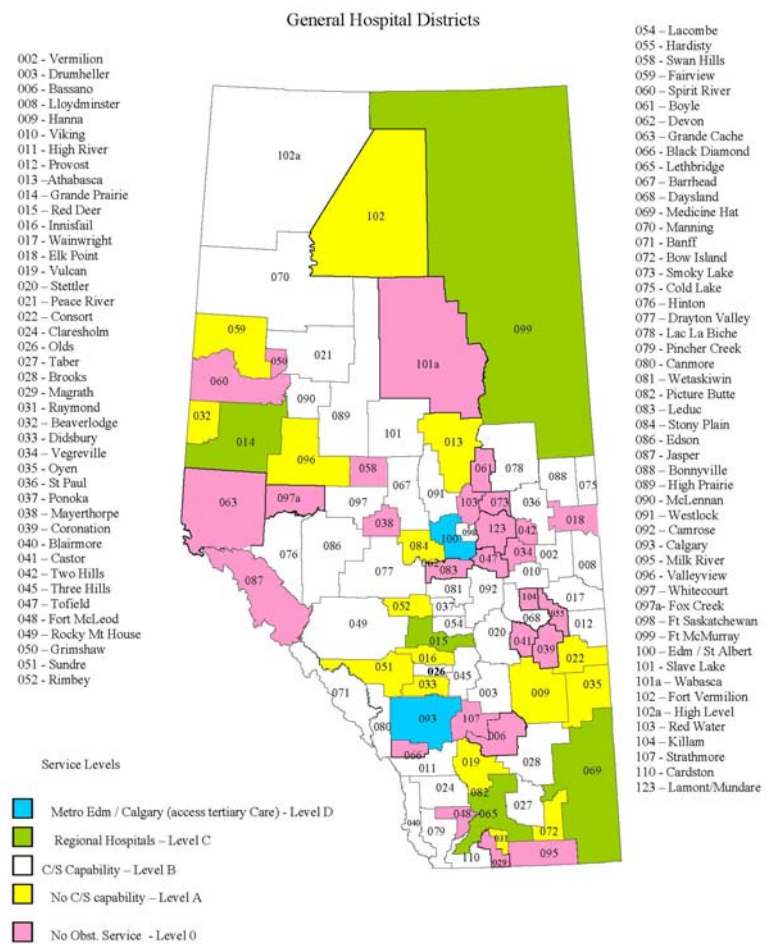
It is important for perinatal programs to be able to map women back into the communities in which they reside, regardless of where they deliver, to be able to both plan for pre-conception and prenatal care, as well as monitor outcomes according to obstetrical service level available in their community of residence.

This section of the report maps women back to their community of residence according to her postal code at the time of delivery, and the data are reported by population and compared to the site of delivery. Geographical “General Hospital Districts” (GHDs) were developed for all acute care hospitals in the province regardless of whether they provide obstetrical service or not. These GHDs were developed, with the assistance of Alberta Health and Wellness, by examining CIHI reporting boundaries, reviewing the pattern of hospital utilization for all admissions over a ten-year time frame and confirming or modifying the boundary.

The GHDs are stratified according to level of obstetrical service available in the community to facilitate analysis of outcomes from the different service levels and patterns of inflow and outflow among the different communities. Levels of service for each hospital district are those developed by Iglesias et al. (JOGC Sept 2005), and defined as follows:

- Level O – Acute care hospital offering no obstetrical service
- Level A – Acute care hospital with obstetrical service but no caesarean section capability
- Level B – Acute care hospital with obstetrical service and caesarean section capability
- Level C – Acute care hospital with access to obstetricians / paediatricians
- Level D – Metro Edmonton/Calgary with access to tertiary care centre

Figure 1.5



Pink areas on the map represent communities without a local obstetrical service.

Changes in obstetrical rural service

As with most provinces in Canada, Alberta has a regionalized system for the delivery of health care, including obstetrical services. There is considerable variation in the level of obstetrical services provided in rural communities with some facilities having full obstetrical service including those with caesarean section capabilities (Level B), others with limited obstetrical service without caesarean section capabilities (Level A) and still others that offer no elective obstetrical service (Level O).

Rural obstetrical services are in decline across Canada and Alberta is no exception. In the year 2000, 17 of the 98 acute care hospitals in Alberta, did not offer an elective obstetrical service (Iglesias et al., 2005). In 2004 there were 29 acute care facilities that did not offer an elective obstetrical service. Lack of availability of care in a rural community means women must travel to give birth. Women who give birth outside of their community report stress and anxiety related to financial costs such as travel expenses, transfer by ambulance and partner's loss of income (Kornelsen and Grzybowski, 2005). Women in rural communities have developed strategies related to needs for a safe birth including seasonal timing of birth, planned home birth, and labouring at home and arriving at the local hospital fully dilated and prepared for imminent delivery to eliminate the possibility of travel. (Kornelsen et al., JOGC April 2005).

There are many issues and challenges that threaten the ability of health care professionals, hospitals, and regional health authorities to provide quality obstetrical services. The challenges are in part, related to availability of human resources. Attention must be paid to recruitment and retention of staff, orientation, and ongoing staff education, experience competency and confidence, and contemporary issues related to lifestyle and work life balance. Practitioners and administrators have expressed a need for standards of care that are appropriate for rural practice and issues related to consultation, referral and transport (Issues in Rural Obstetrics Discussion Paper, 2000).

In 2004, 532 family practitioners attended 42.1% of the births, 99 obstetricians attended 56.9% of the births and 14 Registered Midwives attended 0.3% of the births. Although there is some published evidence that outcomes have not been compromised for women and infants from communities offering limited or no obstetrical service (Iglesias et al., 2005), there is no evidence to suggest that a continued decline in rural obstetrics would not have an effect on these outcomes.

Where a woman delivers versus where she resides

In 2004, communities with regional hospitals (Level C) and communities with tertiary care centres (Level D) delivered 96.5% and 98.6%, respectively of women who, reside in their community. Given the regionalized system of health care delivery it is not surprising that these communities have a high proportion of inflow from other communities 28.3% (n=1951) and 14.8% (n = 3890) respectively.

For women residing in a hospital district without an obstetrical service (Level O), outflow from the hospital district is predictably close to 100% with 10 women remaining in the community and having a midwife attended home birth and 5 delivering at the local facility. Rural hospital districts with limited obstetrical service (Level A) delivered only 22% of their population. As well as experiencing a high volume of outflow from the community, the hospitals in these communities also experience a 33% inflow from other communities.

Rural hospital districts that have caesarean section capabilities (Level B) deliver approximately 59% of their local population as well as 26% from other hospital districts (inflow).

Table 1.2 demonstrates the absolute number of women outflowing from each service level and the distribution of where they ultimately deliver. Outflow is calculated as; the number of pregnant women that reside in a hospital district that deliver outside of that district / number of women that reside in the hospital district that gave birth.

Figure 1.6 illustrates the proportion of inflow and outflow from the aggregates of different service levels.

From the existing APHP data, it is not possible to differentiate outflow as a result of a transfer of care from outflow related to other factors such as women's choice. It is assumed that some of the outflow patterns demonstrated in Table 1.2 such as the 97 women outflowing from Level D hospital districts to Level A hospital districts would be related to choice. The 896 women outflowing from level B hospital districts to Level C facilities may be related to choice, travel patterns or proximity to other facilities and or the requirement for a higher level of care. It can be noted that 30.2% and 29.2% of the women inflowing to a level C or D facility respectively, underwent a caesarean section.

Figure 1.6 Percent of women in aggregate service levels outflowing and inflowing from facilities, Alberta, 2004.

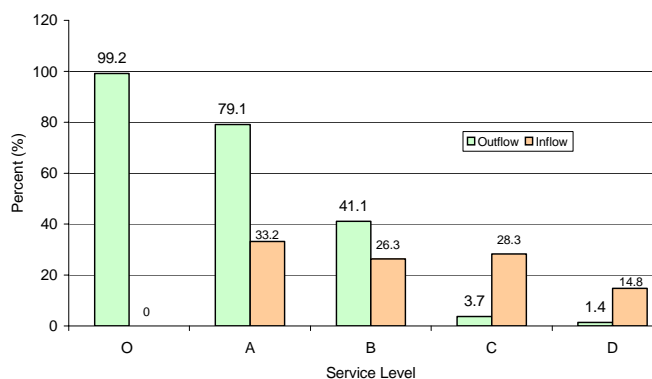


Table 1.2 Outflow of women from their residential hospital district and the service level in which they deliver, Alberta, 2004.

| Service Level at delivery site | Service Level at Maternal Residence | | | | | | Total Inflow |
|--------------------------------|---|---|---|---|---|-------------------------------|--------------|
| | Outflow from Level 0 hospital districts | Outflow from Level A hospital districts | Outflow from Level B hospital districts | Outflow from Level C hospital districts | Outflow from Level D hospital districts | Out of Province or AB Unknown | |
| Inflow to Level A facilities | 38 | 15 | 42 | 31 | 97 | 9 | 232 |
| Inflow to Level B facilities | 500 | 359 | 531 | 38 | 198 | 102* | 1626 |
| Inflow to Level C facilities | 293 | 531 | 896 | 11 | 23 | 197 | 1951 |
| Inflow to Level D facilities | 1261 | 880 | 1377 | 108 | 19 | 335 | 3980 |
| Total Outflow | 2092 | 1785 | 2846 | 188 | 337 | 541 | |

* Excludes out-of-province deliveries at Lloydminster Hospital

Figures 1.7 through 1.11 examine some of the factors that may be associated to these patterns of movement. These figures depict the proportion of a factor occurring in the service level of where a woman resides (population) compared to the factor occurring in the service level of the facility existing in that district. It can be noted that in figures 1.7 through 1.11, service level O has only data for the “population” given that these hospital districts do not provide an elective obstetrical service. Please refer to Appendix 1. for the corresponding absolute number of women in the population (maternal residence) level of service and Appendix 2. for corresponding absolute number of women in the hospital (facility) level of service

Primiparous women are at increased risk for caesarean section (Abu-Heija et al., 1998). In hospital districts that did not have caesarean section capabilities, fewer primiparous women delivered within their own community (27%) than resided there (34%) (figure 1.7). It is of interest that as distribution by population, there are higher proportions of primiparous women residing in the urban hospital districts (Level C and D) than those in the rural districts (Level O, A and B)

Caesarean section rates by population across the spectrum of service levels vary from 21.3 to 26.3 per 100 deliveries (figure 1.8). The SOGC recognizes that in many rural or remote areas “low risk” deliveries are performed with caesarean section capabilities available only by emergency transfer to another institution (The Society of Obstetricians and Gynaecologists of Canada (SOGC), 2000). Service levels C and D have a higher proportion of caesarean sections by hospital activity compared to the population which is reflective of the higher volume of inflow to those districts.

Women with induced labour have a higher incidence of caesarean section and therefore need to have the available support services (SOGC clinical practice guidelines – Induction of Labour at Term). The proportion of inductions by facility is significantly less than by population in hospital districts without caesarean section capabilities (level A) (See figure 1.9).

Preterm birth rates range from 6.7% to 9.4% by population across the spectrum of service levels (figure 1.10). The higher proportion of preterm births at the Level D facilities is evidence of regionalized delivery of care. Figure 1.11 demonstrates the same pattern of referral for low birth weight infants.

Figure 1.7 Primiparous women delivering at facility service level (hospital), compared to the resident service level (population), Alberta 2004

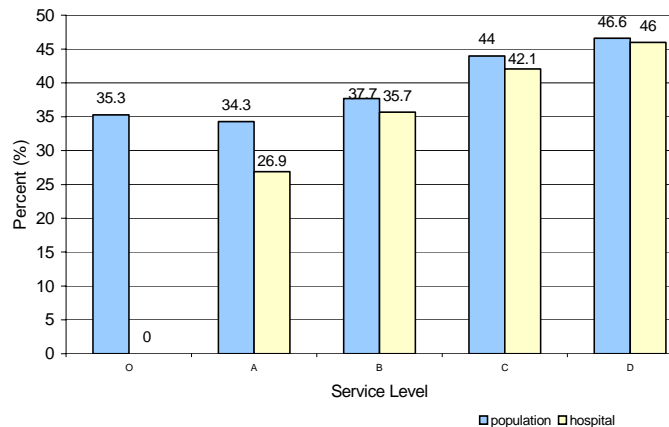


Figure 1.8 Caesarean sections at facility service level (hospital) compared to the resident service level (population), Alberta 2004.

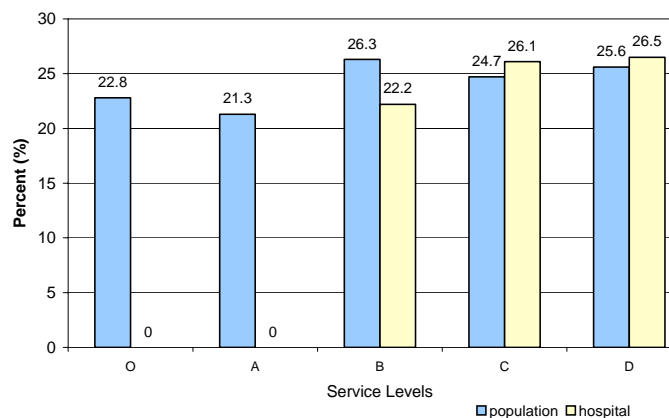
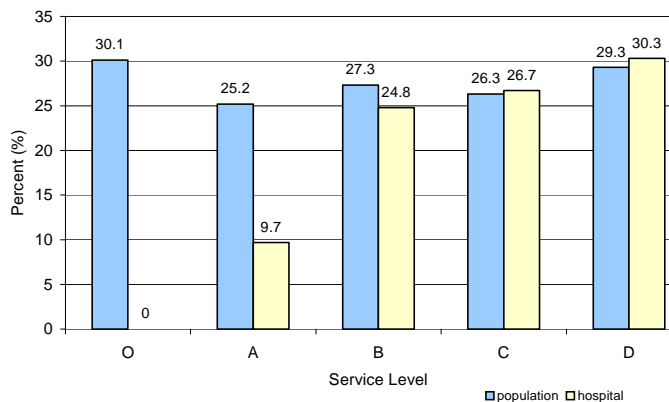


Figure 1.9 Inductions at facility service level (hospital) compared to the resident service level (population), Alberta 2004.



Intra-provincial movement of women between health regions

As women move between facilities of differing service levels (O-D), they may also travel between Health Regions (RHA1-9). Table 1.3 illustrates this inflow and outflow between Health Regions in Alberta, excluding women traveling from outside the province and home births.

