PERINATAL OUTCOMES FOR BELLA COOLA GENERAL HOSPITAL: 1940 TO 2001

by

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ABSTRACT

Objective: To describe obstetric procedures (episiotomy, forceps, vacuum extraction, caesarean section), maternal outcomes, and perinatal outcomes (mortality, low birth weight, condition at birth) for an isolated, rural hospital.

Design: A retrospective descriptive study.

Study Population: Women beyond 20 weeks gestation who gave birth between March 7, 1940 and June 9, 2001 and their newborns (inclusive) at the Bella Coola General Hospital (BCGH).

Main outcome measures: Data collected included aboriginal status, date of delivery, mode of delivery (vaginal delivery vs cesarean section), birth weight, whether there was an episiotomy or not, forceps or vacuum extraction, whether analgesia, sedation, or anesthesia was used, maternal morbidity / complications, and newborn morbidity / complications.

Results: There were 2373 deliveries that included 12 sets of twins. There were no maternal mortalities. Starting in the 1970's there has been an increase in cesarean section rates; an increase in the 1950's through the 1980's followed by a recent sharp decrease in episiotomy rates in the 1990's; an increase from the 1940's to the to the 1980's in the use of forceps followed by a remarkable decline in the 1990's; and a recent increase in use of vacuum extraction in the 1980's and 1990's. The changes in procedure rates appear to reflect best practice guidelines of the times; and for the case of episiotomies, the data suggests rural physicians are capable of rapid incorporation of recent recommendations. Rates of episiotomies, cesarean section, and forceps tended to be lower than those reported elsewhere in Canada and the United States. Over the study period, there has been a decrease in perinatal mortality; and the rates are comparable to those reported elsewhere in North America and the rest of the world.

Conclusions: Women giving birth in the low technology environment of the Bella Coola General Hospital experienced relatively low obstetric procedural rates with excellent maternal and neonatal outcomes.

Key Words: Rural obstetrics, rural hospital, obstetrical maternal outcomes, episiotomy rates, cesarean section rates, forceps rates, neonatal outcomes, perinatal outcomes, newborn mortality

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CHAPTER 1: INTRODUCTION AND JUSTIFICATION FOR THE STUDY

1.1 Introduction and Justification for the Study

The practice of obstetrics in rural Canadian communities is undergoing profound change (Hutten-Czapski, 1999; & Levitt & Kaczorowski, 1999). The age of practicing physicians and obstetricians is nearing retirement with new doctors not incorporating obstetrics into their practice (Levitt & Kaczorowski, 1999). A result is some remote and rural communities have no local access to maternity care services (Johnson, 2002). Indeed rural women are particularly affected by losses in local obstetric services as they must travel and be separated from family and friends when they give birth (SOGC, 1996; Klein, et al. 1984; Buckle, 1994; and College of Family Physicians of Canada, 1998).

Among the reasons given for the discontinuation of obstetrical services in rural hospitals is 'safety' with the thought being secondary and tertiary care centers have specialists who are better skilled in administering analgesia / anesthesia and better skilled in performing obstetric procedures including forceps deliveries and cesarean sections (Levitt & Kaczorowski, 1999; Buckle, 1994; Special Committee on Obstetrical Care 1987, Iglesias, 1999; Hutten-Czapski & Iglesias, 1998; Shapiro, 1999; Rourke, 1998, and Webb, & Kantor, 1992).

Intuitively, one would speculate that being managed by highly skilled obstetrics team would result in lower maternal and neonatal mortality and morbidity. However, it is suggested that 'low risk' women living in rural communities have just as good maternal and neonatal outcomes if they choose to deliver their babies in local primary care facilities even if cesarean section capabilities do not exist (British Columbia Reproductive Care Program, 2000).

In fact, this counter intuitive finding is more common when maternity care is not available locally where women must travel for that care, negative outcomes are more common (Nesbitt et al., 1990; Gagne et al., 1998; Nesbit, 1996; Deutchman, 2001; Black, & Fyfe, 1984; Larimore, & Davis, 1995). However, there tends to be an increase in infant mortality when local physicians are absent in rural communities (Johnson, 2002). Admittedly, a limitation of these studies is their relatively small sample size and the short time periods they cover (Grzybowski, Cadesky, & Hogg, 1991; Grzybowski, 1998).

Initial assumptions assumed rural perinatal outcomes would be worse than urban centers. The literature however indicates rural maternity care is not only safe but perinatal outcomes are similar to urban centers even when cesarean section capabilities do not exist. This study will look to examine whether perinatal outcomes are comparable to provincial and urban centers throughout a 60 year period for a small rural community in British Columbia. This will fill a gap in the literature from both a rural and historical perspective.

CHAPTER 2: LITERATURE REVIEW

2.1 Literature Review

Perinatal and Maternal Mortality

Perinatal mortality is used as a measurement of birth outcomes and can be defined as the number of fetal deaths at 28 or more weeks' gestation plus infant deaths at under 7 days of age, per 1000 births (Special Committee on Obstetrical Care, 1987). In 1950, the perinatal mortality rate (PMR) in Canada was 38/1000 births; and in 1985, it was 9/1000 births (Special Committee on Obstetrical Care, 1987). The maternal mortality from the same years was 1.1/1,000 and 0.04/1000 respectively (Special Committee on Obstetrical Care, 1987). These reductions are attributed to the improved health of mothers, better parity distribution, and cooperation between physicians and obstetricians within effective regionalization (Klein, M. 1988). Canadian statistics from 1993 to 1997 show the perinatal mortality excluding stillbirths to be consistent at about 4 per 1,000 of the population (Statistics Canada, 2002). These rates may reflect consistent and relatively stable levels of obstetrical care in Canada.

While the National rates appear relatively stable in recent years, there are noteable provincial variations in Perinatal Mortality Rate (PMR). In 1995, Prince Edward Island had the highest PMR, New Brunswick had the lowest at 10.2 and 5.6 respectively (Nault, 1997). British Columbia was in the middle range with a rate of 7.5 (Nault, 1997). The differences between provinces may reflect technological differences, lower or higher provider to patient ratios or differences in obstetrical practices; as well as differences in population characteristics that may affect perinatal mortality. For instance, in Toronto in the 1960's the PMR in the 16 census tracts with the lowest income was 36.9 and the 23 tracts with the highest income was 16.1(Ohlsson, & Fohlin, 1983). This illustrates the

possible disparity between socio-economic groups that may reflect population differences including ability or knowledge for accessing care, level of care available, perception of care, alcohol and drug intake, poverty issues and education levels within the different socio-economic groups or census tracts.

Perinatal mortality is associated with low birth weight which, in turn, is associated with a great number of variables (Thompson, Goodman, & Little, 2002). Identified maternal risk factors for low birth weight babies include: age under 18 or over 35, primiparity or parity of more than three, being in manual or non-manual work, being less than 158 cm tall, attending antenatal care after 18 weeks' gestation, having diabetes, urinary tract infection, pre-eclamptic toxemia, antepartum hemorrhage, being a smoker, being of Asian origin, and having a history of infertility (Clark et al., 1993). Other risk factors include bacterial vaginosis, high perceived stress, cocaine use, women living without partners, women with uterine or cervical anomalies, and asymptomatic bacteriuria (Finestone, 1998). A number of these risk factors can be modifiable if women at risk are identified early and / or the woman makes changes in lifestyle.

Birth weight, on the other hand, is thought to be a reflection of socioeconomic status as well as the quality of medical care before birth (Thompson, Goodman, & Little, 2002). It is believed that communities with high rates of low birth weight babies can benefit from interventions and referrals to appropriate community resources.

Aboriginal Status

The Medical Health Officer recently reviewed the health and well being of aboriginal people in British Columbia (British Columbia: Provincial Health Officer, 2002). The overall health of aboriginal people lags behind that of other people; for example, Status Indians live on average 7.5 years less than other British Columbians. There are, however, certain health indicators for which aboriginal people have achieved levels of health comparable to other British Columbians. Among these is neonatal mortality.

For the years 1998 to 2000, the neonatal death rate for Status Indians was 1.8 per 1,000 live births, which was actually lower than the 2.7 neonatal deaths per 1,000 live births for other British Columbians (British Columbia: Provincial Health Officer, 2002). Studies of birth weights reveal higher average birth weight for North American native

populations compared to other North American populations. According to B.C. Vital Statistics Agency (2001), the low birthweight rate for aboriginal people in 2000 was 5.2% and for other British Columbians in 2000 it was 5.1%. For the years 1991-1999, early neonatal mortality rate for British Columbia Status Indians was 3.0 deaths per 1,000 live births as compared to a rate of 2.9 for other British Columbia Residents (British Columbia Vital Statistics Agency, 2001). A limitation of studies on aboriginal verses other people is their small numbers, and the short time periods they cover. For example, B.C. Vital Statistics has information on low birth weight births among Status Indians only back to 1991. Before 1991, Vital Statistics did not routinely collect information on a newborn's aboriginal status.

Episiotomies

Episiotomies were introduced in the eighteenth century with the intent on improving maternal outcomes (Lede, Belizan, & Caroll, 1996). In the 1920's an episiotomy (cut or incision into the perineum), was introduced as a routine procedure to shorten the second stage of labour, lower perinatal mortality and morbidity, reduce severity of maternal trauma and pelvic floor relaxation (Reynolds, 1995). In the 1980's a review of the literature indicated the disadvantages of episiotomies and they were subsequently removed as a routine gynecological procedure (Graham, & Graham, 1997; Reynolds, 1995).

Even though they are not recommended as routine they can still be a necessary component in modern day obstetrical practices. The debate is to when their use is justified. Clinical indications for used include speeding up the later part of the second stage of labour in the presence of fetal distress; to open up posterior areas to allow the correct line of traction for forceps or vacuum extraction; to overcome a perineum that is rigid and delaying the last part of delivery; and if there is likely to be a major perineal tear, an episiotomy may prevent it and be easier to repair (Chamberlain, & Steer, 1999; WHO, 1997). Since episiotomies were introduced without strong scientific evidence there use remains debated. The indications for use are still largely open for debate as fetal distress is grossly misdiagnosed and episiotomies themselves may extend to a fourth degree tear during a vaginal or operative vaginal delivery resulting in major maternal morbidity.

Forceps / Vacuum Extraction

The medicalization of childbirth on one account was initiated by the introduction of forceps in the mid 1600's by Peter Chamberlen (Hosmer, 2001). The invention of forceps was important in advancing the physician's role in childbirth. Their use comes with several prerequisites including 'forceps should never be applied through a non-dilated cervix or with an unengaged presenting part' (Steinitz, & Osmun, 2001).

Although considered a modern device there was a description of an attempted vaginal delivery using a cupping glass in 1705, and in 1848 there was a bell-shaped device called an 'air tractor vacuum extractor' (Putta, & Spencer, 2000). In modern day obstetrics there seems to be a decrease in the use of forceps and vacuum extraction with cesarean sections being the operative delivery of choice. When you compare forceps to vacuum extractors, vacuum extractors seem to be the recommended instrument of choice. However in a recent review the risks and benefits of forceps and vacuum extractors appeared comparable and selected based on physician training and experience (Putta, & Spencer, 2000). Forceps or vacuum extractors are often necessary to speed up delivery in times of fetal or maternal distress but require careful documentation as to their use (Steinitz, & Osmun, 2001).

Analgesics / Anesthesia

Anesthesia was first introduced to medical practice in 1847 by James Young Simpson, his use of ether was seen as a needle some intrusion to a place where the medical professional at the time felt birth was better managed with the least possible interference (Caton, et al. 2002). The most popular method of intervention for management of pain continues to be systemic medications (Stamer, et al. 1999). With the increase in cesarean sections there is an increase in the use of regional anesthesia from 55% in 1981 to 90% in 1997 (Stamer, et al. 1999).

In a 1990 study of residency programs, epidural anesthesia was used by 46% of residency programs for operative vaginal deliveries, pudendal anesthesia by 14%, and spinal anesthesia by 2% and 3% reported no anesthesia for forceps operations (Ramin, et al. 1993). There seems to be differences in pain management and use of anesthetics dependent on the location (Radomsky, 1995; Webb, &Kantor, 1992). There are apparent

rural and urban differences in the availability of anesthetics for a variety of reasons including staffing and training of local practitioners.

Cesarean Sections

In its early days the cesarean was performed by restraining the women, incising and removing the baby without pain control which normally resulted in maternal and fetal demise (Hosmer, 2001). There is controversy and debate over who performed the first cesarean section with some saying it was in 1500 by a Swill sow gilder named Jacob Nufer; and others who note it was Francois Rousset who called the operation a 'hysterotomotokie' (Drife, 2002; Murphy, 2002). There are other people labeled as performing the first and it appears somewhat debatable and potentially culturally reflective.

To look at the cesarean sections today they are labeled as the most common major operation performed in America (ICAN, 2002). There is much controversy over its use with it being offered for medical indications as well as an elective choice to natural childbirth. In Canada the cesarean section rate increased from 4.8 per 100 in 1968 to 12.1 per 100 in 1977 (Wadhera, & Nair, 1982). Klein (1988) concludes that all studies indicate a rising cesarean section rate in Canada, whether it is associated with decrease in family physicians or not, they are not associated with improved fetal health.

From 1989 to 1994, Canada had the second highest cesarean rate in the Western developed world (Menticoglou, 1997). The increase in cesareans is thought to be related to technologic advances, increase in the age of childbearing, and the belief in its safety for both the mother and the fetus, however, perinatal mortality has been declining for decades and incidence of long-term neurological defects has not been conclusively demonstrated with its use (Mindell, Vayda, & Cardillo, 1982). Litigation seems to be a contribution factor to the cesareans high rates of use even when best practices are now calling for an overall population rate of 10 percent. Wagner (2000), stated that if a cesarean is perfored the woman and child take the risk but if not performed the doctor takes the risk. In a society of perfect expectations, increasing age of childbirth, litigation threats, and women having to travel out of communities for care there is no realistic end in sight to the high cesarean section rates.

Bella Coola Valley

The Bella Coola Valley is a rural, remote community located on the Central Coast region of British Columbia. Women have been delivering babies in the Bella Coola Valley for thousands of years, and they have been delivering babies in the Bella Coola General Hospital since the first one was built in 1908 (Thommasen, 1999; Thommasen, Newbery, & Watt, 1999; & McIlwain, & Smith, 2000) Locked away in a safe located in the Bella Coola General Hospital (BCGH) were Case Room Record Books which document the details surrounding births which took place between March 7, 1940 and June 9, 2001. This data represents one of the longest rural hospital data sets available on the topic of obstetrical outcomes and procedural usage rates.

It has been established by the College of Family Physicians of Canada, the Society of Obstetricians and Gynaecologists of Canada, and the Society of Rural Physicians of Canada that there is a need for rural obstetrics and rural practicing physicians and gynaecologists. There is evidence to support the claim that rural obstetrical facilities produce good maternal and perinatal outcomes. However, there is a lack of practicing rural physicians and gynecologists. A position paper on rural maternity care supports women giving birth within their community and points out the need to develop public policy and clinical care guidelines to support rural maternity care programmes in rural Canada (Gagne, et al. 1998).

Current gaps in the literature include the lack of empirical evidence for rural obstetrics within British Columbia. Also with the variety of practice settings and capabilities of these rural facilities there is a need to compare and contrast the facilities outcomes with their obstetrical capabilities. The literature tells us little about historical practices and outcomes and current studies focus only on specific years or points in time (Hutten-Czapski, 1999; Grzybowski, 1998). Research in these areas is a necessary component in assessing the safety and outcomes of rural obstetrical practice. In order to identify this gap, this study explores perinatal outcomes in the rural community of Bella Coola over a 60 year time period. This will contribute to the historical knowledge base of obstetrical practices in rural communities.

Key concepts for this study include outcomes, best practices, and evidenced based medicine. Outcomes in this study refers to perinatal and maternal labour and delivery

results including mortality and morbidity outcomes. Best Practices refers to the planning and/or operational practices that have proven successful in particular circumstances and are used to demonstrate what works and what does not and to accumulate and apply knowledge about how and why they work in different situations and contexts (Definitions of Best Practices on the Web, 2004). Whereas, evidenced based medicine refers to practicing medicine by using a set of evolving principles, strategies, and tactics, and is based on the premise that practitioners are aware of the evidence to support their clinical practice (Kaczorowski, 1998). Although the concepts of best practices and evidence based medicine are similar the first refers to the overall practice recommendations whereas the second would be more or less illustrating the inclusion of recommendations into practice.

2.2 Study Questions

This paper reviews and summarizes the information in the Bella Coola Hospital's birth registry in an attempt to answer the question(s):

1) What procedures were being done by the rural physicians over this time period?

2) How do Bella Coola's obstetrical outcomes and procedural usage rates over time compare to provincial, national and international trends?

3) What was the perinatal mortality for Bella Coola births over this period?

4) What were the low birth weight rates for Bella Coola over this period?

5) Has the description of newborn condition changed significantly over this period?

6) How do Bella Coola's newborn outcome rates compare to provincial, national and international trends?

CHAPTER 3: RESEARCH DESIGN AND METHODS

3.1 Description of the Community

The Bellą Coola Valley is located within the rugged coastal mountains of northwestern British Columbia (Fig 1, 2). According to the 2001 Census, 2,289 people live in the Bella Coola Valley (British Columbia Vital Statistics Agency, 2001; British Columbia Vital Statistics Agency, 2003). Approximately 40% of the population (1100 people) are aboriginal, most of these people being of Nuxalk decent. The Nuxalk Indians are a tribe of Salish-speaking Coastal Indians who settled in the Bella Coola Valley, but formerly lived

throughout the surrounding British Columbia Central Coast area (Thommasen, Loewen, & McInnes, 1995; & Thommasen, 1999).