Overall, approximately 6% of women delivering in a health region have travelled from another region to give birth. This rate varies greatly, with Palliser having the lowest rate of Alberta women from outside the region travelling to their facilities (1.9% of all their deliveries in 2004) and Capital having the highest rate of women inflowing from other regions (12.7% of all their deliveries). This is not unexpected when consideration is given to both geography and the level of service that facilities within a region possess. Although both Capital and Calgary Health Regions have level D facilities and therefore it is expected that there will be Alberta women inflowing into these regions for service utilization, Capital has a greater number of women inflowing (N=1695 compared to N=342 women inflowing to Calgary). Health regions surrounding the Calgary Health Region (RHA 1, 2 and 4) all have at least a Level C facility within their region, and therefore may have less of a need to transport women to the Level D facilities in Calgary. On the other hand, Edmonton is the Level D catchment for the northern portion of the province, in which many of the regions have facilities with level B service, but no C or D. Please see Appendix 3. for a listing of facilities within Health Regions and their designated level of service.

Figure 1.10 Preterm births (<37 weeks) at facility service level (hospital), compared to the resident service level (population), Alberta 2004.

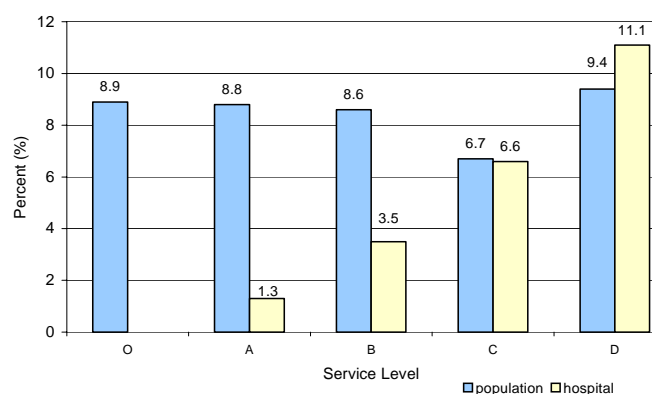


Figure 1.11 Low birth weight infants (<2500g) at facility service level (hospital), compared to resident service levels (population), Alberta, 2004.

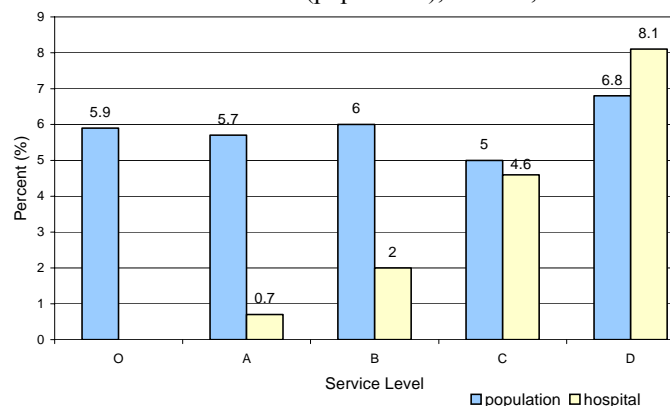


Table 1.3 Outflow of women from their residential health region and the health region in which they deliver, Alberta 2004.

| RHA delivery site | RHA of Maternal Residence | | | | | | | | | Total inflow | Total facility deliveries | % of deliveries from inter-provincial inflow |
|----------------------|---------------------------|------------|------------|------------|------------|-----------|------------|------------|-----------|--------------|---------------------------|--|
| | RHA 1 | RHA 2 | RHA 3 | RHA 4 | RHA 5 | RHA 6 | RHA 7 | RHA 8 | RHA 9 | | | |
| RHA1 | - | 46 | 70 | 2 | 0 | 2 | 0 | 2 | 0 | 122 | 2104 | 5.8 |
| RHA2 | 13 | - | 7 | 2 | 1 | 1 | 0 | 0 | 0 | 24 | 1251 | 1.9 |
| RHA3 | 37 | 65 | - | 224 | 4 | 4 | 4 | 3 | 1 | 342 | 14475 | 2.4 |
| RHA4 | 0 | 11 | 43 | - | 38 | 23 | 2 | 0 | 0 | 117 | 3395 | 3.4 |
| RHA5 | 0 | 1 | 0 | 48 | - | 0 | 14 | 0 | 0 | 63 | 1335 | 4.7 |
| RHA6 | 4 | 4 | 24 | 322 | 379 | - | 803 | 97 | 62 | 1695 | 13390 | 12.7 |
| RHA7 | 0 | 0 | 1 | 1 | 5 | 10 | - | 63 | 1 | 81 | 1667 | 4.9 |
| RHA8 | 0 | 0 | 0 | 2 | 0 | 3 | 7 | - | 33 | 45 | 1810 | 2.5 |
| RHA9 | 0 | 1 | 1 | 0 | 1 | 0 | 1 | 4 | - | 8 | 1252 | 0.6 |
| Total outflow | 54 | 128 | 146 | 601 | 428 | 43 | 831 | 169 | 97 | 2497 | 40888 | 6.1 |

MATERNAL INDICATORS – Total Population

This section of the report examines the method of delivery and labour experience of women in Alberta. The final segment describes maternal behaviours and obstetrical risk factors that may influence a healthy pregnancy and birth.

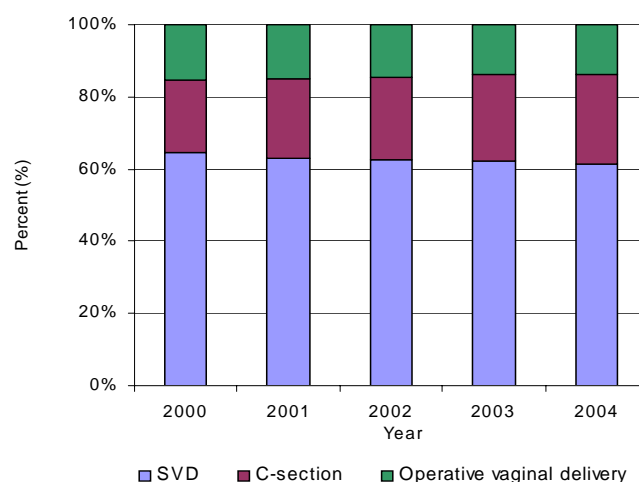
Method of Delivery

Spontaneous vaginal delivery and operative vaginal delivery rates have declined in Alberta, while caesarean section rates have increased between 2000 and 2004 (figure 2.1). The caesarean section rate significantly increased from 19.9 per 100 deliveries in 2000 to 25.2 in 2004. Operative vaginal delivery, which includes forceps, vacuum extraction and vaginal breech delivery dropped from 15.5 per 100 deliveries in 2000 to 13.6 in 2004 (p linear trends = 0.05).

Rates of caesarean sections have increased over the past decade in many developed countries, including Canada. Caesarean sections increased significantly ($p < 0.001$) for both singletons and multiples between 2000 to 2004 in Alberta (table 2.1). In 2004, 24.6 per 100 women delivering singletons and 59.3 per 100 women delivering multiples had a caesarean section. Caesarean delivery is a major abdominal surgery, increasing medical risks to the mother, such as iatrogenic infections (20%), and increasing the length of hospital stays, thus resulting in direct increases in health care costs (Health Canada, 2003). Caesarean section has also been associated with increased risks to the infant, including respiratory distress syndrome and infant morbidity and mortality (Wagner, 2001).

Breech presentation has had an important impact on the increasing caesarean section rates. Recommendations from Hannah et al., 2000 from the large multi-centred term breech trial were that singleton babies in breech presentation at term be delivered by planned caesarean section to reduce the risk of morbidity and mortality. In 2004, 2,080 (5.1%) of infants in Alberta were in breech presentation at delivery, of these, 1,898 (91.3%) were delivered by caesarean section.

Figure 2.1 Method of delivery, Alberta, 2000–2004.



Appendix 1. presents selected summary information on methods of delivery, labour and maternal behaviours and risk factors by resident health region. Appendix 2. presents selected summary information on method of delivery, labour and maternal behaviours and risk factors by facility health region.

Table 2.1 Caesarean sections, Alberta, 2000-2004

| | Year | | | | |
|--------------|--------------------|--------------------|--------------------|--------------------|---------------------|
| | 2000 | 2001 | 2002 | 2003 | 2004 |
| Singletons | 7119 (19.5) | 8059 (21.7) | 8525 (22.4) | 9272 (23.4) | 9871 (24.6) |
| Multiples | 277 (48.2) | 305 (50.8) | 343 (53.6) | 358 (52.4) | 421 (59.3) |
| Total | 7396 (19.9) | 8364 (22.2) | 8868 (23.0) | 9630 (23.9) | 10292 (25.2) |

$p < 0.001$

Nulliparous women, as well as older women, are more likely to have a caesarean section (Abu-Heija et al., 1998). In 2004, 28.2% of primiparous women delivered by C-section compared to 22.9% of multiparous women ($p < 0.001$). Additionally, 34.0% and 43.1% of women aged 35-39 and 40+, respectively delivered by C-section. Previous caesarean delivery, dystocia, breech presentation and fetal distress have been recognized as the most important indications for caesarean delivery (American College of Obstetricians and Gynaecologists Women's Health Care Physicians, 2000). Almost half of all C-sections in Alberta were undertaken before 34 weeks completed gestation and 11.2% were low birth weight (<2500 grams).

Primary caesarean sections are on the rise from 13.3% in 2000 to 15.9% in 2004. This change is being influenced both by the change in practice for breech presentations and the increase in the nulliparous population in Alberta. With a decline in vaginal births after previous caesarean (VBAC), the repeat caesarean section rate is also increasing from 6.6% in 2000 to 9.4% in 2004.

The Society of Obstetricians and Gynaecologists of Canada provides practice guidelines for operative vaginal births. These guidelines identify indications for intervention based on conditions of the foetus or mother (The Society of Obstetricians and Gynaecologists of Canada, 2004). Some factors that have been suggested as playing a role in instrument choice include tradition and training of physicians as well as the mother's health profile (Wen et al., 2001).

Labour

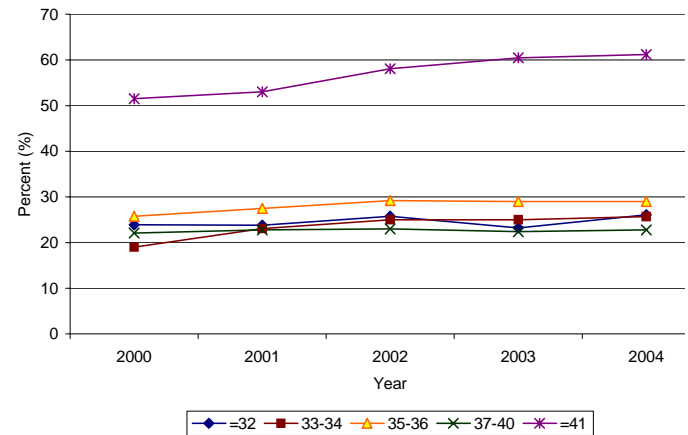
Induced Labour

Induction of labour is indicated when there are signs that continuation of pregnancy may result in adverse outcomes to the foetus and/or the mother. The purpose of induction is to initiate effective uterine contractions for the purpose of delivery. Induction of labour may result in a lower risk of death for overdue babies and increases the likelihood of delivery for slow or non-progressing births. However, it has been noted in the literature that compared to women with spontaneous onset of labour, women who are induced have a higher risk of having caesarean births (Maslow AW & Sweeny AL, 2000) and of painful uterine contractions or uterine rupture (Miles AL, 2000). In 2004 for deliveries in Alberta, 20.2% of women having induced labour subsequently required caesarean section delivery compared with 12.8% of women with spontaneous labour ($p < 0.001$).

Induction rates in Alberta have increased linearly since the late 1980s. Between 2000 and 2002 the rate of inductions increased slightly, with 27.3% undergoing induction in 2000 and 28.3% in 2004. In 2004, among singleton births, 7.8% of women were induced for reasons related to prematurity.

Figure 2.2 represents the percentage of women undergoing labour induction by gestational weeks over the time period 2000 to 2004. Rates of induction are significantly increasing in all gestational age groupings ($p < 0.01$). Of note, the largest changes are observed in post-term deliveries (≥ 41 weeks) in which labour inductions increased from 51.5% in 2000 to 61.2% in 2004 and in the 35-37 week gestation category which increased from 25.8% in 2000 to 29.0% in 2004.

Figure 2.2 Induction by gestational age groupings, Alberta, 2000-2004



Epidural Analgesia

Although the World Health Organization recommends alternatives such as massage, relaxation, breathing and acupuncture to manage labour pain (Chalmers & Porter, 2001), advances in obstetric anaesthesia have made medicated pain relief a popular option. It has been noted in the literature that epidural use is not associated with an increase the rate of caesarean delivery, however it has been associated with lengthening the first and second stages of labour and increasing the rate of assisted delivery, fetal malposition and oxytocin use to augment labour (Howell & Concato, 2004). Epidural use has also been associated with drug side effects in both mother and babies (Leighton & Halpern, 2002).

Epidural use varies between facilities, for the entire province, the use of epidural has increased linearly over time. In 2000, the provincial epidural analgesia rate was 35.4 (per 100 hospital deliveries) compared to 41.6 in 2004 ($p < 0.001$).

Episiotomy

Until the 1970s, episiotomies were more often performed on women having their first baby (Schoon, 2001). However, it is now considered a controversial surgical procedure (Health Canada, 2003). Episiotomies are associated with increased rates of perineal and pelvic floor morbidity relative to deliveries in which the perineum remains intact or tears (Carroli & Belizan, 2004).

The rate of episiotomies for women with vaginal deliveries declined in the province over the period 2000-2005 ($p < 0.001$). In 2000, the rate was 20.1%, which fell linearly to 15.5% in 2004.

Maternal Behaviours & Obstetrical Risk Factors

Antenatal Risk

A formal risk management process should be in place locally in each community starting with identification and analysis of risk (Iglesias, Grybowski, Klein MC, Gagne, & Lalonde A, 1998). The Alberta provincial delivery record is a two part clinical record that was developed by the Alberta Medical Association Committee on Reproductive Care. Part One of the form is an Antenatal Risk Assessment Tool.

The assessment tool contains four sections, Part A examining pre-pregnancy risk factors, Part B, past obstetrical history, Part C problems in current pregnancy and Part D, other risk factors that include lifestyle factors and acute medical disorders. Each risk factor on the tool is assigned a weighted value, which contributes to the total risk score. Caution should be used when the total score is used for decision making related to assessment of risk. The individual risk factors that contribute to the total score are most important when using the tool for clinical decision-making. Generalized categories of low moderate and higher risk derived from total scores have been used for reporting and surveillance.

Total score categorizes as follows:

- 0 - 2 are considered low risk,
- 3-6 moderate risk, and
- >6 a high risk.