Highway 20 provides the main access to the Bella Coola Valley. It extends 465 km west from Williams Lake across the Chilcotin plateau through communities of Alexis Creek, Tatla Lake, Nimpo Lake and Anahim Lake and down the infamous Bella Coola hill to the floor of the Bella Coola Valley. The paved highway then winds along the Atnarko and Bella Coola rivers for roughly 100 km, to the wharf at the mouth of the Bella Coola River. One passes through the small communities of Stuie, Firvale, Hagensborg, before reaching the town of Bella Coola, which is situated next to the estuary at the mouth of the Bella Coola River.

The Bella Coola General Hospital is located in the town of Bella Coola and serves a geographic region, which includes the communities of Bella Coola, Hagensborg, Firvale, Stuie, Anaheim Lake, and Nimpo Lake (figure 2). Bella Coola Hospital is one of the most isolated health care facilities in British Columbia. The closest referral hospital is over 450 km by road to Williams Lake or a two-hour flight by air to Vancouver. Three physicians service Bella Coola at any given time. Each year the Bella Coola physicians see over 8,000 patients in the clinic, 2,500 patients in the emergency department, admit approximately 400 patients to the hospital and deliver up to 40 babies (Thommasen, Newbery, & Watt, 1999).

Over the past 30 years, there has been a 46% increase in the total population of the Bella Coola Valley from 1568 in 1971 to 2289 in 2001(British Columbia Vital Statistics Agency, 2001; & British Columbia Vital Statistics Agency, 2003). The valley population showed a slight drop in Census 2001 for the first time in 30 years.

3.2 Study Population

The study population consisted of women beyond 20 weeks gestation who delivered in the Bella Coola General Hospital between March 7, 1940 and June 9, 2001. Specific information on maternal age, aboriginal status, date of delivery, gravid status prior to delivery, maternal mortality/morbidity, analgesia, anesthesia, sedation, episiotomies, forceps and vacuum deliveries, and cesarean sections were extracted from labour and delivery case room record books. Maternal morbidities noted included retained placenta, placenta previa, placental abruption, hemorrhage, need for blood

transfusion, hypertensive disease, shoulder dystocia, precipitous or prolonged labour, uterine rupture, uterine prolapse/version, amnionitis, or cord prolepses. The author did not check the accuracy of these morbidities, if any of these were mentioned it was noted on the data spreadsheet. Birth weight, newborn mortality, and newborn condition, morbidity / complications were also recorded.

Newborn Condition: Activity, Pulse, Grimace, Appearance, and Respiration (APGAR) scores were not used until September 11, 1971. Before 1971, the physician would describe condition and color of infant. A scoring system was therefore set up to describe the condition of infant in a simple manner over the entire study period (see Table 1).

Table 1: Newborn Condition

Physician Description	APGAR score	Morbidity Score
Good or excellent	8,9,10	1
Fair, slow to breath, or cyanosed	6,7	2
Poor, Difficult breathing or resuscitated	≤ 5	3
Stillbirth	0	4
Missing data	m.d.	m.d.

3.3 Vital Statistics Information (1986 to 2000)

Vital Statistics Information from BC Vital Stats is available for women who delivered 1986 to 2000 (inclusive) and listed Bella Coola Valley as their residence. Their data includes women who delivered locally and those who delivered elsewhere. BC Vital Statistics also provided data on Status Indian women for the years 1991 to 2000.

The data was entered into an electronic EXCEL spreadsheet and later transferred to a statistical program (SPSS) for statistical analyses. The results were summarized into graphs and tables, which were then reviewed with fourteen Bella Coola Valley residents who were young adults in the 1940's, and with four nurses and one doctor who worked in the valley in the 1950's and 1960's. All were asked specifically if they recalled any maternal deaths dating back to 1941. The five health care professionals were specifically asked if the procedure usage rates seem to fit with what they recalled. This was

conducted only to assess whether practice and experience coincided with the statistics and not as a subject for review.

Review of the literature was exhaustive and included all known sources of information available. These included all published journal articles through PubMed and research sites as well as Statistics Canada, BC Vital Stats, National and provincial bodies such as medical associations (GP and OBGYN), research associations (CIHR) several sites and vested interest groups such as the BC Reproductive Care Program data and reports and many, many more. Reviews and searches were conducted through some of the following data banks Historical Statistics of Canada through Statistics Canada at http://www.statcan.ca/english/freepub/11-516-XIE/free.htm, various list serves such as Pub Med, and library searches at UNBC, UBC, PGRH databanks and on line list serves. Others included British Medical Journal website, OBG Management, BC Vital Statistics Websites and searches.

The various searches resulted in large amounts of articles and reviews on the topics of interest with the biggest gap being the historical documentation of the topics of interest before the 1980's with relatively few articles or submissions found for the study period between the 1940's to the 1970's. Therefore statistics and information were extracted from published literature that may not be critical reviews or study based but rather historical articles of interest and personal journals were utilized.

3.4 Ethics

The University of British Columbia's Clinical Research Ethics Board granted ethics approval for this project prior to start of data collection on July 13, 2000. Before entering the data names of subjects were removed to ensure privacy and maintain confidentiality. All data used was summarized by decade which would also ensure privacy and maintain confidentiality. The principle of beneficence was maintained as this descriptive study would not appear to cause harm to the population under study.

3.5 Methods

The main outcome variables included aboriginal status, date of delivery, mode of delivery (vaginal versus cesarean birth), birth weight, episotomy or not, forceps / vacuum extraction, whether analgesia, sedation or anesthesia was used, maternal morbidity / complications, and newborn morbidity / complications.

The study variables were nominal indicating the use of descriptive statistics. Chi-square was therefore used to assess frequency and significance between variables. Crosstabs were used to illustrate whether an intervention such as episiotomy, anesthesia, forceps and / or vacuum extraction, and cesarean section was performed over time by using a value of yes or no. The Pearson Chi-Square with the level of significance set at 0.05 was then calculated using SPSS software to see if the interventions being used varied significantly with the decade of birth.

CHAPTER 4: DESCRIPTIVE STATISTICS

4.1 Birth Trends

There were 2373 deliveries involving 2361 women between March 7, 1940 and June 9, 2001 within the Bella Coola Hospital. This included 12 twin deliveries. There was a steady increase in births until the early 1960's and then a decline throughout the 60's and 70's with another increase in the early 80's followed by a gradual decline thereafter. The years with the highest birth rates appear in 1960, 1963, 1983, and 1992 with over 60 births a year, and lows in 1945, 1971, and 1995 with under 30 births per year. Data was missing for the time period March 21, 1967 through to January 7, 1969, inclusive. The summary of deliveries is illustrated in Table 2.

Table 2: Summary of Deliveries

Race	1940-1954	1955-1969	1970-1984	1985-2001
Aboriginal	221	317	271	316
Non-aboriginal	229	359	346	314
Total	450	676	617	630

Gravida status was available for the majority of women (2318/2361). From the 1940's to 1960's, average gravid score was between 3.6 and 3.8 for the entire population; and this dropped to 2.4 to 2.6 between the 1970's to the present time period (Table 3). Aboriginal women had higher gravida scores compared to other women, though this difference is notably declining over time.

Table 3: Mean Gravida Number Over Time

Time Period	1940-1954	1955-1969	1970-1984	1985-2001
Total Population	3.62	3.77	2.40	2.54
Aboriginal Women	4.49	4.81	2.66	2.73
Non-aboriginal Women	2.78	2.85	2.19	2.36

4.2 Maternal Mortality Rates (MMR)

There were no reported maternal deaths in the Bella Coola Hospital during the entire study period. Narcotics, sedatives, inhalation agents, and regional anesthetics were all used to relieve the pain of labour and delivery. A descriptive summary of the inhalation agents, narcotics, and sedatives used are presented in table 4. The use of regional anesthetics over time is summarized in table 5. A variety of maternal morbidities was mentioned over the years and these are summarized in table 6.

TABLE 4: ANALGESIA GIVEN TO LABOURING WOMEN

Total # Women	**2361**	
	Number of Women Receiving	**Years Mentioned**
Inhalation Agents		
Chloroform	246	1940-1953
Ether	413	1940-1953
Trilene	215	1956-1977
Cyclopropane	34	1959-1964
Nitrous Oxide	69	1958-1981
Entonox	145	1984-2001
Narcotic		
Heroin	24	1940-1945
Morphine	36	1941-1961
Codeine	13	1942-1967
Demerol	869	1946-2001
Sedatives		
Benzodiazepines	5	1960-1992
Sodium Amytal	206	1940-1957
Nembutol	95	1941-1955
Seconal	216	1946-1964
Pentothal	22	1959-1964

TABLE 5: REGIONAL ANESTHETICS GIVEN OVER TIME

Decade	1940's	1950's	1960's	1970's	1980's	1990's	Total
Spinal Anesthesia	0	2	0	6	0	24	32
Pudendal Nerve Block	0	4	9	17	21	2	53
Epidural Anesthesia	0	0	12	19	88	55	174
Cesarean-section	0	1	0	13	42	44	100
Regional and Cesarean-section	0	0	0	8	39	39	86

TABLE 6: MATERNAL OBSTETRIC COMPLICATIONS

BCGH	1940's	1950's	1960's	1970's	1980's	1990's	Total
#Women	251	443	425	368	475	399	2361
#Births	253	447	426	370	478	399	2373
Maternal Deaths	0	0	0	0	0	0	0
Retained Placentae	1	3	11	8	5	4	32
Placenta Previa	1	0	2	0	0	1	4
Placental Abruption	0	1	1	0	3	1	6
Hemorrhage	19	14	4	2	18	57	114
Blood Transfusion	1	2	1	1	0	2	7
Hypertensive	3	2	2	0	7	1	15
Shoulder Dystocia	0	0	0	0	3	3	6
Prolonged Labour	0	3	0	11	32	40	86
Uterine Rupture	0	1	1	0	1	0	3
Uterine Prolapse	0	0	0	0	1	0	1
Uterine Inversion	0	0	0	0	1	0	1
Amnionitis	0	0	0	0	2	2	4
Prolapsed Cord	0	2	0	0	0	0	2

4.3 Episiotomies

The number of episiotomies performed per decade during the study period is summarized in tables 7 & 8. The data show a gradually increasing episiotomy rate into the 1970's after which it dropped to less than 5% in the 1990's. The highest episiotomy

rates occurred during 1978 through 1980; thereafter, episiotomy rates fell to less than 5% during 1993 to 1995 time period (Table 8).

TABLE 7: OBSTETRIC PROCEDURE USAGE RATES

BCGH	1940's	1950's	1960's	1970's	1980's	1990's	Total
# Women	251	443	425	368	475	399	2361
# Births	253	447	426	370	478	399	2373
Operative Delivery:							
Forceps (#)	18	27	34	37	43	10	169
Vacuum (#)	0	0	0	0	32	36	68
Forceps + Vacuum (#)	18	27	34	37	75	46	237
Episiotomy (#)	69	146	152	175	166	16	724
C-section (#)	0	1	0	13	42	44	100

TABLE 8: OBSTETRIC PROCEDURE USAGE RATES (%)

BCGH	1940's	1950's	1960's	1970's	1980's	1990's
# Women	251	443	425	368	475	399
Forceps (%)	7.2%	6.1%	8%	10%	9%	2.5%
Vacuum (%)	0%	0%	0%	0%	6.7%	9%
Forceps + Vacuum (%)	7.2%	6.1%	8%	10%	15.7%	11.5%
Episiotomy (%)	27.5%	33%	35.8%	47.3%	34.9%	4.0%
C-section (%)	0%	0.2%	0%	3.5%	8.8%	11%

4.4 Operative Deliveries (Forceps/Vacuum Extraction)

Bella Coola's forceps and vacuum rates indicate a reduction in the rates of forceps use from the 1960's to the 1980's with a marked decrease from the 1980's to the 1990's (Tables 7&8). Vacuum deliveries were not used in Bella Coola prior to the 1980's. Operative deliveries before that time denote the exclusive use of forceps.

4.5 Cesarean Sections

Up until the 1970's there was only one Cesarean section done in the Bella Coola General Hospital. That one was done in 1959, and it was an emergency Cesarean section because a woman was hemorrhaging from a ruptured uterus. From the 1970's onwards there has been a gradual rise in the rates of cesareans (Tables 7&8). Reasons for cesarean

sections over time are summarized in table 9. Failure to progress, repeat C-sections, breech, and fetal distress were the main reasons listed for having a cesarean section.

TABLE 9: REASONS FOR CESAREAN SECTION PER DECADE

Decade	1940's	1950's	1960's	1970's	1980's	1990's	Total
Failure to Progress	0	0	0	8	14	24	46
Breech	0	0	0	3	7	7	17
Repeat C-section	0	0	0	0	9	10	19
Fetal Distress	0	0	0	0	3	5	8
Miscellaneous	0	1	0	0	6	1	8
No information	0	0	0	2	3	1	6

4.6 Twin Data

There were 12 sets of twins, 9 to non-Aboriginal women and 3 to Aboriginal women (Table 10). Five of the 24 twin newborns died, all during the 1955 to 1969 time-period - one aboriginal female, three non-Aboriginal females, and a non-Aboriginal male. Two of these deaths (non-Aboriginal male and female) were from one twin delivery. These two were described as being premature and both died a few hours after birth. Another twin death was a non-Aboriginal female stillbirth; and the last twin death was a female described as being a premature female who died 7days after delivery.

Table 10: Summary of Twin Data

Time Period	1940-1954	1955-1969	1970-1984	1985-2001	Total
Aboriginal Twins	1	1	0	1	3
Non-aboriginal Twins	2	3	4	0	9
Total	3	4	4	1	12

4.7 Perinatal Mortality

Perinatal mortalities over time are summarized below (Table 11). Total newborn mortality rates declined from around 4.7% in the 1940-1954-time-period to 0.7% in the 1970-1984 time-period and have remained around that level since.

Table 11: Newborn Mortality (Total Population)

Year	1940-1954	1955-1969	1970-1984	1985-2001
Total Number of Births	450 (100%)	676	617	630
Stillbirth	13 (2.9%)	13(1.9%)	4 (0.7%)	5 (0.8%)
Died < 24 hours	4 (0.9%)	12 (1.8%)	0 (0%)	2 (0.3%)
Died 1 day to 30 days	4 (0.9%)	2 (0.3%)	0 (0%)	0 (0%)
Total Deaths	21 (4.7%)	27 (4.0%)	4 (0.7%)	7 (1.1%)

Review of aboriginal vs non-aboriginal newborn death rates reveals that total mortality for aboriginal newborns has dropped dramatically from rates of around 6.3% during the 1940 to 1954 time period to 0.3% during the 1985 to 2001 time period. Total newborn mortality also fell from 3.1% to 0.3% over this time period.

Since Bella Coola lacks the numbers to calculate a true perinatal mortality rate a calculation was made by dividing the number of perinatal deaths by the number of live births (including twin births), and then multiplying that number by 1000 to get the perinatal mortality rate for Bella Coola during the study period. Perinatal mortality included stillbirths, antenatal deaths, intrauterine deaths and deaths up to a week after birth (see table 12).

Table 12: Bella Coola General Hospital (BCGH) Mortality Summary

BCGH	1940's	1950's	1960's	1970's	1980's	1990's
# Women	251	443	425	368	475	399
# Births	253	447	426	370	478	399
# Maternal deaths	0	0	0	0	0	0
# newborn deaths	11	22	14	4	6	2
PMR (#/1000 births)	43.8	49.2	32.9	10.8	12.6	5

4.8 Newborn Condition at Birth

Information on condition of newborn at birth is summarized in table 13 below. The data below shows that the condition of the vast majority of newborns is described as being 'good' at birth (approximately 90%).

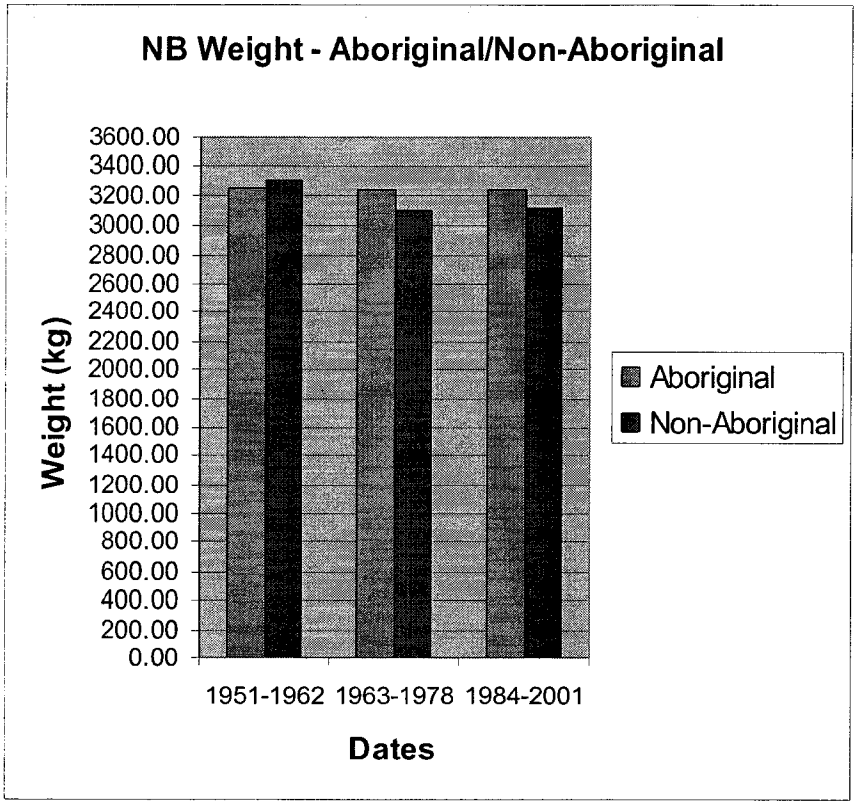
Table 13: Condition of Newborn Per Decade

Newborn Condition (%)	1940's	1950's	1960's	1970's	1980's	1990's
# Births	253	447	426	370	478	399
Good	91%	90%	90%	84%	92.5%	96%
Fair	2%	3%	3%	8%	5%	3%
Poor	2%	3%	3.5%	2%	0.4%	1%
Deceased	3.5%	2.5%	1.4%	0.5%	1%	0%
Missing	1.5%	1.5%	1.9%	6%	1%	0.25%

4.9 Newborn Weight

Mean weights for newborns are summarized in graph 1 below. The data shows that mean weight has not really changed much over time. Mean weights for non-aboriginal and aboriginal newborns also seem comparable over time.