Some research has been done to validate the risk factors as they relate to the specific outcomes of small for gestational age and preterm birth (Newburn-Cook et al., 2002). The risk assessment tool is currently being reviewed through APHP quality improvement activities.

In 2004, 64.8% of women delivering in Alberta were classified as low risk, 29.7% at moderate risk and 5.5% at high risk. Of the women determined to be at higher risk, 73.2% delivered at a facility designated as level D, 18.3% at a facility designated C and 8.3% at level B suggesting that in a regionalized system of care delivery, the women at highest risk are delivering in facilities with the highest level of care.

Gestational Hypertension

Gestational hypertension is elevated blood pressure occurring during pregnancy and can lead to serious maternal complications such as placental abruption, stroke and preeclampsia, and foetal complications, such as preterm birth, stillbirth and neonatal death (Livingston & Sibai, 2001). Hypertension in pregnancy is found in about 5-7% of all pregnancies in North America (Reproductive Health Report Working Group, 2005). Risk factors for hypertension in pregnancy include increased maternal age, having a history of diabetes, a history of hypertension before pregnancy, multiple births and of African descent (Reproductive Health Report Working Group, 2005). In Alberta for the years 2000-2004, combined, 7.8% of nulliparous women were reported to have gestational hypertension compared to 3.3% of multiparous women ($p < 0.001$).

In 2004, 5.2% of women in Alberta were reported as having gestational hypertension. Of these women, 20.6% delivered preterm (<37 weeks) compared to 7.6% of women without gestational hypertension ($p < 0.001$). Although there has not been a significant increase in the proportion of women with gestational hypertension between 2000 and 2004 in Alberta, there has been an increase in the percentage of preterm infants delivered to these women. In 2000, 16.6% of women with gestational hypertension delivered a preterm infant which increased to 20.8% in 2004 ($p < 0.001$). There was no noted difference in stillbirth comparing women with gestational hypertension to those without in this data set.

Group B streptococcus (GBS)

Over the last 3 decades, infection with group B streptococcus (GBS) has emerged as a major cause of neonatal mortality and morbidity. The Society of Obstetricians and Gynaecologists of Canada recommend offering all women screening for Group B Streptococcal disease at 35 to 37 weeks gestation

In 2004, 17.0% of women had a positive screen recorded on the delivery record. For women with a positive screen, 7.7% had a preterm delivery compared to 5.8% of women with a negative screen for GBS ($p < 0.001$)

Smoking

Smoking during pregnancy remains perhaps the most important modifiable influence on adverse pregnancy outcomes. In 2004, 19.9% of Alberta women reported smoking at some point during their pregnancy. Smoking during pregnancy has been declining linearly in Alberta. In 2000, 23.6% of women reported smoking during pregnancy compared to 19.9% in 2004 ($p < 0.001$).

The effects of smoking on pregnancy outcome, particularly the increased incidence of low birth weight (LBW) and small for gestational age (SGA) births, have been documented for more than four decades (Wisborg, Henriksen, Hedegaard, & Secher, 1996). Infants born to mothers who smoke during pregnancy are estimated to have an increased risk of LBW, or an average weight decrement of 150-200 grams at birth, as compared with babies born to non-smoking mothers (Walsh, 1994). For the years 2000-2004 combined, 7.4% of women who smoked at any point during pregnancy delivered a low birth weight infant (singletons) compared to 4.1% of non-smokers ($p < 0.001$).

Smoking behaviours during pregnancy vary across the province.

Alcohol

Prenatal exposure to alcohol is one of the leading causes of neurodevelopmental deficits in children, including Fetal Alcohol Spectrum Disorder (FASD) (Riley E. et al., 2003). In 1998-1999, 14.6% of children under the age of two in Canada had a mother who reported drinking some alcohol during pregnancy (Health Canada, 2003).

The effects of alcohol on the foetus are likely influenced by the timing and amount of alcohol consumed as well as by maternal metabolism and foetal genetics (Health Canada, 1996). Fetal Alcohol Syndrome (FAS), a collection of the most severe abnormalities caused by moderate to excessive maternal alcohol consumption, includes pre and postnatal growth deficiencies, characteristic craniofacial dysmorphism, and varying degrees of central nervous system (CNS) dysfunction (Astley, Bailey, Talbot, & Clarren, 2000). Equally debilitating are mental and behavioural impairments that may occur in the absence of craniofacial abnormalities (Riley, 2003). Based on a synthesis of best available evidence, the estimated global incidence of FAS is 0.97 per 1000 live births, and is higher among “heavy” drinkers (i.e., 2 or more drinks per day or 5-6 drinks per occasion) at 43.1 per 1000 live births (Abel, 1995).

Alcohol consumption during pregnancy is generally under reported (Kesmodel & Schioler, 1998). In 2004, 1.4% of women delivering in Alberta reported consuming alcohol on a regular basis (>1 drink per day or >3 drinks/one occasion at any point during pregnancy). Low or moderate alcohol consumption has been reported between 10% and 50% (Tough et al., In Press, b)

Assisted Conception

It has been estimated that 1 in 14 Canadian couples experience infertility (as measured after a two-year period) (Accreditation Committee of the Canadian Fertility and Andrology Society, 2003). Assisted Reproductive Technology (ART) data and statistics are not readily available through most of the country, however, according to the Canadian Fertility and Andrology Society, which collects data from 21 of the 22 in vitro fertilization centres in Canada, 1237 infants were born in Canada as a result of IVF in 2001 (about 0.4% of live births that year) (Statistics Canada, 2001).

The increased use of ART, partly as a consequence of delayed childbearing, has contributed to increases in multiple births, increases in preterm delivery and the associated risk of complications to the infant including intrauterine growth restriction, intraventricular haemorrhage and bronchopulmonary dysplasia (Tough, Greene, Svenson & Belik, 2000; Newman & Ellings, 1995). In developed countries, 30% to 50% of twin pregnancies and at least 75% of triplet pregnancies occur after infertility treatment (Blondel & Kaminski, 2002).

Although only a snapshot, and possibly under-reported, for the years 2002-2004 combined, 424 women were reported to have used assisted reproductive techniques in Northern and Central Alberta. Of these women, 191 used ovulation induction (45%) and 233 (55%) used in vitro fertilization. Sixteen percent of the women using ovulation induction had a multiple pregnancies and 45% of women using IVF had multiple pregnancies.

MATERNAL INDICATORS - Subpopulations

This section provides information on two obstetric subpopulations, the low risk primipara subpopulation; a cohort of women who would be expected to have similar outcomes regardless of where they deliver and secondly, the vaginal birth after caesarean (VBAC) subpopulation; a cohort of women who are most ideal candidates for VBAC.

Low Risk Primipara Subpopulation

The standard of care for a low-risk maternity patient should be the same in the smallest Level I hospital as it is in tertiary care centres (Iglesias S. et al., 1998). The regionalized system for health care delivery creates considerable variation in the level of obstetrical service available throughout the province. Women and foetuses at increased risk are managed through referral and transport within the referral system. Quality Improvement activities rely on, among other things, the availability of reliable, comparable, local statistics.

The “Low Risk Primipara Subpopulation” is a cohort of women that would be expected to have similar outcomes regardless of where in Alberta they delivered. In 2004, 11,810 women met the inclusion criteria for this subpopulation (28.9% of women delivering in 2004).

VBAC Subpopulation

Caesarean section rates in Alberta and Canada have increased steadily since 1996 (Alberta Reproductive Health: Pregnancies and Births 2004). The most common indication for caesarean section is repeat elective caesarean section. In 2004, 31% of all caesarean sections were repeat elective caesareans. The overall repeat caesarean births accounted for 9.4% of all live births.

The Society of Obstetricians and Gynaecologists of Canada has developed guidelines for Vaginal Birth after previous caesarean (VBAC), recommending that provided there are no contraindications, a woman with one previous transverse low segment caesarean section should be offered a trial of labour. Ultimately the decision for a trial of labour is the decision of the woman and her health care provider. Availability of resources including physicians, anaesthetic, and operating room staff to achieve timely caesarean as well as the woman’s attitude towards attempting a vaginal birth affect the decision.

Primary Caesarean Section rates are increasing while VBAC attempt rates are declining (Hamilton, Martin, Sutton, & Centers for Disease Control and Prevention, 2004). This drop in the rate of VBAC has been associated with recent studies demonstrating an increase in both maternal and neonatal morbidity occurring with VBAC compared with repeat caesarean delivery.

This subpopulation is the cohort of women who are the most ideal candidates for VBAC. Success rates for VBAC have been consistently above 70% regardless of attempt rates. Trials of labour are reported for those women who have presented in labour, or for induction with the intent to attempt a vaginal birth. Women who have planned a repeat caesarean and present at the hospital in labour or with ruptured membranes prior to their planned caesarean date and proceed to a caesarean birth prior to the planned date are not considered to have attempted a trial of labour.

In 2004, 3687 women met the inclusion criteria for the VBAC subpopulation. The 2004 provincial rate for VBAC attempt in this population was 40.1% and the success rate amongst this group was 75.3%. This compares to an overall VBAC attempt rate (women attempting VBAC who had any number of prior caesarean sections) of 32.6% and a success rate of 74.6%.

NEONATAL INDICATORS – Live Born

This section examines neonatal outcomes, including low birth weight and preterm deliveries. As low birth weight and preterm delivery are considered to be important determinants of perinatal and infant mortality, examination of these indicators is of vital importance.

In 2004, there were 41,320 live born infants delivered in health facilities in Alberta.

Gestational Age – Preterm Birth

Preterm birth is an important cause of perinatal mortality and morbidity in industrialized countries (Slattery & Morrison, 2002). Surviving preterm infants, particularly those delivered prior to 32 weeks, remain at increased risk for poor health and lifelong physical disabilities and/or developmental disabilities, including lower scholastic achievement, athletic competence, job competence and self esteem (Marlow, Wolke, Bracewell, & Samara, 2005). Additionally, poor infant outcomes have emotional costs to the family, costs to the community and education systems, and to the health care system (Jackson, Ternstedt, & Schollin, 2003). Risk factors associated with delivering a preterm infant include higher or lower maternal age, multiple gestation pregnancy, intrauterine infection, parity, and ethnicity (Robinson, Regan & Norwitz, 2001). It should be noted that risk factors for delivering preterm infants are multiple and complex, and it has been suggested that known risk factors may explain only a small fraction of these outcomes.

Preterm rates among all births in Alberta have ranged from 7.9% to 9.0% between 2000 and 2004 (figure 4.1). The rate has increased over time. The national overall rate of preterm birth (singletons and multiples) was 7.6% (Health Canada, 2003). The 2004 preterm rate for singletons in Alberta was 7.1 per 100 live births and the combined multiple and singleton rate was 9.0 per 100 live births. Table 4.1 outlines the breakdown of gestational ages for live born infants between 2000 and 2004

Figure 4.1 Preterm birth, singletons and all births, Alberta, 2000–2004.

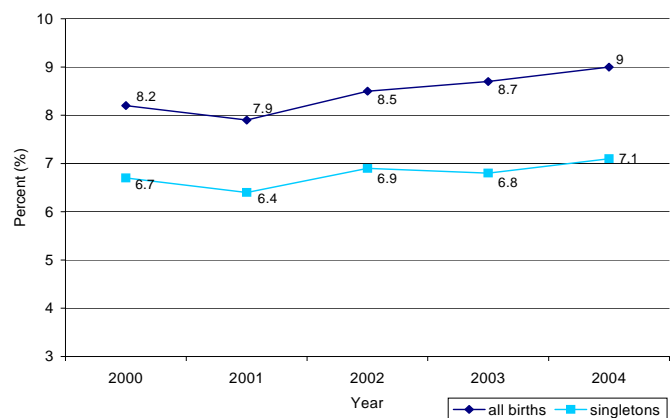


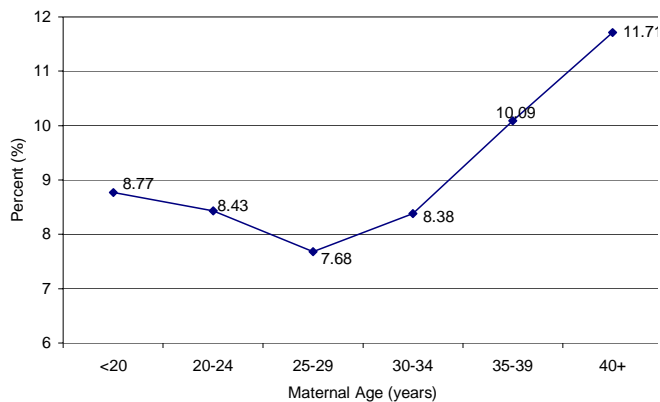
Table 4.1 Gestational age by year, Alberta 2000-2004

| Weeks gestation | Year | | | | |
|-----------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| | 2000 | 2001 | 2002 | 2003 | 2004 |
| <23 | 56 (0.1) | 51 (0.1) | 69 (0.2) | 70 (0.2) | 84 (0.2) |
| 23 | 24 (0.1) | 22 (0.1) | 31 (0.1) | 25 (0.1) | 19 (0.0) |
| 24 | 22 (0.1) | 23 (0.1) | 34 (0.1) | 30 (0.1) | 24 (0.1) |
| 25 | 31 (0.1) | 25 (0.1) | 26 (0.1) | 31 (0.1) | 26 (0.1) |
| 26 | 39 (0.1) | 48 (0.1) | 35 (0.1) | 47 (0.1) | 50 (0.1) |
| 27 | 45 (0.1) | 31 (0.1) | 54 (0.1) | 34 (0.1) | 40 (0.1) |
| 28 | 46 (0.1) | 51 (0.1) | 49 (0.1) | 55 (0.1) | 61 (0.1) |
| 29 | 61 (0.2) | 62 (0.2) | 75 (0.2) | 51 (0.1) | 58 (0.1) |
| 30-32 | 350 (0.9) | 327 (0.9) | 339 (0.9) | 423 (1.0) | 404 (1.0) |
| 33-36 | 2382 (6.4) | 2378 (6.3) | 2603 (6.7) | 2775 (6.8) | 2940 (7.1) |
| 37-40 | 27869 (74.5) | 28143 (74.0) | 29560 (75.7) | 31089 (76.3) | 32055 (77.7) |
| 41 | 5808 (15.5) | 6297 (16.6) | 5801 (14.9) | 5781 (14.2) | 5224 (12.7) |
| ≥42 | 662 (1.8) | 573 (1.5) | 376 (1.0) | 327 (0.8) | 283 (0.7) |
| Total | 37395 (100.0) | 38031 (100.0) | 39052 (100.0) | 40738 (100.0) | 41268 (100.0) |

p<0.001

Figure 4.2 depicts preterm delivery by maternal age for the years 2000 to 2004, combined. Provincial data suggests a ‘U’ shaped risk of preterm delivery (singleton and multiple) with maternal age, with lowest risk evident among women aged 25 to 29 (7.7%).

Figure 4.2 Preterm birth (<37 weeks) by maternal age, Alberta 2000–2004, combined.



Birth Weight

In addition to preterm birth, low birth weight is an important determinant of neonatal mortality and morbidity and childhood morbidity (Shinwell, 2002). Care should be taken in the interpretation of simple low birth weight rates, which reflect the combined effects of restricted growth for gestational age and preterm birth (Wilcox, 2001). These types of low birth weight may have different underlying causes (Millar & Chen, 1998). While mortality rates have declined for low birth weight infants, the consequences of survival for these children may be associated with adverse infant/child health and developmental outcomes, particularly infants in the extremely low birth weight categories (<1000g) (Hack et al., 2002). Compared to infants in the 3,500-3,999g group, infants weighing <1500 g have been shown to have an increased risk of being orthopedically impaired, mentally handicapped, having speech impairment and learning disabilities (Saigal, Hoult, Streiner, Stoskopf, & Rosenbaum, 2000). Risk factors associated with delivering a low birth weight infant include maternal smoking during pregnancy, multiple gestation, advanced maternal age, maternal hypertension, marital status and ethnicity (Newburn-Cook C et al., 2002; Tough et al., 2002)

Low birth weight rates among all births occurring in Alberta have ranged from 6.1 per 100 births to 6.4 per 100 births between 2000 and 2004. Figure 4.4 illustrates the low birth weight rate for singletons, as well as all birth between 2000 and 2004. In 2004, the low birth rate for singletons was 4.8 per 100 births and the combined singletons and multiples rate was 6.4 per 100 live births. Table 4.2 provides the breakdown of birth weights for live born infants in Alberta between 2000 and 2004. In 2004, 51 infants (0.1%) were born with birth weights less than 500 grams and 720 (1.7%) were over 4500 grams.

Figure 4.4 Low birth weight (<2500 grams), singletons and all births, Alberta, 2000–2004.

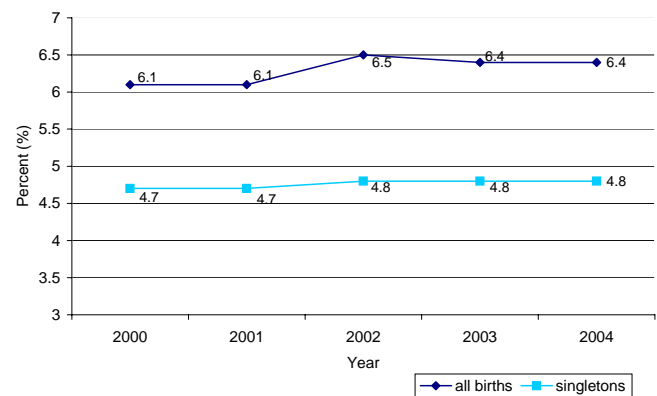


Table 4.2 provides the breakdown of birth weights for live born infants in Alberta between 2000 and 2004. In 2004, 51 infants (0.1%) were born with birth weights less than 500 grams and 720 (1.7%) were over 4500 grams.

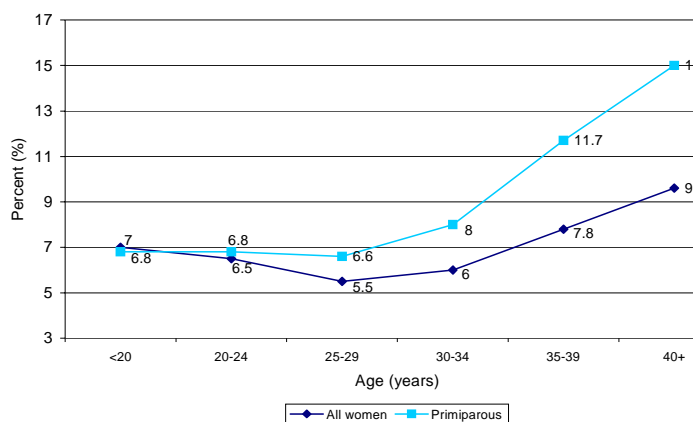
Table 4.2 Birth weight by year, Alberta 2000-2004

| Birth weight (grams) | Year | | | | |
|----------------------|---------------|---------------|---------------|---------------|---------------|
| | 2000 | 2001 | 2002 | 2003 | 2004 |
| <500 | 33 (0.1) | 28 (0.1) | 39 (0.1) | 46 (0.1) | 51 (0.1) |
| 500-749 | 76 (0.2) | 70 (0.2) | 87 (0.2) | 76 (0.2) | 85 (0.2) |
| 750-999 | 95 (0.3) | 89 (0.2) | 81 (0.2) | 79 (0.2) | 72 (0.) |
| 1000-1249 | 84 (0.2) | 93 (0.2) | 119 (0.3) | 107 (0.3) | 102 (0.2) |
| 1250-1499 | 124 (0.3) | 123 (0.3) | 122 (0.3) | 135 (0.3) | 135 (0.3) |
| 1500-2499 | 1885 (5.0) | 1923 (5.1) | 2075 (5.3) | 2147 (5.3) | 2202 (5.3) |
| 2500-4499 | 34288 (91.8) | 34876 (91.8) | 35718 (91.6) | 37291 (91.7) | 37832 (91.8) |
| ≥4500 | 786 (2.1) | 809 (2.1) | 749 (1.9) | 786 (1.9) | 720 (1.7) |
| Total | 37371 (100.0) | 38011 (100.0) | 38990 (100.0) | 40667 (100.0) | 41199 (100.0) |

p=0.014

The low birth weight rate among all births is highest among women under age 20 (7.0%) and those over age 35 and ≥ 40 years (7.8% and 9.6%). The risk of low birth weight reveals a ‘U’ shaped distribution with lowest risk evident among women age 25 to 34 (figure 4.5). There is a substantial increase in risk below age 20, and in particular, above age 35. The low birth weight rate for primiparous women (both singleton and multiple) is highest among women over age 35. The lowest risk of low birth weight delivery among first time mothers is evident among women under the age of 30. There is a substantial increase in risk for low birth weight for primiparous women over age 30.

Figure 4.5 Low birth weight (<2500 grams) by maternal age, primiparous and all women, Alberta, 2000–2004, combined.



Multiple Births

Over the past two decades, there has been a dramatic rise in the number of multiple births in developed countries. In Canada, between 1994 and 2003, the rate of multiples (per 100 births) increased 35% (Health Canada, 2004). Multiple births have been associated with poor infant outcomes and maternal health outcomes, including pregnancy complications, preterm delivery, low birth weight, congenital malformations, and infant death (Kinzler et al., 2000; Spellacy et al., 1990). Many factors may be involved with the increase in multiple births. The increasing use of assisted reproductive technology (ART) in the past two decades has been implicated in the increase of multiple births (Reynolds et al., 2000). Additionally, another factor that may contribute to the increase is the shift in the maternal age distribution as more women delay childbearing into their late 30s and 40s. The risk for multiple birth among naturally conceived pregnancies increases with maternal age (Tough et al., 2002) This is noted in Alberta, for the years 2000 to 2004 combined, multiple births were more common in women between ages 35 and 39 (4.9%) and women 40 or older (4.6%) compared to women under 20 years (1.7%) and 20-24 (2.4%).

The multiple birth rates ranged from 3.0% to 3.4% between 2000 and 2004 and have increased steadily over time. This is substantially higher than the national multiple birth rate of 2.7% in 2000 (Canadian Perinatal Health Report, 2003). There are differences in multiple birth rates between health regions in Alberta.

MORTALITY

This section of the report describes perinatal, neonatal and maternal mortality for the years 2003 and 2004, and associated factors contributing to perinatal mortality. It also provides a description of the trends and distribution of perinatal mortality from 2000 to 2004. A summary of quality assurance issues identified through the ongoing study of perinatal mortality and the recommendations made to primary health care providers are included.

Perinatal, Neonatal & Maternal Mortality

Stillbirth, infant and maternal mortality are devastating experiences for families and caregivers. Each death may involve unique circumstances and it is important not only that standardized investigation be carried out, but that timely reporting of data and discussion take place. Alberta perinatal and neonatal statistics for the years 2003 and 2004 are provided in table 5.1. Maternal deaths are discussed in a subsequent section

Table 5.1 Perinatal and Neonatal Statistics, Alberta 2003 and 2004

| Statistic | 2003 (N) | 2003 (rate per 1,000 total or live births) | 2004 (N) | 2004 (rate per 1,000 total or live births) |
|---|----------|--|----------|--|
| Perinatal ¹ mortality rate (per 1000 total births) | 447 | 10.9 | 469 | 11.3 |
| Perinatal mortality rate \geq 500g | 263 | 6.4 | 282 | 6.8 |
| Perinatal mortality rate \geq 500g Corrected | 198 | 4.9 | 203 | 4.9 |
| Perinatal mortality rate \geq 1000g | 169 | 4.2 | 167 | 4.1 |
| Perinatal mortality rate \geq 1000g Corrected | 128 | 3.2 | 125 | 3.0 |
| Stillbirth rate (per 1000 total births) | 279 | 6.9 | 303 | 7.3 |
| Stillbirth rate \geq 500g | 162 | 4.0 | 194 | 4.7 |
| Stillbirth rate \geq 500g Corrected | 136 | 3.3 | 154 | 3.7 |
| Stillbirth rate \geq 1000g | 116 | 2.9 | 128 | 3.1 |
| Stillbirth rate \geq 1000g Corrected | 106 | 2.6 | 112 | 2.7 |
| Neonatal ² mortality rate (per 1000 live births) | 199 | 4.9 | 184 | 4.5 |
| Neonatal mortality rate \geq 500g | 132 | 3.2 | 105 | 2.6 |
| Neonatal mortality rate \geq 500g Corrected | 80 | 2.0 | 59 | 1.4 |
| Neonatal mortality rate \geq 1000g | 71 | 1.8 | 52 | 1.3 |
| Neonatal mortality rate \geq 1000g Corrected | 30 | 0.7 | 19 | 0.5 |
| Early Neonatal ³ mortality rate (per 1000 live births) | 168 | 4.1 | 166 | 4.0 |
| Early Neonatal mortality rate \geq 500g | 101 | 2.5 | 88 | 2.1 |
| Early Neonatal mortality rate \geq 500g Corrected | 62 | 1.5 | 49 | 1.2 |
| Early Neonatal mortality rate \geq 1000g | 53 | 1.3 | 39 | 1.0 |
| Early Neonatal mortality rate \geq 1000g Corrected | 22 | 0.5 | 13 | 0.3 |
| Late Neonatal ⁴ mortality rate (per 1000 live births) | 31 | 0.8 | 18 | 0.4 |
| Late Neonatal mortality rate \geq 500g | 31 | 0.8 | 17 | 0.4 |
| Late Neonatal mortality rate \geq 500g Corrected | 18 | 0.4 | 10 | 0.2 |
| Late Neonatal mortality rate \geq 1000g | 18 | 0.4 | 13 | 0.3 |
| Late Neonatal mortality rate \geq 1000g Corrected | 8 | 0.2 | 6 | 0.1 |

Note: * Corrected numbers exclude deaths due to major anomalies

1. Stillbirths + early neonatal deaths
2. Deaths of live born infants less than 28 full days
3. Deaths of live born infants less than 7 full days
4. Deaths of live born infants greater than 7 days and less than 28 full days

Data may differ from previously published data due to differences in definitions and dates of data extraction.

Data include out of province cases

Stillbirth

The definition of stillbirth often varies between countries and health authorities. In Alberta, stillbirth is defined as the complete expulsion or extraction of a dead fetus at or after 20 weeks of pregnancy, or after attaining a weight of 500 grams or more. Corrected rates refer to the exclusion of mortalities in which a major congenital anomaly was present.

Factors that are currently associated with stillbirth, in developed countries, are congenital anomalies, pre-eclampsia related complications, intrauterine growth restriction and intrauterine infections (Cnattingius, 2002, Kean 2003). Additional factors include placental disorders, complications of multiple gestations and umbilical cord abnormalities or accidents (Konchak, 1989, Cnattingius, 2002). In many of the cases, causes of stillbirth are unknown. Maternal risk factors such as low maternal education and smoking during pregnancy have also been associated with increased odds of stillbirth (Chen et al., 1998). Figure 5.1 depicts the stillbirth rate in Alberta (per 1,000 total births) between 2000 and 2004. The stillbirth rate ranged from 6.3 in 2001 to 7.3 in 2004. The variation in stillbirth rate between 2003 and 2004 was not significant ($p>0.05$).

Figure 5.1 Stillbirths per 1,000 total births (crude, $\geq 500g$, $\geq 500g$ corrected), Alberta, 2000–2004.

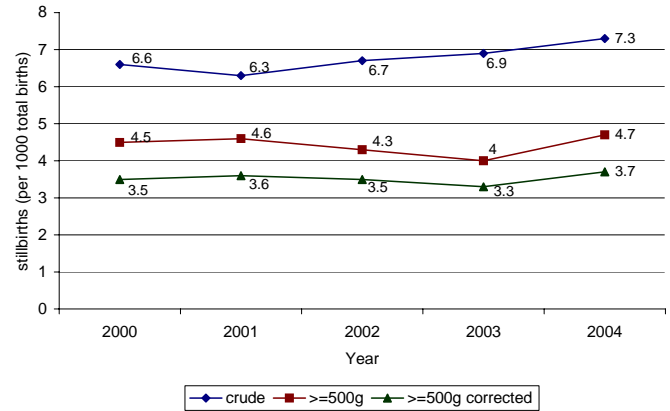


Table 5.2 provides counts of 2003 and 2004 stillbirths by time of death (intrapartum or antepartum) and by place of death (in hospital or prior to admission). There were 279 stillbirths in Alberta for the year 2003 (86 intrapartum and 193 antepartum). In 2004 there were 303 stillbirths (107 intrapartum and 196 antepartum). Intrapartum fetal deaths (during labour) may be the result of fetal asphyxia or obstructed labour, while antepartum stillbirths (before the onset of labour) are often the result of maternal, placental or fetal abnormalities (Kramer et al., 2002).