Graph 1: Newborn Weight



4.10 Low Birth Weight

Low Birth Weight Rate is defined as the proportion of live births with a birth weight less than 2500g. Birth weight data is available for 1793 newborns starting around 1951, and except for the period from 1978 to 1984 it is more or less continuous. About 5% of newborns have birth weights less than 2500 grams and this has not changed much over the years. Aboriginal women appeared to have a higher percentage of infants with birth weight of < 2500 grams but this percentage has declined over time to the point where the rate is similar to non-aboriginals at around 5%.

Table 14: Low Birth Weight (< 2500 gms)

Year	1951-1962	1963-1978	1984-2001
Total Aboriginal Number	254	285	334
Aboriginal Number < 2500 gms (%)	21 (8%)	16 (6%)	15 (5%)
Total Non-aboriginal Number	300	275	345
Non-aboriginal Number < 2500 gms (%)	14 (5%)	13 (5%)	15 (4%)

4.11 Inferential Statistical Analyses

Pearson Chi-Square statistical analyses reveals that the likelihood of any of the interventions - episiotomy, operative delivery (forceps and vacuum extraction), and cesarean section - being used, varied significantly with the decade of birth ($p < 0.05$). Due to the nominal level of data the Chi-Square was the test used to denote significant difference between the proportion of births that included various interventions over time.

The results of the analysis included the following significant results with a p-value of 0.05. The proportion of births that involved anesthetic peaked in the 1980's, and the proportion of births that involved episiotomy peaked in the 1970's. The proportion of births that involved forceps and / or vacuum peaked in the 1980's. Finally the proportion of deliveries by cesarean section increased across all of the decades being highest in the 1990's. All other variables and frequencies tested did not illustrate significant results.

CHAPTER 5: DISCUSSION

The Bella Coola General Hospital is located in the isolated, rural, remote community of Bella Coola. The data described in this paper covers a 60-year time period from 1940 to 2001, and the results support the joint position of the SOGC, SRPC, and College of Family Physicians of Canada. The information presented in this paper reveals excellent maternal and perinatal outcomes are possible when an isolated rural community offers obstetric services and capabilities including cesarean section and anesthesia (regional and general).

There were no reported maternal deaths in the Bella Coola Hospital during the entire study period. Fourteen Bella Coola Valley residents who were young adults in the 1940's, and four nurses and one doctor who worked in the valley in the 1950's and 1960's confirmed that they were not aware of any women dying during our study period. To their knowledge and recollection, a woman died giving birth in 1906; and several people mentioned the deaths of two women several days after they gave birth before 1940 from what sounded like toxemia of pregnancy.

Maternal mortality rate (MMR) can be defined as the number of maternal deaths due to complications of pregnancy, childbirth and the puerperium, per 10,000 live births (Special Committee on Obstetrical Care, 1987). Maternal mortality has decreased throughout the decades. The maternal mortality rate was 31 per 10,000 live births in British Columbia compared to 40 per 10,000 in Canada for 1940 (Strong-Boag, & McPherson, 1986). Current maternal mortality rates in Canada are in the order of 0.3 to 0.5 per 10,000.

MMR in a Report from the United Kingdom titled "Why Mothers Die," documented trends in maternal mortality from the 80's to the 90's. For the 1994-96 period there was a rate of 9.9 per 10,000 mortalities (direct and indirect causes), with the major causes of death being thrombosis and thromboembolism (Department of Health, 1998). Amniotic fluid embolism, sepsis, uterine rupture, pregnancy induced hypertension, anesthesia related deaths, and haemorrhage are other causes of pregnancy associated maternal mortalities.

Maternal mortality in Canada is less than 1% of all deaths of women, whereas it accounts for 25 to 30 percent of deaths of women in developing countries (Lalonde, 1998). Another source states the maternal mortality rate in developing countries is as high as 1%, and one woman dies in pregnancy every minute of every day due to sepsis, haemorrhage, hypertensive disease, and unsafe abortion (Drife, 2002). There is an estimated worldwide maternal mortality of 500,000 a year; 25% due to hemorrhage, 15 % related to sepsis, 12 % due to hypertensive disorders, 8% related to obstructed labour, and 13 % due to abortion (WHO, 1994). The disproportionate rates between developing and developed countries is astronomical. Worldwide health organizations are looking at ways of decreasing this largely preventable cause of mortality for women across the globe.

During the entire study period there were no reported maternal mortalities. This may reflect good nutrition and health for the population of Bella Coola as well as good health care provided by the physicians over the study period. Since there was no maternal deaths there is no way to illustrate similarities or differences between aboriginal or non-aboriginal maternal mortalities.

In Bella Coola the most commonly mentioned maternal morbidity was hemorrhage but despite this, relatively few women actually received a blood transfusion

for the problem (7/2361 women). Prolonged labour was the next most commonly mentioned maternal morbidity. It is interesting to note physicians rarely mentioned the term prolonged labour before the 1970's. This sudden shift may be related to changes in defining, diagnosing, and treatment of a long labour. Or in light of the subsequent increase in cesarean sections during the same time period a diagnosis of prolonged labour may have been a justification for initiating this mode of delivery. Other issues happening in the 1970's included major strides in the women's movement and women's rights that also may have impacted on physicians diagnosing a prolonged labour due to women wanting their labour shortened.

Data from the Bella Coola Hospital obstetrics casebook reveal that women have been receiving narcotics, sedatives, inhalation anesthetics, and regional anesthetics since the 1940's. The specific agents used have changed over the years but the broad category of medicine has not - for example, demerol is given these days instead of heroin, entonox gas instead of ether gas, and benzodiazepines are given instead of barbiturates (Caton, Froiioh, & Euliano, 2002).

A review of the literature suggests wide variations in use of pain management when you compare different cities in Canada in the 1990's. In a study of anesthesia availability in cities across Canada, epidural anesthesia was unavailable in Edmonton whereas in Toronto 58.7% were managed using epidural anesthesia (Radomsky, 1995). Epidural anesthesia was offered routinely in Bella Coola during the 1990's but this practice may not be representative of other rural communities. The literature suggests use of epidural anesthesia in rural and remote areas seems to be rather low and may be related to fewer deliveries, and fewer personnel resources to perform the procedure (Stammer, et al., 1999).

5.1 Episiotomies

Episiotomies were introduced in the eighteenth century with the intent of improving maternal outcomes (Lede, Belizan, & Caroll, 1996). In the 1920's the episiotomy was introduced as a routine procedure to shorten the second stage of labour, lower perinatal mortality and morbidity, reduce severity of perineal tears, improve sexual function, and reduce the possibility of urine and fecal incontinence (Lede, Belizan, & Caroll, 1996; & Reynolds, 1995). The routine use of episiotomies was introduced

without strong scientific evidence of its benefits. There is no justification for the routine use although episiotomies remain a necessary component in modern obstetrical practices to facilitate or expedite delivery in times of fetal distress.

Recent studies indicate the use of episiotomies may result in 1) a decrease in muscle strength of vaginal muscles; 2) slower wound healing; 3) more pain when resuming sexual intercourse; and 4) higher rates of urinary and fecal incontinence (Lede, Belizan, & Caroll, 1996; & Signorello, et al., 2000).

As a result of these studies, and since an initial review of the literature in 1983 illustrating the disadvantages of episiotomies and the lack of advantages, there has been a noticeable decline in prevalence of episiotomies in Canada (Reynolds, 1995; & Graham, & Graham, 1997).