Table 5.2 Stillbirths by year and Time of Death, Alberta, 2000-2004

| Year | Total stillbirths | Antepartum deaths | | | | Intrapartum deaths | | | |
|------|-------------------|-----------------------------|-------------|------------------|------------------------------|-----------------------------|-------------|-------------------|-------------------------------|
| | | Prior to Hospital Admission | In Hospital | Total Antepartum | Total Antepartum, Corrected* | Prior to Hospital Admission | In Hospital | Total Intrapartum | Total Intrapartum, Corrected* |
| 2000 | 248 | 149 | 8 | 157 | 133 | 8 | 83 | 91 | 54 |
| 2001 | 243 | 170 | 11 | 181 | 154 | 10 | 52 | 62 | 27 |
| 2002 | 265 | 166 | 9 | 175 | 155 | 4 | 86 | 90 | 46 |
| 2003 | 279 | 183 | 10 | 193 | 173 | 3 | 83 | 86 | 45 |
| 2004 | 303 | 184 | 12 | 196 | 175 | 0 | 107 | 107 | 44 |

Corrected numbers exclude deaths due to major anomalies

Data may differ from previously published data due to differences in definitions and dates of data extraction.

Table 5.3 shows some of the factors influencing stillbirths in Alberta from 2000 to 2004. The three main influencing factors were congenital anomalies, cord/placental anomalies and the unexplained. Congenital anomalies were an influencing factor in 24.2–28.4% of stillbirths. Cord and placental anomalies were a factor in 24.8–28.6% of the stillbirths and the unexplained stillbirths varied from 20.2–28.0% of the stillbirths during the 2000 to 2004 time frame.

Table 5.3 Factors Influencing Stillbirth, Alberta, 2000–2004.

| Factors | 2000 | 2001 | 2002 | 2003 | 2004 |
|--|-------------|-------------|-------------|-------------|-------------|
| Lethal Anomalies | 61 | 61 | 64 | 66 | 86 |
| Cord accidents | 41 | 31 | 22 | 32 | 43 |
| Fetal Factors - intrauterine growth restriction, multiple pregnancy, twin to twin transfusion, fetomaternal hemorrhage | 8 | 9 | 18 | 13 | 21 |
| Maternal Factors – hypertensive diseases, diabetes, motor vehicle accidents, drug misuse | 19 | 15 | 19 | 12 | 20 |
| Placental Factors | 30 | 40 | 47 | 48 | 32 |
| Prematurity | 39 | 19 | 31 | 35 | 29 |
| Unexplained | 50 | 68 | 64 | 73 | 72 |
| Total | 248 | 243 | 265 | 279 | 303 |

Stillbirths and stillbirth rate by birth weight category appear in table 5.4 for 2003 and 2004. For 2003 and 2004 combined, over half (55.3%) were of extremely low birth weight (<1,000 grams) and three quarters (77.5%) were low birth weight (<2,500 grams).

Table 5.4 Weight specific stillbirths and stillbirth rate, Alberta 2003 and 2004

| Birth weight (grams) | 2003 | | 2004 | |
|-----------------------------|------------------------|------------------------------------|------------------------|------------------------------------|
| | Stillbirths (N) | Stillbirth rate¹ | Stillbirths (N) | Stillbirth rate¹ |
| <500 | 107 | 1000 ² | 103 | 1000 ² |
| 500-999 | 46 | 228.9 | 66 | 304.1 |
| 1000-1249 | 13 | 108.3 | 10 | 88.5 |
| 1250-1499 | 12 | 81.6 | 11 | 75.3 |
| 1500-2499 | 36 | 16.5 | 47 | 20.9 |
| 2500-3999 | 54 | 1.6 | 54 | 1.6 |
| 4000-4499 | 1 | 0.2 | 5 | 1.2 |
| ≥4500 | 0 | 0.0 | 1 | 1.4 |
| Unknown | 10 | - | 6 | - |
| Total | 279 | 6.8 | 303 | 7.1 |

Note: Rates are not corrected for major congenital anomalies

1. Stillbirths per 1,000 total births in birth weight category

2. There are more deaths than births in this category due to the fact that some live births and stillbirths are inconsistently registered.

Data may differ from previously published data due to differences in definitions and dates of data extraction.

Preterm birth is an important cause of perinatal mortality and morbidity in industrialized countries (Slattery & Morrison, 2002). Stillbirths and stillbirth rate by length of gestation appear in table 5.5 for 2003 and 2004. For 2003 and 2004 combined, 78.4% of stillbirths were preterm (<37 weeks). As stated earlier in this report the risk factors associated with delivering a preterm infant are somewhat similar to low birth weight and include higher or lower maternal age, multiple gestation pregnancy, intrauterine infection, parity, and ethnicity (Robinson et al., 2001).

Table 5.5 Stillbirth by length of gestation, Alberta, 2003 and 2004

| Gestational age (weeks) | 2003 | | 2004 | |
|----------------------------|--------------------|------------------------------|--------------------|------------------------------|
| | Stillbirths (N) | Stillbirth Rate ¹ | Stillbirths (N) | Stillbirth Rate ¹ |
| <20 | 1 | 1000.0 ² | 1 | 1000.0 ² |
| 20-21 | 77 | 726.4 | 72 | 676.2 |
| 22-27 | 70 | 82.0 | 91 | 327.3 |
| 28-33 | 43 | 38.2 | 40 | 47.3 |
| 34-35 | 15 | 10.8 | 24 | 20.3 |
| 36 | 12 | 8.6 | 10 | 6.6 |
| 37-40 | 56 | 1.8 | 61 | 1.9 |
| ≥41 | 5 | 0.8 | 4 | 0.7 |
| Total | 279 | 6.9 | 303 | 7.3 |

Note: Rates are not corrected for major congenital anomalies

1. Stillbirths per 1,000 total births in gestational age category

2. There are more deaths than births in this category due to the fact that some live births and stillbirths are inconsistently registered.

Data may differ from previously published data due to differences in definitions and dates of data extraction.

Neonatal Mortality

Neonatal mortality is defined as Neonatal Death (NND) before four weeks of age. The leading causes of neonatal death in Canada (1999) were immaturity (32.6% of neonatal deaths), congenital anomalies (28.5%), and asphyxia (14.7%). (Health Canada, 2003). The crude neonatal mortality rate in Alberta has not changed significantly (>0.05) between 2000 and 2004 (4.3 to 4.5 per 1000 live births, respectively). Figure 5.2 shows the crude neonatal mortality rate as well as the ≥ 500 gram neonatal mortality rate and the ≥ 500 gram mortality rate corrected for anomalies.

Neonatal deaths (NND) and neonatal mortality rate by birth weight category appear in table 5.6 for 2003 and 2004. For 2003 and 2004 combined, over half (67.1%) were of extremely low birth weight ($<1,000$ grams). Rates of neonatal death start to level off above 1,000 grams. Low birth weight is an important determinant of neonatal mortality and morbidity and childhood morbidity (Shinwell, 2002). The low birth weight NND rate was 6.2 in 2003 and 5.8 in 2004 per 1,000 live births in 2004.

Figure 5.2 Neonatal mortality (crude, ≥ 500 g, ≥ 500 g corrected), Alberta, 2000–2004.

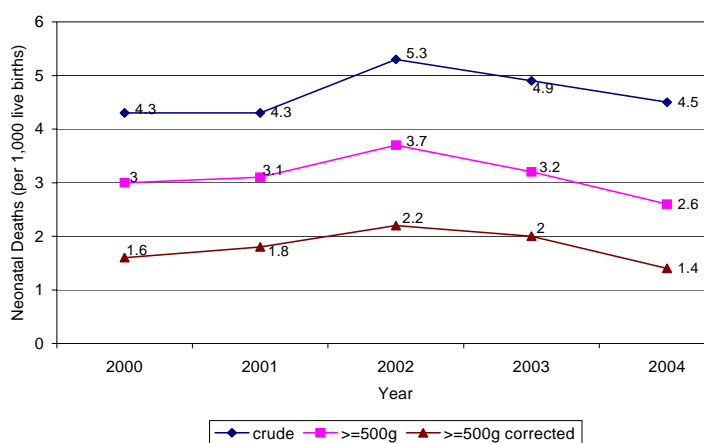


Table 5.6 Weight specific neonatal mortality, Alberta, 2003 and 2004.

| Birth Weight (grams) | 2003 | | 2004 | |
|----------------------|---------------------|--------------------------------------|---------------------|--------------------------------------|
| | Neonatal Deaths (N) | Neonatal Mortality Rate ¹ | Neonatal Deaths (N) | Neonatal Mortality Rate ¹ |
| <500 | 65 | 1000 ² | 78 | 1000 ² |
| 500-999 | 61 | 393.5 | 53 | 337.6 |
| 1000-1249 | 7 | 65.4 | 8 | 78.4 |
| 1250-1499 | 3 | 22.2 | 5 | 37.0 |
| 1500-2499 | 25 | 11.6 | 9 | 4.1 |
| 2500-3999 | 31 | 0.9 | 28 | 0.8 |
| 4000-4499 | 4 | 1.0 | 1 | 0.2 |
| ≥4500 | 1 | 1.3 | 1 | 1.4 |
| Unknown | 2 | - | 1 | - |
| Total | 199 | 4.8 | 184 | 4.5 |

Note: Rates are not corrected for major congenital anomalies

1. Deaths of live born infants less than 28 full days per 1,000 live births in birth weight category

2. There are more deaths than births in this category due to the fact that some live births and stillbirths are inconsistently registered.

Data may differ from previously published data due to differences in definitions and dates of data extraction.

Data include out of province cases

Neonatal deaths and neonatal mortality rate by length of gestation appear in table 5.7. Neonatal mortality decreases with increasing gestational age. For 2003 and 2004 combined, 83.2% of neonatal deaths were preterm (<37 weeks).

Table 5.7 Neonatal Mortality by length of gestation, Alberta, 2003 and 2004

| Gestational Age (weeks) | 2003 | | 2004 | |
|-------------------------|---------------------|--------------------------------------|---------------------|--------------------------------------|
| | Neonatal Deaths (N) | Neonatal Mortality Rate ² | Neonatal Deaths (N) | Neonatal Mortality Rate ² |
| <20 | 8 | 1000.0 ² | 13 | 1000.0 ² |
| 20-21 | 40 | 1000.0 ² | 44 | 1000.0 ² |
| 22-27 | 79 | 407.2 | 77 | 409.6 |
| 28-33 | 18 | 22.2 | 11 | 13.6 |
| 34-35 | 10 | 9.0 | 2 | 1.7 |
| 36 | 7 | 5.1 | 9 | 6.0 |
| 37-40 | 33 | 1.1 | 22 | 0.7 |
| ≥41 | 4 | 0.7 | 5 | 0.9 |
| Unknown | 0 | - | 1 | - |
| Total | 199 | 4.9 | 183 | 4.4 |

Note: Rates are not corrected for major congenital anomalies

1. Deaths of live born infants less than 28 full days per 1,000 live births in gestational age category

2. There are more deaths than births in this category due to the fact that some live births and stillbirths are inconsistently registered.

Data may differ from previously published data due to differences in definitions and dates of data extraction.

Data include out of province cases

Table 5.8 shows the factors influencing neonatal deaths in Alberta from 2000 to 2004. The leading factors influencing neonatal deaths were; prematurity at 43.9 to 55.4%; followed by congenital anomalies at 44.7 to 37.5% of the neonatal deaths during 2000 to 2004.

Table 5.8 Factors Influencing Neonatal Death, Alberta, 2000–2004.

| Factors | 2000 | 2001 | 2002 | 2003 | 2004 |
|---|-------------|-------------|-------------|-------------|-------------|
| Anomalies | 72 | 64 | 82 | 77 | 69 |
| Complications of pregnancy, labour or delivery | 7 | 10 | 3 | 10 | 6 |
| Prematurity | 74 | 72 | 104 | 95 | 102 |
| Sepsis | 2 | 4 | 5 | 4 | 2 |
| SIDS | 1 | 2 | 3 | 6 | 2 |
| Twin to Twin Transfusion Syndrome | 3 | 2 | 1 | 4 | 2 |
| Unknown | 1 | 4 | 2 | 1 | 1 |
| Other - drowning, myocardial, ABO incompatibility, metabolic, trauma , bilirubin encephalopathy | 1 | 6 | 4 | 2 | 0 |
| Total | 161 | 164 | 204 | 199 | 184 |

Table 5.9 classifies the congenital anomalies identified in both stillbirths and neonatal deaths in Alberta from 2000 to 2004. Congenital anomalies account for about 30% of stillbirth and neonatal deaths. Chromosomal anomalies were the most frequent anomaly identified in 2004 at 10.1% of the stillbirth and neonatal deaths.

Table 5.9 Major Congenital Anomalies, Alberta, 2000-2004.

| Anomaly Classification | 2000 | | | 2001 | | | 2002 | | | 2003 | | | 2004 | | |
|---|-------------|------------|--------------------------|-------------|------------|--------------------------|-------------|------------|--------------------------|-------------|------------|--------------------------|-------------|------------|--------------------------|
| | SB | NND | % of Total Deaths | SB | NND | % of Total Deaths | SB | NND | % of Total Deaths | SB | NND | % of Total Deaths | SB | NND | % of Total Deaths |
| Neural Tube Defects/ Other Central Nervous System | 9 | 7 | 3.9 | 5 | 9 | 3.4 | 8 | 10 | 3.8 | 12 | 13 | 5.2 | 10 | 14 | 4.9 |
| Cardio-Respiratory | 6 | 22 | 6.8 | 8 | 14 | 5.4 | 11 | 13 | 5.1 | 6 | 16 | 4.6 | 10 | 13 | 4.7 |
| Gastrointestinal / Musculoskeletal / Integument | 8 | 6 | 3.4 | 5 | 7 | 2.9 | 2 | 13 | 3.2 | 10 | 10 | 4.2 | 10 | 6 | 3.3 |
| Genitourinary | 3 | 1 | 1.0 | 5 | 5 | 2.5 | 6 | 14 | 4.3 | 7 | 12 | 4.0 | 7 | 10 | 3.5 |
| Chromosomal | 19 | 12 | 7.6 | 24 | 16 | 9.8 | 30 | 22 | 11.1 | 13 | 15 | 5.9 | 33 | 16 | 10.1 |
| Other/Unspecified Congenital | 15 | 24 | 9.5 | 14 | 13 | 6.6 | 7 | 10 | 3.6 | 13 | 10 | 4.8 | 11 | 9 | 4.1 |
| Totals | 60 | 72 | 32.3 | 61 | 64 | 30.7 | 64 | 82 | 31.1 | 61 | 76 | 28.7 | 81 | 68 | 30.6 |

SB = stillbirth

NND = neonatal death

Investigations

Although the cause of stillbirth and neonatal mortality can remain unexplained, it is important to establish an appropriate diagnosis where possible in order to appropriately counsel families. Identifying causes of death can 1) act as an audit of clinical diagnosis, 2) identify unsuspecting clinically important conditions and 3) provide knowledge for research and teaching (Magee, 2001, Khong, 1997). The Alberta Medical Association Stillbirth Investigation Protocol recommends that health care providers request permission for a complete autopsy in **all** cases of stillbirth, even if the cause of death appears evident. Should consent for a complete autopsy be refused an attempt should be made to obtain consent for a limited autopsy. (1998). “Low autopsy rates can be attributed to: 1) difficulty in discussing this with parents during the acute distress which follows bereavement 2) consent being sought by uninformed professionals 3) the personal and religious objections of some parents to necropsy.” (Royal College of Obstetricians and Gynaecologists and Royal College of Pathologists, 2001). Table 5.10 lists the proportion of stillbirths, early and late neonatal deaths in which an autopsy and placental pathology was performed, in 2003 and 2004.

Table 5.10 Autopsy and placenta pathology by type of death, Alberta 2000-2004

| Year | Stillbirths | | | Early Neonatal Mortality | | | Late Neonatal Mortality | | |
|------|-------------|------------------|--------------------|--------------------------|------------------|--------------------|-------------------------|------------------|--------------------|
| | Total N | Autopsy n (%) | Pathology n (%) | Total N | Autopsy n (%) | Pathology n (%) | Total N | Autopsy n (%) | Pathology n (%) |
| 2000 | 248 | 134 (54.0) | 222 (89.5) | 134 | 49 (36.6) | 101 (75.4) | 27 | 12 (44.4) | 12 (44.4) |
| 2001 | 243 | 136 (74.5) | 215 (88.5) | 123 | 45 (36.6) | 95 (77.2) | 41 | 18 (43.9) | 21 (51.2) |
| 2002 | 265 | 150 (56.6) | 239 (90.2) | 166 | 52 (31.3) | 125 (75.3) | 40 | 11 (27.5) | 18 (45.0) |
| 2003 | 279 | 137 (49.1) | 246 (88.2) | 168 | 54 (32.1) | 126 (75.0) | 31 | 9 (29.0) | 11 (35.5) |
| 2004 | 303 | 148 (48.8) | 274 (90.4) | 166 | 51 (30.7) | 146 (88.0) | 18 | 5 (27.8) | 10 (55.6) |

Wigglesworth Classification

The classification was adapted from a version of the Wigglesworth classification described in the article by Keeling, J.W.; MacGillivray, I., Golding, J., & Wigglesworth, J, et al. (1989). Classification of perinatal death. Archives of Disease in Childhood. (64), 1345–1351.

A summary of perinatal and neonatal deaths classified according to the Wigglesworth standards of coding is presented in Appendix 4 (2003) and 5 (2004).

Maternal Mortality

The Special Report on Maternal Mortality and Severe Morbidity in Canada (Health Canada & CPSS, 2004) shows that Canada's maternal mortality ratio of 6.1 per 100,000 live births is among the lowest in the world. The report identifies pulmonary embolism and pre-eclampsia as the most common causes of direct maternal deaths. Cardiovascular was the leading cause of death in the indirect field as was motor vehicle collisions in the incidental/non-related deaths. This report strongly reinforces the need to report and review the circumstances surrounding maternal deaths. These devastating experiences offer important lessons for maternity health care providers.

Maternal deaths can be difficult to identify. This report relies on the services of health care providers, Alberta Vital Statistics, as well as the Office of the Chief Medical Examiner in Alberta to assist us in identifying women who fit the maternal death criteria. All identifiable maternal deaths that occur in Alberta, although the women may not be Alberta residents, are included within this report.

Table 5.15 lists the direct and indirect maternal mortality rates (per 10,000 live births) in Alberta between 1970 and 2004. Maternal mortality rates in Alberta are minimal and direct rates decreased linearly from 1970 to 2002. Since 1991, direct maternal mortality rates have remained relatively stable, between 0.2 and 0.5 per 10,000 live births.

Table 5.15 Maternal mortality rates, Alberta, 1970–2004.

| Year | Maternal Deaths | | | | Rates ¹ | |
|------|-----------------|--------|----------|-----------|--------------------|--------|
| | Total | Direct | Indirect | Unrelated | Overall | Direct |
| 1970 | 11 | 4 | 1 | 6 | 3.4 | 1.3 |
| 1971 | 13 | 3 | 2 | 8 | 4.3 | 1.0 |
| 1972 | 10 | 5 | 0 | 5 | 3.4 | 1.7 |
| 1973 | 17 | 5 | 2 | 10 | 5.8 | 1.7 |
| 1974 | 5 | 1 | 1 | 3 | 1.7 | 0.3 |
| 1975 | 6 | 1 | 2 | 3 | 1.9 | 0.3 |
| 1976 | 4 | 1 | 1 | 2 | 1.2 | 0.3 |
| 1977 | 9 | 1 | 4 | 4 | 2.6 | 0.3 |
| 1978 | 5 | 1 | 2 | 2 | 1.4 | 0.3 |
| 1979 | 9 | 2 | 1 | 6 | 2.4 | 0.5 |
| 1980 | 3 | 2 | 1 | 0 | 0.8 | 0.5 |
| 1981 | 8 | 2 | 4 | 2 | 1.9 | 0.5 |
| 1982 | 9 | 1 | 4 | 4 | 2.0 | 0.2 |
| 1983 | 8 | 5 | 1 | 2 | 1.8 | 1.1 |
| 1984 | 5 | 0 | 1 | 4 | 1.1 | 0.0 |
| 1985 | 8 | 2 | 0 | 6 | 1.8 | 0.5 |
| 1986 | 7 | 0 | 0 | 7 | 1.6 | 0.0 |
| 1987 | 7 | 0 | 0 | 7 | 1.7 | 0.0 |
| 1988 | 13 | 4 | 3 | 6 | 3.1 | 0.9 |
| 1989 | 7 | 3 | 2 | 2 | 1.6 | 0.7 |
| 1990 | 6 | 3 | 0 | 3 | 1.4 | 0.7 |
| 1991 | 5 | 1 | 3 | 1 | 1.2 | 0.2 |
| 1992 | 6 | 2 | 3 | 1 | 1.4 | 0.5 |
| 1993 | 4 | 1 | 1 | 2 | 1.0 | 0.2 |
| 1994 | 3 | 2 | 0 | 1 | 0.8 | 0.5 |
| 1995 | 4 | 2 | 2 | 0 | 1.0 | 0.5 |
| 1996 | 6 | 2 | 2 | 2 | 1.6 | 0.5 |
| 1997 | 1 | 1 | 0 | 0 | 0.3 | 0.3 |
| 1998 | 8 | 2 | 5 | 1 | 2.1 | 0.5 |
| 1999 | 1 | 0 | 0 | 1 | 0.3 | 0.0 |
| 2000 | 0 | 0 | 0 | 0 | 0.0 | 0.0 |
| 2001 | 4 | 2 | 1 | 1 | 1.1 | 0.5 |
| 2002 | 6 | 1 | 0 | 5 | 1.5 | 0.3 |
| 2003 | 9 | 2 | 1 | 6 | 2.2 | 0.5 |
| 2004 | 2 | 0 | 1 | 1 | 0.5 | 0.0 |

1. Rates per 10,000 live births.

Data may differ from previously published data due to differences in definitions and dates of data extraction.

Data include out of province cases

Outcomes of The Alberta Study of Perinatal Mortality

The AMA Committee on Reproductive Care continues to review all cases of Perinatal and Maternal Mortality that occur in the province of Alberta. This report summarizes factors/issues identified in previous reports as well as factors/issues identified in the review of 2003 and 2004 cases. After careful review of the circumstances of the deaths, recommendations were provided in the form of an educational letter to the primary health care provider. While every attempt has been made to ensure that the information provided here is accurate and current, the Alberta Perinatal Health Program assumes no responsibility or liability for errors. This information is provided for quality improvement purposes. The information learned through the Alberta Study of Perinatal Mortality is useful for all healthcare providers and administrators as we work together to improve perinatal care in Alberta.

Factors and Issues Identified in Previous Reports:

In past reviews and reports the following pregnancy and neonatal care issues were identified:

Pregnancy Care:

- Recognition and management of intrauterine growth restriction
- Management of patients reporting reduced fetal movements
- Interpretation/communication of tests assessing fetal status
- Communication between health care providers
- Documentation of events
- Management of obese pregnant patients
- Appropriate use of vacuum/forceps

Neonatal care:

- Appropriate newborn resuscitation and follow-up treatment
- Timing and place of transfer
- Recognition and management of the ill newborn

In reviewing, 2003 and 2004 mortality cases it is noted that compared to previous years there has been improvement in the following areas:

- Recognition and management of intrauterine growth restriction
- Management of the patient reporting reduced fetal movements
- Communication and documentation between health care providers
- Appropriate use of vacuum or forceps for assisted vaginal delivery
- Recognition of the ill newborn

Current factors related to perinatal mortality

The key issues identified in the cases reviewed for 2003 and 2004 include: fetal surveillance in labour, maternal obesity, preterm births, undiagnosed pregnancy, lack of attendance and/or compliance with recommended care, pre conceptual counselling and maternal mortality. The recommendations in each of these areas are included following.

Intraparum Fetal Surveillance

There were a number of cases that had issues related to:

- Recognition of non-reassuring fetal heart tracings
- Communication to the appropriate caregiver once a non-reassuring fetal heart rate tracing was identified
- Management of the patient in the face of obvious non-reassuring fetal heart rate tracings
- Maternal pulse was mistaken as the apparent fetal heart tracing
- Fetal monitoring strips were unable to be located within the facility of birth

Recommendations:

- Perform intermittent auscultation in accordance with the SOGC Guideline on fetal health surveillance in labour.
- Establish policies and procedures to reflect the current SOGC guidelines for fetal surveillance during labor.
- Provide appropriate training for personnel regarding intermittent auscultation and electronic fetal monitoring. Establish a process to maintain competence in application and interpretation of monitor tracings. Ensure there is appropriate clinical skill and facilities to deal with non-reassuring tracings. (The Alberta Perinatal Health Program offers education sessions

on fetal monitoring. Content on fetal monitoring is also included in the Managing Obstetrical Risk Efficiently (MORE^{OB}) and Advanced Labor and Risk Management (ALARM) programs offered by the Society of Obstetrics and Gynecology of Canada).

- Establish procedures regarding the safe storage and the archival of fetal monitor strips.
- Physicians concerned about the fetal heart rate tracing should consider rupturing the membranes to allow application of an internal electrode for fetal monitoring. If available, the physician could consider fetal scalp sampling or an urgent ultrasound.
- Fax fetal heart rate tracings to a consultant, if a second opinion is warranted.

Maternal Obesity

The current epidemic of obesity in Canada has not spared pregnant women. These women are at increased risk for:

- perinatal and maternal mortality and morbidity
- high blood pressure
- gestational hypertension
- diabetes
- abnormal labor
- assisted delivery – vaginally or by caesarean section
- difficulties in achieving fetal monitoring

The neonate of an obese mother is at increased risk for

- macrosomia
- intrauterine growth restriction
- preterm delivery
- shoulder dystocia
- low Apgar scores
- the need for intensive care

Recommendations:

- Pre pregnancy consultation - especially with regards to diabetes and hypertension. Both of these medical conditions need to be well controlled for a healthy pregnancy outcome.
- Screen obese woman more frequently during pregnancy for gestational diabetes, beginning in the first trimester.
- Physical assessment of fetal growth, position, and estimation of fetal weight can be difficult in the obese woman so ultrasound may be the only way to properly assess these parameters. A third trimester ultrasound is warranted in the obese woman.
- Consider consultation with anesthesia before labor or as soon as possible after admission in labor to allow early epidural anesthesia, as the risk of general anesthesia is so much greater in the obese pregnant woman.
- As with any delivery, be prepared for shoulder dystocia!

Preterm Births

Pre-term births in singleton pregnancies continue to contribute to perinatal mortality, although nowhere near to the same extent as multiple pregnancies. Risks for preterm labour include:

- a history of a prior preterm birth
- a history of cervical instrumentation such as
 - termination of pregnancy,
 - dilatation and curettage,
- a mid-trimester loss or delivery.

Clinicians should examine the cervix of woman at risk to identify instances in which it is shortening or dilating. The outcome of the pregnancy might be improved by management such as:

- cervical cerclage
- restriction of activity
- corticosteroids to enhance lung maturity
- antibiotics
- tocolysis
- hospitalization and/or transfer to tertiary facility

Recommendations:

- Examine the cervix of pregnant woman with a history that might suggest pre-term labour.
- Educate women about the signs and symptoms of preterm labour
- Follow the SOGC guideline, where possible, which states that transferring a woman with the baby in utero is preferable to neonatal transport.⁵

Lack of Attendance and/or Compliance with Recommended Care

There are a number of cases each year in which mothers did not seek prenatal care or failed to comply with the advice offered by their health care provider. In these cases, some preventable factors were identified that, if they had been addressed in the antenatal period, may have resulted in a different outcome. In some instances there are multiple social factors that contributed to these perinatal deaths.

Recommendations:

- Consider using the College of Physicians and Surgeons of Alberta guideline entitled *Preventing Follow-up Failures When Caring for Patients*.
- Assess the patient's ability to attend and refer to social services if necessary. Educate women and inform all patients of the importance of prenatal care in an effort to promote the best possible outcome of each pregnancy.

Undiagnosed Pregnancy

There have been instances in which women who did not know that they were pregnant presented to the emergency department with symptoms of abdominal pain and/or bleeding. There was a delay in treatment because of failure to diagnose that the woman was pregnant.

Recommendations:

- Assess for pregnancy and its complications as a possible cause of abdominal pain and/or bleeding in any female patient of childbearing age.

Preconception Counselling

A goal of preconception care is to optimize a woman's health and knowledge as part of planning and conceiving a pregnancy, thereby enhancing the outcome of pregnancy. Other issues to consider include:

- undiagnosed, untreated, or poorly controlled medical conditions
- immunization history
- current medications
- nutrition
- family history and genetic risk
- occupational and environmental exposures
- social issues
- mental health issues
- tobacco and substance use
- other high-risk behaviors

Recommendations:

- Provide pre pregnancy nutrition counselling and close follow-up to ensure weight gain and fetal growth are progressing as they should be throughout pregnancy.
- Encourage folic acid supplementation prior to pregnancy for all.
- Perform a thorough pre conceptual history to identify and provide referrals or counselling on any medical, social or behavioral concerns.

Maternal Mortality

The “Special Report on Maternal Mortality and Severe Morbidity in Canada” by Health Canada showed that the causes of Direct Maternal Deaths in Canada (excluding Quebec) from 1997 to 2000 were pulmonary embolism (20.5%), pre-eclampsia/PIH (20.5%), amniotic fluid embolism (15.9%), intra-cranial hemorrhage (15.9%), ectopic pregnancy (13.6%), hemorrhage (9.1%), and other (septic abortion, anaesthesia related) (4.5%). In Alberta, in 2003 and 2004 there were 11 maternal deaths:

These cases offer the opportunity to remind all individuals providing maternity and child care that complications of pregnancy can happen at any time and the best protection is to be prepared. Health care providers need to be alert to the potential problems which may occur in patients with medical problems such as hypertension, diabetes, and thyroid disease. There are various programs available to assist with enhancing one’s knowledge level and the APHP works collaboratively with regional educators to assist in tailoring the education needs particular to each region/facility.