One Canadian study revealed the episiotomy rate declined from 66.8 in 1981/1982 to 37.7 percent of all women giving birth vaginally in 1993/1994 (Graham, & Graham, 1997). Another study reports episotomy rates in the 1990's at 41.8% for mutiparas and 62.7% for primiparas in Canadian hospitals (Kaczorowski, et al., 1998). Other studies reveal episiotomy rates of 45% in Red Deer, Alberta; 55.2% in Toronto; and 62% in Edmonton (Radomsky, 1995; & Lede, Belizan, & Caroll, 1996).

In the United States (US) in 1983, 69.6% of vaginal births had an episiotomy (ACOG, 2002). In the 1990's the episiotomy rate in the US had fallen to around 52.5%. A recent US data analysis from nulliparous women in Philadelphia hospitals shows episiotomy rates of 42 percent overall with 7.7 percent of women having a third or fourth degree tear during childbirth (Webb, & Culhane, 2002).

The European episiotomy rate in the 1990's is reported to be around 30% (Radomsky, 1995; & Lede, Belizan, & Caroll, 1996); and between 15-40% dependent upon the hospital (Chamberlain, & Steer, 1999). In China, episiotomies are still routine with rates above 85% in 3 hospitals (Qian et al., 2001). In the Netherlands midwives have an episiotomy rate of 24.5% (WHO, 1995). Such wide variations in rates hints at possible institutional or physician factors that may influence episiotomy rates.

Klein et al (1995) illustrate that if a physician views episiotomies favorably or unfavorably affects patient outcomes. In this study those physicians favoring episiotomies not only had difficulty limiting their episiotomy use in the restricted-arm

group of the study but also diagnosed fetal distress and perineal inadequacy more often and had decreased patient satisfaction and increased perineal trauma (Klein et al., 1995). This suggests the physician has a major impact on obstetrical procedures and outcomes.

The World Health Organization (WHO) recognizes the reasons for performing an episiotomy but also recognizes that they are frequently used inappropriately (WHO, 1995). WHO (1995), recommends an overall episiotomy rate of around 10% because of the evidence suggesting liberal use of episiotomies causes more harm than good. Restrictive use of episiotomies is seen as a positive initiative in relation to evidence-based recommendations (Graham, & Graham, 1997).

Rates of episiotomies use in the Bella Coola Valley seem to follow best practice guidelines. Bella Coola's episiotomy rate of less than 5% in the 1990's is significantly lower than other provincial, national, and international rates making this hospital one of the few health care facilities in the world actually meeting and exceeding best practice guidelines.

5.2 Operative Deliveries (Forceps/Vacuum Extraction)

Trends in forceps delivery rates in Bella Coola concur with other Canadian and International studies reporting decreases in forceps usage since the 1970's with subsequent increases in vacuum extraction rates (Gagne, et al., 1998; Hankins, & Rowe, 1996; Ramin, Little, & Gilstrap, 1993; & Bofill, et al., 1996).

Bella Coola's rate of forceps when compared to BC and Canadian data, indicate Bella Coola has a rate that falls far below the national and provincial averages for both the 1980's and the 1990's. Reported forceps usage rates in Canada range from 6.5% to 21%. In British Columbia forceps delivery declined from 13% in 1987 to 7.4% in 1995 and vacuum deliveries increased from 0.8% in 1987 to 4.9% in 1995 (MacNab, 1996).

Canadian forceps rates are far lower than Australia's, far higher than Sweden's, and on par with British forceps usage rates. In Sweden forceps deliveries are rare with a rate of 0.2%; whereas vacuum delivery rates are around 6.9% Sweden is viewed as a leader in obstetrical intervention guidelines as they defined forceps and vacuum extraction best practice guidelines almost a decade before Canada. Britain's rate of forceps usage was 5-10% in the 1990's (Chamberlain, & Steer, 1999). In New South Wales, Australia, the forceps usage rate in 1990 was 58.1% and declined to 33.8 % in

1997 (Ohlsson, & Fohlin, 1983). During the same time period the vacuum extraction rates rose from 9.6 to 26.5 percent respectively (Roberts, et al., 2002). Since Austrailia, Sweden, and Britian have similar health care systems and training these countries were used to compare and contrast with Canada.

5.3 Cesarean Section

In some ways, the cesarean section has become an icon of all the medical advances made in obstetrics. Currently cesarean section is used as both a medical intervention and an option for women who prefer it as an alternative to vaginal birth. According to American Statistics, the caesarean section is now the most common major operation performed in America with the US having a rate of 22.9% in 2000, an increase of 4% from 1999 (ICAN, 2002).

As with other centers around the world, the Bella Coola data show there has been a gradual rise in the rate of cesareans since the 1970's from zero to less than 15%. Comparatively, Bella Coola has cesarean section rates that are lower than provincial, national, and international rates (Mindell, Vayda, & Cardilla, 1982). The World Health Organizations recommends a cesarean rate of 10-15%, within which the rate reported for Bella Coola falls.

In Canada, the cesarean rate increased from 4.8 per 100 in 1968 to 12.1 per 100 in 1977 (Wadhera, & Nair, 1982). The Canadian experience shows provincial variations in 1988 from Manitoba's low of 15.5 per 100, and Alberta's 17.1 per 100 deliveries to British Columbia's and Newfoundland's highs of 22.2 and 23.3 per 100 respectively (Richman, 1999). Another study reported cesarean rates for British Columbia for 1987 and 1995 of 21% and 19.8%, respectively (MacNab, 1996).

Klein concludes that all studies indicate a rising cesarean section rate in Canada, and notes this rising cesarean section rate is not associated with improved fetal health (Klein, 1988). Earlier Canadian data from the 60's, 70's and 80's show an increasing cesarean trend. The rate in 1967-1969 was 5.8% and 1977-79 the rate was 16.9%; major factors contributing to this have been the change in approach to the breech presentation. However, there has not been a subsequent drop in perinatal mortality with this increased use of cesarean section that would seem to adequately justify its current use (Baskett, & McMillen, 1981).

Worldwide trends illustrate marked differences in cesarean rates. These studies show the Americas as having the highest cesarean section rates in the world compared to their European and Asian counterparts. Among developed countries, the US and Canada have relatively high cesarean section rates (19 to 23%) (Menticoglou, 1997). In contrast, some Eastern European (e.g. former Czechoslovakia and Hungary), some Western European (e.g. Netherlands) countries, Scandinavian countries (e.g. Iceland and Sweden) and Japan report relatively low rates of cesarean sections (5 to 10%) (Klein, 1988; Notzon, 1990).

In Britain the frequency of cesarean sections has increased from 5% in 1930 to 16% in 1999; 6.5% of all deliveries are elective cesarean sections with 9% of all births being emergency cesarean sections (Chamberlain, & Steer, 1999). The main reason cited for the rise in cesarean sections in Britain was litigation. In New South Wales, Australia the cesarean rate increased from 32.3 percent in 1990 to 39.8 percent in 1997 (Roberts, et al., 2002).

In developing countries, cesarean section rates have soared. International data from 1981 to 1986 show Brazil with a 31 to 37% cesarean rate, Mexico City with a 27% cesarean rate and Puerto Rico with a 24 to 27% cesarean rate (Notzon, 1990; & Notzon, Placek, & Taffel, 1987).

In Rio de Janeiro the caesarean section rate is around 90% (Drife, 2002). In China, county hospitals had rates of 30%, whereas district hospitals had rates of 73% (Qiàn, et al., 2001). Such worldwide differences in rates indicates cesareans are not related as much to maternal or fetal factors as much as cultural, technological, geographical and social factors (Klein, 1988; Menticoglou, 1997; & Wagner, 2000).

The indications for cesarean sections are vast. One account states that a cesarean section is indicated whenever a practitioner makes the judgment that "the risk of vaginal delivery exceeds the risk of the operation or that the mother's perception is that it does" (Chamberlain, & Steer, 1999). The main indications for cesarean sections in Canada and the US are 1) previous cesarean section, 2) dystocia, and 3) fetal distress (Holmes, Oppenheimer, & Wu Wen, 2001). According to Ontario data from 1979 to 1982, the main indications for cesarean section were previous cesarean at 68%, followed by 11% for breech, dystocia, and fetal distress combined (Anderson, & Lomas, 1984). In Bella

Coola the main indications for cesarean section were dystocia, previous cesarean section, breech, and fetal distress.

5.4 Perinatal Mortality Rate

Bella Coola's perinatal mortality rate (PMR) was between 44 and 50 per 1000 live births in the 1940's to 1950's; the PMR was 10.8 per 1000 live births in the 1970's, and for the last 10-15 years the PMR has been approximately 5 per 1000.

The trends in perinatal mortality and low birth rates reported for Bella Coola are comparable to provincial, federal and international rates reported elsewhere. From 1940-1960, Bella Coola's PMR is higher than Canada's, it is lower than Canada's in the 1970's, and again higher in the 1980's and about the same for the 1990's. Because of the relatively small number of births per year and within a decade, fluctuations in the perinatal mortality rate are to be expected. Some authors believe such fluctuations make perinatal mortality rate a poor indicator of rural obstetrical care or safety (Grzybowski, Cadesky, & Hogg, 1991).