An area of concern for the future, given the current caesarean section rate in excess of 20% of deliveries, is an increase in the incidence of placenta previa and associated placenta accreta/increta/percreta. If there is any suggestion that there is going to be significant difficulty in delivery of the placenta, serious consideration must be given to delivery in a facility with the capability of performing a caesarean hysterectomy. MRI may be indicated during the pregnancy to determine if there is significant invasion of the placenta into the myometrium. Consultation with Maternal-Fetal Medicine is warranted if there is any doubt about placental implantation.

Recommendations:

- Establish policies and activities to maintain and enhance the abilities of personnel in dealing with complications of pregnancy, labour and delivery. Many courses are available to assist with this - ALARM, MORE^{OB} and ACLS. Courses are also available regarding appropriate care of the newborn - NRP and ACoRN.
- Refer families to social services or other appropriate resources in the event of a maternal death.

ALARM – Advanced Labour and Risk Management
MORE^{OB} – Managing Obstetrical Risk Efficiently
ACLS – Advanced Cardiac Life Support
NRP – Neonatal Resuscitation Program
ACoRN – Advanced Care of the At Risk Newborn

REFERENCES

- Abel, E. L. (1995). An update on incidence of FAS: FAS is not an equal opportunity birth defect. *Neurotoxicology and Teratology*, 17, 437-443.
- Abu-Hejja, A., Rasheed, R., & el Qaraan, O. (1998). Effect of age and parity on primary caesarean section rates. *Clin Exp. Obstet Gynaecology*, 25, 38-39.
- Accreditation Committee of the Canadian Fertility and Andrology Society (2003). *Human Assisted Reproduction Live Birth Rates for Canada*.
- Alberta Health and Wellness (2004). *Alberta Congenital Anomalies Surveillance System 1980-2001* (Rep. No. Sixth report). Edmonton, Alberta: Health Surveillance, Alberta Health and Wellness.
- American College of Obstetricians and Gynaecologists Committee Opinion Number 315 (2005). *Obesity in Pregnancy, Obstetrics and Gynecology*, 106:671-5.
- American College of Obstetricians and Gynaecologists Practice Bulletin Number 12 (2000). *Intrauterine Growth Restriction*.
- American College of Obstetricians and Gynaecologists Practice Bulletin Number 70 (2005). *Intrapartum Fetal Heart Rate Monitoring*, 106, 6, December 2005.
- American College of Obstetricians and Gynaecologists Women's Health Care Physicians, T. F. O. C. D. R. (2000). *Evaluation of caesarean delivery* Washington, DC: American College of Obstetricians and Gynaecologists.
- Astley, S. J., Bailey, D., Talbot, C., & Clarren, S. K. (2000). Fetal alcohol syndrome (FAS) primary prevention through FAS diagnosis: I. Identification of high-risk birth mothers through the diagnosis of their children. *Alcohol and Alcoholism*, 35, 499-508.
- Berkowitz, G. S., Skovron, M. L., Lapinski, R. H., & Berkowitz, R. L. (1990). Delayed childbearing and the outcome of pregnancy. *New England Journal of Medicine*, 322, 659-664.
- Blondel, B. & Kaminski, M. (2002). Trends in the occurrence, determinants, and consequences of multiple births. *Seminars in Perinatology*, 26, 239-249.
- Catanzarite, V. A., Stanco, L. M., Schrimmer, D. R., & Conroy, C. (1996). Managing placenta previa/accreta. *Contemporary Ob/Gyn*, May, 66-95.
- Carroli, G. & Belizan, J. Episiotomy for vaginal birth. *The Cochrane Library*. (Oxford) ** 2005;(4): (ID #CD000081), ID.
- Chalmers, B. & Porter, R. (2001). Assessing effective care in normal labor: the Bologna score. *Birth*, 28, 79-83.
- Chen, J., Fair, M., Wilkins, R., & Cyr, M. (1998). Maternal education and fetal and infant mortality in Quebec. Fetal and Infant Mortality Study Group of the Canadian Perinatal Surveillance System. *Health Rep.*, 10, 53-64.
- Cnattingius, S. & Stephansson, O. (2002). The epidemiology of stillbirth. *Semin.Perinatol.*, 26, 25-30.
- Demasio, K. A. & Bahado-Singh, R. O. (2002). Fetal growth restriction: An evidence-based approach – Part I. *Contemporary Ob/Gyn*, June, 53-63.
- Demasio, K. A. & Bahado-Singh, R. O. (2002). Fetal growth restriction: An evidence-based approach – Part II. *Contemporary Ob/Gyn*, June, 43-61.
- Fraser, A. M., Brockert, J. E., & Ward, R. H. (1995). Association of young maternal age with adverse reproductive outcomes. *New England Journal of Medicine*, 332, 1113-1117.
- Hack, M., Flannery, D. J., Schluchter, M., Cartar, L., Borawski, E., & Klein, N. (2002). Outcomes in young adulthood for very-low-birth-weight infants. *New England Journal of Medicine*, 346, 149-157.
- Hamilton, B. E., Martin, J. A., Sutton, P. D., & Centers for Disease Control and Prevention (2004). Births: preliminary data for 2003. *National Vital Statistics Reports*, 53, 1-17.
- Harkness, U. F. & Mari, G. (2004). Diagnosis and management of intrauterine growth restriction. *Clinics in Perinatology*, 31, 743-764.
- Health Canada (1996). *Joint Statement: Prevention of Fetal Alcohol Syndrome (FAS), Fetal Alcohol Effects (FAE) in Canada* (Rep. No. Cat. No. H39-348/1996E). Ottawa: Health Canada.

- Health Canada (2003). *Canadian Perinatal Health Report, 2003* Ottawa: Minister of Public Works and Government Services Canada.
- Heffner, L. J. (2005). How much does parity matter? *Obstetrics & Gynecology, 106*, 444-445.
- Howell, E. A. & Concato, J. (2004). Obstetric patient satisfaction: asking patients what they like. *American Journal of Obstetrics and Gynecology, 190*, 175-182.
- Iglesias S., Bott N., Ellehoj E., Yee J., Jennissen B., Bunnah T., Schopflochler D. (2005). Outcomes of maternity care services in Alberta, 1999 and 2000: A population-based analysis. *JOGC, September 2005*, 855-863
- Iglesias S., Grzybowski S., Klein, M., Gagne, G., & Lalonde A. (1998). Rural Obstetrics. Joint position paper on rural maternity care. Joint Working Group of the Society of Rural Physicians of Canada (SRPC), the Maternity Care Committee of the College of Family Physicians of Canada (CFPC), and the Society of Obstetricians and Gynaecologists of Canada (SOGC). *Canadian Family Physician, 44*, 831-843.
- Jackson K., Ternstedt, B. M., & Schollin, J. (2003). From alienation to familiarity: experiences of mothers and fathers of preterm infants. *J Adv. Nurs, 43*, 120-129.
- Keeling J. W., MacGillivray I., Golding J., & Wigglesworth, J., et al. (1989). Classification of perinatal death. *Archives of Disease in Childhood. (64)*, 1345-1351.
- Kesmodel U. & Schioler K. P. (1998). Drinking during pregnancy: attitudes and knowledge among pregnant Danish women. *Alcohol Clin Exp Res, 26*, 1553-1560.
- Khong, T. Y. (1997). Improving perinatal autopsy rates: who is counseling bereaved parents for autopsy consent? *Birth., 24*, 55-57.
- Kinzler, W. L., Ananth, C. V., & Vintzileos, A. M. (2000). Medical and economic effects of twin gestations. *Journal of the Society for Gynecologic Investigation, 7*, 321-327.
- Konchak, P. S., Billman, B. D., & Walczak, J. R. (1989). Stillbirth: maternal and fetal evaluation. *J Am Osteopath.Assoc., 89*, 1150-1157.
- Kornelsen, J. & Grzybowski, S. (2005). Is local maternity care an optional service in rural communities? *Journal of Obstetrics & Gynaecology Canada: JOGC, 27*, 329-331.
- Kramer, M. S., Liu, S., Luo, Z., Yuan, H., Platt, R. W., & Joseph, K. S. (2002). Analysis of perinatal mortality and its components: time for a change? *Am J Epidemiol., 156*, 493-497.
- Leighton, B. L. & Halpern, S. H. (2002). The effects of epidural analgesia on labor, maternal, and neonatal outcomes: a systematic review. *American Journal of Obstetrics & Gynecology, 186*, Suppl-77.
- Livingston, J. C. & Sibai, B. M. (2001). Chronic hypertension in pregnancy. *Obstetrics & Gynecology Clinics of North America, 28*, 447-463.
- Magee, J. F. (2001). Investigation of stillbirth. *Pediatr.Dev.Pathol., 4*, 1-22.
- Marlow, N., Wolke, D., Bracewell, M. A., & Samara, M. (2005). Neurologic and developmental disability at six years of age after extremely preterm birth. *New England Journal of Medicine, 352*, 9-19.
- Maslow, A.W. & Sweeny A.L. (2000). Elective induction of labor as a risk factor for caesarean delivery among low-risk women at term. *Obstetrics and Gynaecology, 95*, 917-922.
- Miles AL., Monga, M., Walker, DK., Dande, D., Pschirrer, ER. (2000). Risk factors for symptomatic uterine rupture during a trial of labor: the 1990s. *Am J Perinatol., 17*, 385-389.
- Millar, W. J. & Chen, J. (1998). Maternal education and risk factors for small-for-gestational-age births. *Health Rep, 10*, 43-51.
- Newburn-Cook, C., White, D., Svenson L., Demianczuk, N., Bott N., & Edwards J. M. (2002). Where and to what extent is prevention of low birth weight possible? *Western Journal of Nursing Research, 24*, 887-904.
- Newman, R. B. & Ellings, J. M. (1995). Antepartum management of the multiple gestation: the case for specialized care. *Semin. Perinatology, 19*, 387-403.
- Oyelese, Y., Lewis, K. M., & Collela, J. (2003). Vasa Previa: Are most perinatal deaths preventable? *Contemporary Ob/Gyn, November*, 43-56.
- Perlow, J. H. (1995) Obstetric management of the obese patient. *Contemporary Ob/Gyn, November*, 15-48.

Reproductive Health Report Working Group (2005). *Alberta Reproductive Health: Pregnancies and Births 2004* Edmonton, AB: Alberta Health and Wellness.

Resnik, R. (2002). Intrauterine Growth Restriction. *Obstetrics and Gynaecology*, 3, 490-496.

Reynolds, M. A., Schieve, L. A., Martin, J. A., Jeng, G., & Macaluso, M. (2003). Trends in multiple births conceived using assisted reproductive technology, United States, 1997-2000. *Pediatrics*, 111, 1159-1162.

Riley E, Mattson S., Li, T., Jacobson, S. W., Coles, C. D., Koditwakkhu, P. et al. (2003). Neurobehavioural consequences of prenatal alcohol exposure: an international perspective. *Alcoholism: Clinical and Experimental Research*, 27, 362-373.

Robertson, C. M. T., Svenson, L. W., Kyle, J. M. (2002) Birth weight by gestational age for Albertan liveborn infants, 1985 through 1998. *Journal of Obstetrics and Gynaecology Canada*, 24 (2), 138-148.

Robinson, J. N., Regan, J. A., & Norwitz, E. R. (2001). The epidemiology of preterm labor. *Semin. Perinatol*, 25, 204-214.

Saigal, S., Hoult, L. A., Streiner, D. L., Stoskopf, B. L., & Rosenbaum, P. L. (2000). School difficulties at adolescence in a regional cohort of children who were extremely low birth weight. *Pediatrics*, 105, 325-331.

Schoon, P.G. (2001). Episiotomy: yea or nay. *Obstetrical & Gynecological Survey*, 56, 667-669.

Shinwell, E. S. (2002). Neonatal and long-term outcomes of very low birth weight infants from single and multiple pregnancies. [Review] [48 refs]. *Seminars in Neonatology*, 7, 203-209.

Slattery, M. M. & Morrison, J. J. (2002). Preterm delivery. *Lancet*, 360, 1489-1497.

Small, D. (2001). Obesity in Pregnancy. *Journal SOGC, January 2001*.

Statistics Canada (2003). *Statistics Canada, 2001 Census*.

Statistics Canada (2001). *Births, 2001* (Rep. No. 84F0210XPB).

The Society of Obstetricians and Gynaecologists of Canada (2000). *Attendance at Labour and Delivery Guidelines for Obstetrical Care* (Rep. No. 89). Ottawa: SOGC Clinical Practice Guidelines.

The Society of Obstetricians and Gynaecologists of Canada (2002). *Fetal Health Surveillance in Labour* (Rep. No 112) Ottawa: SOGC Clinical Practice Guidelines.

The Society of Obstetricians and Gynaecologists of Canada (2004). *Guidelines for Operative Vaginal Birth* (Rep. No. 148). Ottawa: SOGC Clinical Practice Guidelines.

Tough S., Benzies K., Newburn-Cook C., Tofflemire K., Fraser-Lee N., Faber A., Sauve R., What do women know about the risks of delayed childbearing? *Canadian Journal of Public Health*, In Press, a.

Tough S., Tofflemire K., Clarke M., Newburn-Cook C., Do women change their drinking behaviours while trying to conceive? An opportunity for preconception counselling. *Clinical Medicine & Research*, In Press, b.

Tough, S. C., Greene, C. A., Svenson, L. W., & Belik, J. (2000). Effects of in vitro fertilization on low birth weight, preterm delivery, and multiple birth. *Journal of Pediatrics*, 136, 618-622.

Tough, S. C., Newburn-Cook, C., Johnston, D. W., Svenson, L. W., Rose, S., & Belik, J. (2002). Delayed childbearing and its impact on population rate changes in lower birth weight, multiple birth, and preterm delivery. *Pediatrics*, 109, 399-403.

Wagner, M. (2001). Choosing caesarean section. *Midwifery Today With International Midwife*, 57, 26-29.

Walsh, R. A. (1994). Effects of maternal smoking on adverse pregnancy outcomes: examination of the criteria of causation. *Hum.Biol.*, 66, 1059-1092.

Weiss, J. L. & Malone, F. D. (2001). Caring for obese obstetric patients. *Contemporary Ob/Gyn*, June, 13-26.