North American perinatal mortality rates are in the order of 10 per 1000 births (Nault, 1997). Sweden has maintained one of the lower perinatal mortality rates among international countries and had a PMR of 9.4 in 1978 compared to 14.0 in Alberta in 1974 (Ohlsson, & Fohlin, 1983).

Although there is a certain rate of expected intrauterine deaths, there appears to be a decline in stillbirths in the Bella Coola Valley (BCV) from the 1940's to the 1990's. This may be attributed to an increase in the level of prenatal care, nutrition, and general living conditions that have changed over time or may be related to increased knowledge of obstetrical practices and referrals of high-risk women to other facilities that impact Bella Coola's statistics. Whatever the reasons, Bella Coola Hospital illustrates apparently improved perinatal outcomes overtime regardless of the extenuating factors.

Table 15: Perinatal Mortality

PMR (#/1000)	*1940's*	*1950's*	*1960's*	*1970's*	*1980's*	*1990's*
US				*20.2 – 24.5***		*7.5*
Canada		*37.9****	*28.4****	*12.8-21.8****	*8.7-10.9****	*8**
British Columbia				*17.3**	*10.0**	*7.5**
Bella Coola	*43.8*	*51.6*	*32.9*	*10.8*	*12.6*	*5*

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***Baskett, T.F. and McMillen, R.M.*
****Special Committee on Obstetrical Care(1987)*

The current trend towards centralization of obstetric services is difficult to justify based on the data presented in this paper. Forcing rural women to give birth away from friends and support systems, in high technology 'baby delivering' factories, under the wing of health care strangers may not actually be in their best interests (Grzybowski, 1998; & Royal College Of Obstetricians and Gynaecologists, 2002).

The data presented in this paper support the position(s) that 1) rural obstetrical care is safe, 2) rural family physicians can practice obstetrics without an obstetrician, and 3) maternity and neonatal care should be provided as close as possible to the rural patient's home location (Iglesias, 1999; Gagne, et al., 1998; Iglesias, S., et al. 1998; Iglesias, Klein, Gagne, & Lalonde, 1998).

CHAPTER 6: RESEARCH IMPLICATIONS

6.1 Limitations

The data presented in this thesis provides detailed insights into the practice of rural obstetrics in one rural community over a 60-year period. As with most data sets, this data set is not perfect. First of all, the study population size of 2373 deliveries may not be large enough to capture significant differences involving rarely occurring events such as maternal mortality; that is, certain variables studied are at risk of suffering a type II statistical error – false negative finding. Maternal mortality rates for Canadian women are presently in the order of 1 in 10,000 births (Hoyert, Danel, & Tully,). We do believe

the population studied was large enough for the study variable of episiotomy, cesarean section rates, and perinatal mortality.

A second limitation of the data relates to the fact that since the late 1970's an increasing number of women have been choosing to deliver their babies out of the Bella Coola Valley. Local residents and health professionals who worked in Bella Coola during the 1950's, 1960's, and 1970's state that very few women went out to deliver their babies prior to the start of the 1980's. The Bella Coola airstrip was paved and extended in 1977 and this allowed for medical evacuations by provincial ambulance jet. Therefore it is unknown as to whether the outcomes were better or worse for women who delivered outside of the community.

The development of a rapid medical evacuation system is an important factor in more and more women being transferred elsewhere to deliver, and more and more women being told that they should deliver elsewhere because of the possibility there would be no cesarean section coverage during the time of their delivery. Nevertheless, Vital Statistics information reveals that over the past 15 years, over 80% of women living in the Bella Coola Valley were still giving birth at the Bella Coola General Hospital.

Lynch et al. reviewed obstetric outcome data obtained from British Columbia Vital Statistics for women who listed the Bella Coola Valley as their home residence. Obstetric outcomes for women who gave birth at the Bella Coola General Hospital were also compared to outcomes reported for women who delivered elsewhere over the time period January 1, 1986 to December 31, 2000 (Lynch, Thommasen, & Grzybowsky, currently submitted to CMAJ). A finding was that more of the women who delivered elsewhere had a cesarean section (31% vs 12%). Other results seem comparable. Statistical analyses revealed no significant differences in obstetrical outcomes between native and non-native women. A summary of that data is presented in table 16.

Table 16: Summary of results (%) for all BCV women in both cohorts from 1986 – 2000

Variable	Local (BCGH)	Elsewhere	Total
Population	570	247	817
Vaginal Delivery	88%	69%	82%
Cesarean Section	12%	31%	18%
Epidural	16%	NA	NA
Episiotomy	9%	NA	NA
VBAC*	4%	NA	NA
Forceps / Vacuum	10%	6%	9%
Maternal Mortality	0	0	0

NA = data not available
*VBAC = vaginal birth after cesarean section

A third limitation of the data is that definitions and perceptions of perinatal conditions may have changed over time. For example, the definition of perinatal mortality has changed over time based on weight, whereas some institutions may calculate or classify according to older literature (Nault, 1997). Since there is no way of knowing in what week of gestation a stillbirth occurred it has been simply listed as 'stillbirth' on the labour and delivery sheets, all stillbirths listed in the data were included in the calculations. It was assumed medical staff were basing the diagnosis on the proper medical definitions of the time but there is no way of knowing if some "stillbirths" were omitted and if some "spontaneous abortions" were included as a stillbirth.

A fourth limitation pertains to mortalities that may have occurred beyond the early post partum period. There were probably perinatal deaths occurring after the first few days of delivery that were not recorded on the labour and delivery forms. There were some neonatal deaths recorded in the labour and delivery book that occurred a few weeks post delivery but we do not know how comprehensive or uniform the recording of these later deaths was.

Lastly, the data reported here were for only one rural, remote, hospital and it is not clear how applicable these results are to other rural, remote hospitals. Even though the transfer rate of women would have been probably limited, prior to the airstrip, the hospital based nature of the data does not allow for comparisons to other populations or population based cohorts.

Implications for Practice

Bella Coola appears to use a low intervention philosophy to obstetrical interventions. Other practice implications include how to shift from best practice guidelines into actual practice. Recommendations to decrease cesarean sections rates has not made a dramatic impact on the rates as best practice recommendations did the forcep use and episiotomy rates. This implies that there are other factors other than knowledge of guidelines that impact on this procedure such as the fear of litigation, the normalization of cesarean section, and the expectations of perfect birth outcomes.

Implications for Future Research

Perhaps people working in other rural hospitals could look in their old safes to see if they too, have similar obstetric data sets that could also be summarized and compared to the results presented in this thesis.

Future research into what factors influence decision making in physicians in rural verses urban is warranted in order to understand what would impact or assist in decreasing forcep, episiotomy, and cesarean section rates to meet the current recommendations. As well, it would be of interest to research physician characteristics how other factors such as culture, education, personality, experience and others influence low versus high intervention approaches in obstetrical practices.

Implications for Health Policy

This study illustrates that to increase physicians practicing rural obstetrics there needs to be changes made to the education of physicians. There is a need to provide appropriate training for rural practice as well as offering educational opportunities for practicing physicians (The College of Family Physicians of Canada, 2002). As well in order to decrease certain interventions there needs to be better evaluation and critique of current rural and urban obstetrical procedures and a way of encouraging facilities to lower their rates without disciplinary actions. Decreasing cesarean sections and encouraging vaginal birth after cesarean is a logical model with a sound body of research with positive economical and patient outcomes.

CONCLUSION

The data presented in this research thesis supports the position that rural hospitals like the Bella Coola General Hospital have been offering, and continue to offer relatively safe obstetric services to local residents. The absence of immediate specialist backup and advanced technological support has not resulted in an obvious substandard level of maternity or obstetrical care.

Trends in maternal mortality, perinatal mortality, as well as in use of episiotomy, forceps, vacuum extraction, and cesarean section mirror that recorded for British Columbia, Canada, and the United States. Episiotomy, forceps, and cesarean section rates were, however, lower than rates reported for British Columbia, Canada, and the United States suggesting the physicians in Bella Coola had a low interventionist philosophy. The newborn condition data is unique and there is nothing with which to compare it at this time.

The results in this thesis are relevant to both health care planners and to women struggling to decide whether they should stay or leave their isolated rural communities to give birth. Local residents can be reassured that choosing to stay home does not expose them to greater perinatal risk. Being able to stay in their home community for delivery has many benefits including 1) a avoidance of travel and accommodation risk and costs; 2) the avoidance of unnecessary specialist consultation; and 3) statistically lower rates of adverse perinatal outcomes. The obstetric literature strongly suggests that there are worse outcomes associated with delivering low risk mothers in large tertiary care centers.

With Canada's vast geographic area and large rural base, there is an obvious need for rural obstetrical care. Studies report better labour and delivery outcomes if 'low risk' rural woman give birth in their own community surrounded by family and friends (Gagne et al., 1998). There is also ample evidence to support the claim that rural obstetrical care is safe and that rural family physicians can practice obstetrics without an obstetrician (Hutten-Czapski, 1998). The joint position of the SOGC, the SRPC and the College of Family Physicians of Canada is that maternity care should be provided as close as possible to the rural patient's home location, within the limits of safe practice, regardless of on-site C section support (Gagne, et al. 1998, Iglesias, et al. 1998; & Iglesias, Klein, et al. 1998).

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Definitions

Best Practices: Planning and/or operational practices that have proven successful in particular circumstances. Best practices are used to demonstrate what works and what does not and to accumulate and apply knowledge about how and why they work in different situations and contexts (Definitions of Best Practices on the web, 2004).

Caesarean Section: removal of the fetus by means of an incision into the uterus, usually by way of the abdominal wall (Thomas, 1989).

Episiotomy: Incision of perineum at end of second stage of labor to avoid spontaneous laceration of perineum and to facilitate delivery (Thomas, 1989).

Evidenced Based Medicine: Practicing medicine by using a set of evolving principles, strategies, and tactics, and is based on the premise that practitioners are aware of the evidence to support their clinical practice (Kaczorowski, 1998).

Forceps: A tool used in expediting vaginal delivery in times of fetal or maternal complications (Steinitz, & Osmun, 2001).

Low Birth Weight (LBW): A birth weight of less than 2.5 kilograms (Unicef, 2004).

Maternal Mortality Rate (MMR): The number of maternal deaths due to delivery and complications of pregnancy, childbirth and the puerperium, per 10,000 live births (Special Committee on Obstetrical Care, 1987).

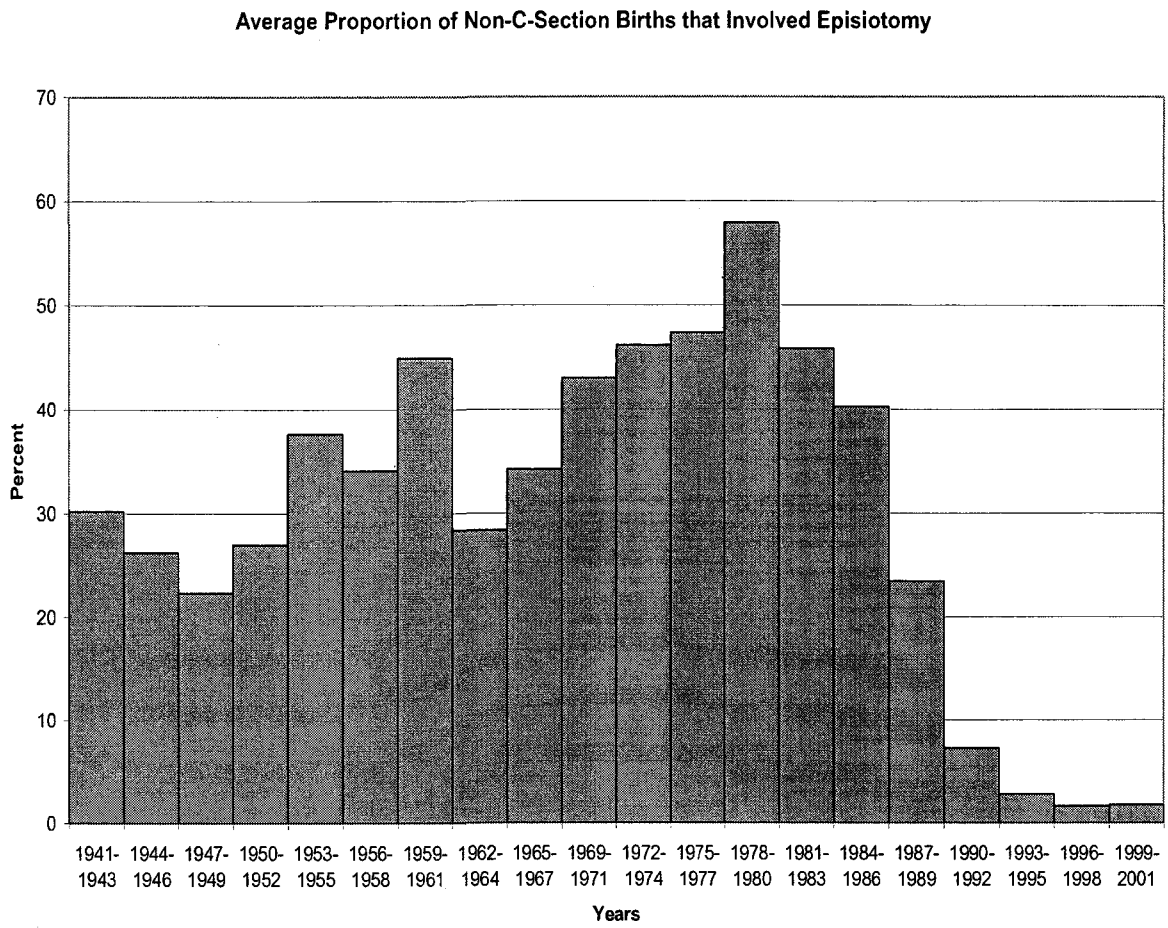
Operative Delivery: Refers to cesarean sections,

Perinatal Mortality Rate (PMR): The number of stillbirths of 500 grams or more (28 or more weeks gestation), plus infant deaths at under 7 days of age, per 1000 total births (Special Committee on Obstetrical Care, 1987).

Rural Hospital/Obstetrics: "Rural remote" as communities ranging from 80 to 400 km from a major regional hospital and "rural isolated" as communities more than 400 km away or about 4 hours transport time in good weather and "rural close" as widely dispersed population that are serviced by a hospital that is within 80 km of small urban centers (Iglesias, 1998).

Vacuum Extractor: Device, using a suction cup attached to the fetal head, for applying traction to the fetus during delivery (Thomas, 1989).

Graph 2



Graph 2: Average Proportion of non-C-section births involving Episiotomy

Figure 1: Location of the Bella Coola Valley

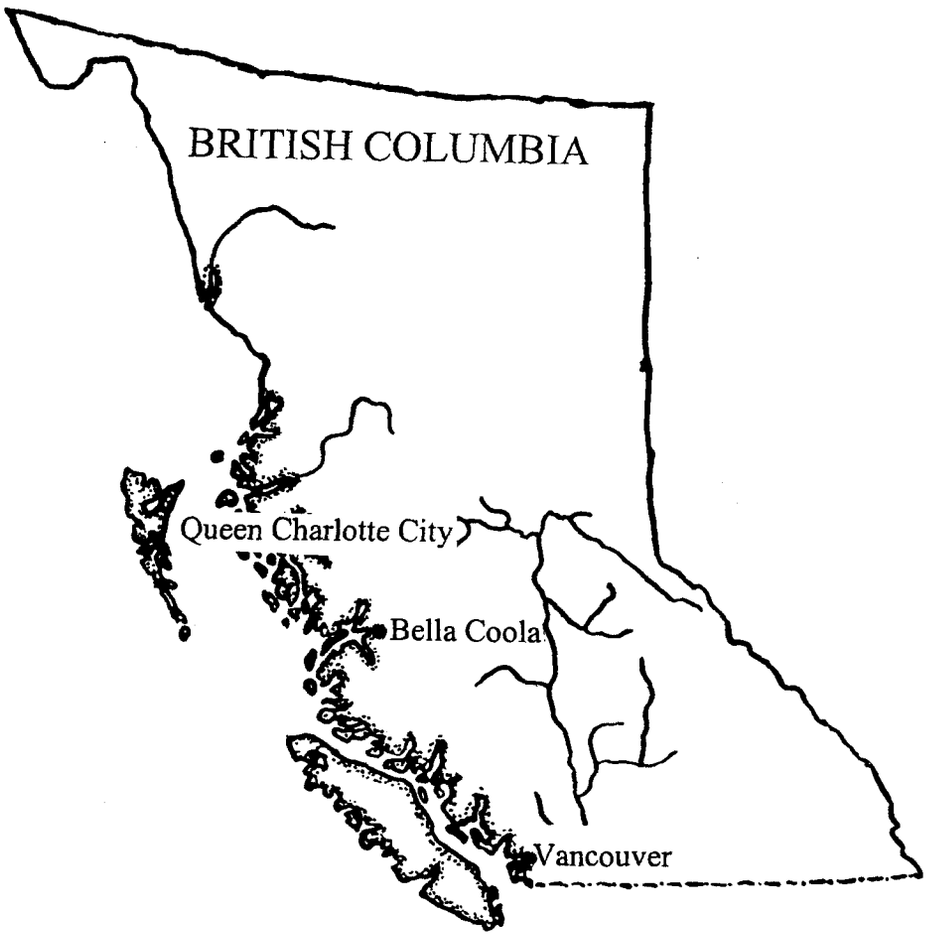


Figure 2: Bella Coola Region