Wen, S. W., Liu, S., Kramer, M. S., Marcoux, S., Ohlsson, A., Sauve, R. et al. (2001). Comparison of maternal and infant outcomes between vacuum extraction and forceps deliveries. *American Journal of Epidemiology*, 153, 103-107.

Wilcox, A. J. (2001). On the importance – and the unimportance – of birth weight. *International Journal of Epidemiology*, 30, 1233-1241.

Wisborg, K., Henriksen, T. B., Hedegaard, M., & Secher, N. J. (1996). Smoking during pregnancy and preterm birth. *British Journal of Obstetrics and Gynaecology*, 103, 800-805.

Appendix 1. Summary of selected indicators by population (maternal residence) Level of Service, Alberta, 2004.

| | Level of Service | | | | | | Unknown/out of province N (%) | Total N (%) |
|---------------------------|-------------------------|-------------------|-------------------|-------------------|-------------------|-------------|---|-----------------------|
| | O N (%) | A N (%) | B N (%) | C N (%) | D N (%) | | | |
| Total Women | 2107 | 2258 | 6917 | 5130 | 23380 | 1096 | 40888 | |
| Nulliparous | 743 (35.3) | 774 (34.3) | 2605 (37.7) | 2257 (44.0) | 10879 (46.6) | 445 (40.6) | 17703 (43.4) | |
| Caesarean Section | 481 (22.8) | 480 (21.3) | 1814 (26.2) | 1268 (24.7) | 5990 (25.6) | 259 (23.6) | 10292 (25.2) | |
| Induction | 634 (30.1) | 569 (25.2) | 1885 (27.3) | 1351 (26.3) | 6858 (29.3) | 291 (26.6) | 11588 (28.3) | |
| Total Live Births | 2126 | 2284 | 6959 | 5191 | 23657 | 1103 | 41320 | |
| Preterm (<37 weeks) | 190 (8.9) | 199 (8.8) | 596 (8.6) | 348 (6.7) | 2223 (9.4) | 150 (13.7) | 3706 (9.0) | |
| Low Birth Weight (<2500g) | 124 (5.9) | 130 (5.7) | 417 (6.0) | 258 (5.0) | 1608 (6.8) | 110 (10.0) | 2647 (6.4) | |

Appendix 2. Summary of selected indicators by hospital (facility) Level of Service, Alberta, 2004.

| | Level of Service | | | | | | Midwife attended N (%) | Total N (%) |
|---------------------------|-------------------------|-------------------|-------------------|-------------------|-------------------|------------|----------------------------------|-----------------------|
| | O N (%) | A N (%) | B N (%) | C N (%) | D N (%) | | | |
| Total Women | <5 | 699 | 6189 | 6891 | 26895 | 209 | 40888 | |
| Nulliparous | <5 | 188 (26.9) | 2202 (35.7) | 2898 (42.1) | 12352 (46.0) | 61 (29.2) | 17703 (43.4) | |
| Caesarean Section | 0 (0.0) | 0 (0.0) | 1371 (22.2) | 1798 (26.1) | 7123 (26.5) | 0 (0.0) | 10292 (25.2) | |
| Induction | 0 (0.0) | 68 (9.7) | 1532 (24.8) | 1836 (26.7) | 8152 (30.3) | 0 (0.0) | 11588 (28.5) | |
| Total Live Births | <5 | 699 | 6175 | 6966 | 27266 | 209 | 41320 | |
| Preterm (<37 weeks) | <5 | 9 (1.3) | 215 (3.5) | 460 (6.6) | 3019 (11.1) | <5 | 3706 (9.0) | |
| Low Birth Weight (<2500g) | <5 | 5 (0.7) | 123 (2.0) | 322 (4.6) | 2193 (8.1) | <5 | 2647 (6.4) | |

Appendix 3. Participating facilities, their Level of Service (LOS) by health region, Alberta, 2004.

| 1 - Chinook | | |
|--------------------|---------------------------------|---------------|
| LOS | Facility | Town |
| O | Fort MacLeod Health Care Centre | Fort MacLeod |
| O | Magrath Health Care Centre | Magrath |
| O | Milk River General Hospital | Milk River |
| A | Raymond Hospital | Raymond |
| B | Crownest Pass General Hospital | Baltimore |
| B | Cardston General Hospital | Cardston |
| B | Pincher Creek Hospital | Pincher Creek |
| B | Taber General Hospital | Taber |
| C | Lethbridge Regional Hospital | Lethbridge |

| 2 - Palliser | | |
|---------------------|------------------------------------|--------------|
| LOS | Facility | Town |
| O | Bassano Health Centre | Bassano |
| A | Bow Island Community Health Centre | Bow Island |
| A | Big Country Health Centre | Oyen |
| B | Brooks Health Centre | Brooks |
| C | Medicine Hat Regional Hospital | Medicine Hat |

| 3 - Calgary | | |
|--------------------|-------------------------------------|---------------|
| LOS | Facility | Town |
| O | Oilfields General Hospital | Black Diamond |
| O | Strathmore District Health Services | Strathmore |
| A | Didsbury District Health Services | Didsbury |
| A | Vulcan Community Health Centre | Vulcan |
| B | Mineral Springs Hospital | Banff |
| B | Canmore General Hospital | Canmore |
| B | Claresholm General Hospital | Claresholm |
| B | High River General Hospital | High River |
| D | Foothills Medical Centre | Calgary |
| D | Rockyview General Hospital | Calgary |
| D | Peter Lougheed Centre | Calgary |

| 4 – David Thompson | | |
|---------------------------|---|----------------------|
| LOS | Facility | Town |
| O | Our Lady of the Rosary Hospital & Care Centre | Castor |
| O | Coronation Hospital & Care Centre | Coronation |
| A | Consort Hospital & Care Centre | Consort |
| A | Hanna Health Centre | Hanna |
| A | Innisfail Health Centre | Innisfail |
| A | Rimbey Hospital & Care Centre | Rimbey |
| A | Sundre Hospital & Care Centre | Sundre |
| B | Drayton Valley Hospital & Care Centre | Drayton Valley |
| B | Drumheller Health Centre | Drumheller |
| B | Lacombe Hospital & Care Centre | Lacombe |
| B | Olds Hospital & Care Centre | Olds |
| B | Ponoka Hospital & Care Centre | Ponoka |
| B | Rocky Mountain House Health Centre | Rocky Mountain House |
| B | Stettler Hospital & Care Centre | Stettler |
| B | Three Hills Health Centre | Three Hills |
| B | Wetaskiwin Hospital & Care Centre | Wetaskiwin |
| C | Red Deer Regional Hospital Centre | Red Deer |

| 5 – East Central | | |
|-------------------------|-----------------------------------|--------------|
| LOS | Facility | Town |
| O | Hardisty Health Centre | Hardisty |
| O | Killam General Hospital | Killam |
| O | Lamont Health Centre | Lamont |
| O | Mary Immaculate Hospital | Mundare |
| O | Tofield Health Centre | Tofield |
| O | Two Hills Community Health Centre | Two Hills |
| O | St. Joseph's General Hospital | Vegreville |
| B | St. Mary's Hospital | Camrose |
| B | Daysland Health Centre | Daysland |
| B | Lloydminster Hospital | Lloydminster |
| B | Provost Health Centre | Provost |
| B | Vermilion Health Centre | Vermilion |
| B | Viking Health Centre | Viking |
| B | Wainwright Health Centre | Wainwright |

| 6 - Capital | | |
|--------------------|---------------------------------|-------------------|
| LOS | Facility | Town |
| O | Devon General Hospital | Devon |
| O | Leduc Community Hospital | Leduc |
| O | Redwater Health Centre | Redwater |
| A | Westview Health Centre | Stony Plain |
| B | Fort Saskatchewan Health Centre | Fort Saskatchewan |
| D | Misericordia Community Hospital | Edmonton |
| D | Grey Nuns Community Hospital | Edmonton |
| D | Royal Alexandra Hospital | Edmonton |
| D | Sturgeon Community Hospital | St. Albert |

| 7 – Aspen | | |
|------------------|-------------------------------------|--------------|
| LOS | Facility | Town |
| O | Boyle Healthcare Centre | Boyle |
| O | Elk Point Healthcare Centre | Elk Point |
| O | Seton Jasper Healthcare Centre | Jasper |
| O | Mayerthorpe Healthcare Centre | Mayerthorpe |
| O | George McDougall Healthcare Centre | Smoky Lake |
| O | Swan Hills Healthcare Centre | Swan Hills |
| O | Wabasca/Desmarais Healthcare Centre | Desmarais |
| A | Athabasca Healthcare Centre | Athabasca |
| B | Barrhead Healthcare Centre | Barrhead |
| B | Bonnyville Healthcare Centre | Bonnyville |
| B | Cold Lake Healthcare Centre | Cold Lake |
| B | Edson Healthcare Centre | Edson |
| B | Hinton Healthcare Centre | Hinton |
| B | William J. Cadzow Healthcare Centre | Lac La Biche |
| B | Slave Lake Healthcare Centre | Slave Lake |
| B | St. Therese Healthcare Centre | St. Paul |
| B | Westlock Healthcare Centre | Westlock |
| B | Whitecourt General Hospital | Whitecourt |

| 8 – Peace Country | | |
|--------------------------|--|----------------|
| LOS | Facility | Town |
| O | Central Peace Health Complex | Spirit River |
| O | Grande Cache Hospital | Grande Cache |
| O | Grimshaw/Berwyn Community Health Complex | Grimshaw |
| O | Fox Creek Health Care Centre | Fox Creek |
| A | Beaverlodge Municipal Hospital | Beaverlodge |
| A | Fairview Health Complex | Fairview |
| A | Valleyview Health Centre | Valleyview |
| B | High Prairie Health Complex | High Prairie |
| B | Sacred Heart Community Health Centre | McLennan |
| B | Manning Community Health Centre | Manning |
| B | Peace River Community Health Centre | Peace River |
| C | Queen Elizabeth II Hospital | Grande Prairie |

| 9 – Northern Lights | | |
|----------------------------|--|----------------|
| LOS | Facility | Town |
| A | St. Theresa General Hospital | Fort Vermilion |
| B | Northwest Health Centre | High Level |
| C | Northern Lights Regional Health Centre | Fort McMurray |

Appendix 4. Wigglesworth classification of perinatal and neonatal deaths, Alberta, 2003.

| Group Classification | No. of babies |
|---|----------------------|
| Group 1 - Deaths before the start of labour | 127 |
| <37 wks | 94 |
| ≥37 wks | 33 |
| <1000 grams | 55 |
| ≥1000 grams | 71 |
| <2500 grams | 94 |
| ≥2500 grams | 32 |
| * one baby not weighed in this category | |
| Subgroup 1.1 - Abruptio | 25 |
| Group 2 - Lethal or potentially lethal malformation | 143 |
| Stillbirths | 66 |
| Neonatal Deaths | 77 |
| Subgroup 2.1 - Secondary malformation | 12 |
| Group 3 - Deaths associated with prematurity | 126 |
| <24 weeks | 89 |
| <28 weeks | 123 |
| <1000 grams | 120 |
| <1000 gram Stillbirths - Intrapartum | 31 |
| <1000 grams END | 77 |
| <1000 grams LND | 12 |
| Neonatal Deaths <37 wks | 95 |
| * one baby not weighed in this category | |
| Subgroup 3.1 - Extreme immaturity - <25 weeks,<750 grams | 98 |
| Group 4 - Intrapartum Deaths, NND <4hrs. of age, NND >1000gms.>4hrs of age with evidence of cerebral birth trauma/asphyxia. | 19 |
| Intrapartum Deaths | 5 |
| NND <4hrs. of age | 4 |
| NND >1000 gms >4hrs. of age cerebral birth trauma or asphyxia | 9 |
| Subgroup 4.1 - Massive antepartum hemorrhage/abruptio | 4 |
| Group 5 - Neonatal 37+ weeks gestation, stillbirth/NND with defined specific conditions. | 63 |
| AP | 46 |
| IP | 2 |
| NND | 15 |
| <1000 grams | 23 |
| ≥1000 grams | 40 |
| <2500 grams | 37 |
| ≥2500 grams | 26 |
| Defined Specific Conditions: | |
| Cord accident/Cord anomaly | 33 |
| Placental Insufficiency | 2 |
| Twin to twin transfusion | 8 |
| Specific or unusual infection | 5 |
| Fetomaternal Bleed | 1 |
| Fetal condition - Rh isoimmunization | 1 |
| Non-Immune Hydrops | 2 |
| Maternal condition - MVA, diabetic ketoacidosis | 3 |
| SIDS | 6 |
| Unexplained death in term newborn | 2 |

Appendix 5: Wigglesworth classification of perinatal and neonatal deaths, Alberta, 2004.

| Group Classification | Number of Babies |
|---|-------------------------|
| Group 1 - Deaths before the start of labour | 121 |
| <37 wks | 85 |
| ≥37 wks | 36 |
| <1000 grams | 51 |
| ≥1000 grams | 70 |
| <2500 grams | 87 |
| ≥2500 grams | 34 |
| Subgroup 1.1 - Abruption | 21 |
| Group 2 - Lethal or potentially lethal malformation | 155 |
| Stillbirths | 86 |
| Neonatal Deaths | 69 |
| Subgroup 2.1 - Secondary malformation | 7 |
| Group 3 - Deaths associated with prematurity | 125 |
| <24 weeks | 92 |
| <28 weeks gestation | 118 |
| <1000 grams | 117 |
| <1000 gram Stillbirths - Intrapartum | 24 |
| <1000 grams END | 89 |
| <1000 grams LND | 4 |
| Neonatal Deaths <37 wks | 101 |
| Subgroup 3.1 - Extreme immaturity | 101 |
| Group 4 - Intrapartum Deaths, NND <4hrs. of age, NND >1000gms.>4hrs of age with evidence of cerebral birth trauma/asphyxia. | 20 |
| Intrapartum Deaths | 12 |
| NND <4hrs. of age | 3 |
| NND >1000 gms >4hrs. of age cerebral birth trauma or asphyxia | 2 |
| Subgroup 4.1 - Massive antepartum hemorrhage/abruption | 6 |
| Group 5 - Neonatal 37+ weeks gestation, stillbirth/NND with defined specific conditions. | 66 |
| AP | 55 |
| IP | 4 |
| NND | 7 |
| <1000 grams | 21 |
| ≥1000 grams | 44 |
| <2500 grams | 41 |
| ≥2500 grams | 24 |
| Defined Specific Conditions: | |
| Cord accident/Cord anomaly | 44 |
| Twin to twin transfusion | 7 |
| Specific or unusual infection | 3 |
| Fetomaternal Bleed | 3 |
| Fetal condition - sigmoid volvulus, Rh isoimmunization | 2 |
| SIDS | 2 |
| Unexplained death in term newborn | 5 |

