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Perinatal outcomes at Bella Coola General Hospital: 1940 to 2001

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Objective: To describe perinatal outcomes (mortality, weight, condition at birth) at an isolated, rural hospital.
Design: A retrospective cohort study.
Study population: Neonates born to women beyond 20 weeks' gestation who delivered in the Bella Coola General Hospital (BCGH) between Mar. 7, 1940, and June 9, 2001, inclusive.
Main outcome measures: Information collected from the labour and delivery case room record book includes Aboriginal status, date of delivery, birth weight, newborn mortality, and newborn condition at birth.
Results: There were 2373 deliveries, including 12 sets of twins. Total newborn mortality rates declined from approximately 4.7% in the 1940–1954 time period to 0.7% in the 1970–1984 time period and have remained near that level ever since. From 1940–1960 BCGH's perinatal mortality rate was higher than Canada's; it was lower than Canada's in the 1970s, higher in the 1980s and about the same for the 1990s. The condition of the vast majority (approximately 90%) of newborns was described as being "good" at birth. Approximately 5% of newborns had birth weights < 2500 g, and this has not changed much over the years. In the 1951–1962 time period Aboriginal women had a higher percentage (8%) of infants with birth weight < 2500 g compared with non-Aboriginal women (5%), but this percentage has declined over time to the point where the rate for both groups is now around 5%.
Conclusions: Women giving birth in the low technology environment of the BCGH experienced acceptable neonatal outcomes. Trends in perinatal mortality, morbidity and low-birth-weight rates mirror those recorded for Canada.

Objectif : Décrire les résultats périnataux (mortalité, poids, état à la naissance) dans un hôpital rural isolé.
Conception : Étude de cohorte rétrospective.
Population de l'étude : Nouveau-nés, nés après 20 semaines de gestation de femmes ayant accouché à l'Hôpital général Bella Coola (BCGH) entre le 7 mars 1940 et le 9 juin 2001 inclusivement.
Principales mesures de résultats : L'information tirée du registre des cas de la salle de travail et d'accouchement comprend le statut d'Autochtone, la date de l'accouchement, le poids à la naissance, la mortalité néonatale et l'état du nouveau-né à la naissance.
Résultats : Il y a eu 2373 accouchements, dont 12 paires de jumeaux. Les taux totaux de mortalité chez les nouveau-nés ont chuté d'environ 4,7 % entre 1940 et 1954 à 0,7 % entre 1970 et 1984, et sont demeurés à peu près à ce niveau depuis. Entre 1940 et 1960, le taux de mortalité périnatale à l'hôpital BCGH était plus élevé que dans l'ensemble du Canada. Il a été moins élevé dans les années 1970, plus élevé dans les années 1980 et à peu près le même dans les années 1990. L'état de la grande majorité (environ 90 %) des nouveau-nés a été jugé «bon» à la naissance. Environ 5 % des nouveau-nés avaient un poids à la naissance inférieur à 2500 g, pourcentage qui n'a pas beaucoup changé au fil des ans. Entre 1951 et 1962, les femmes autochtones ont donné naissance à un pourcentage plus élevé (8 %) de bébés pesant moins de 2500 g à la naissance que les femmes non-autochtones (5 %), mais ce pourcentage a diminué au fil du temps et se situe maintenant pour les deux groupes à environ 5 %.

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Conclusions : Les femmes qui ont accouché dans l'environnement à faible technologie de l'Hôpital BCGH ont eu des résultats néonataux acceptables. Les tendances de mortalité et morbidité périnatales, ainsi que du faible poids à la naissance, sont à l'image de celles du Canada dans l'ensemble.

Introduction

With each passing year there are fewer rural hospitals providing obstetric services, and the result is that more and more rural women are being referred to secondary and tertiary care centres to deliver their babies.[1–9] It is generally assumed that management of these women by highly skilled obstetrics teams located in these secondary and tertiary care centres will result in lower maternal and neonatal adverse outcomes.

Interestingly, some studies have shown that low-risk women living in rural communities who deliver in secondary and tertiary hospitals have higher rates of complicated deliveries and higher rates of prematurity compared with low risk women who deliver in their local community hospital, and the newborns require more neonatal care.[6,7,10,11] This subject requires more attention. In particular, there continues to be a surprising lack of baseline data available on the subject of maternal and neonatal outcomes in the rural setting.

A retrospective cohort study of 2373 consecutive deliveries between 1940 and 2001 at the Bella Coola General Hospital (BCGH) revealed that women giving birth in this rural and remote hospital experienced low obstetric procedural rates with excellent maternal outcomes.[12]

This paper uses the same database to answer perinatal-related questions:

1. What was the perinatal mortality rate (PMR) at BCGH over this time period?
2. What was the low-birth-weight rate for BCGH over this time period?
3. Did the description of newborn condition change significantly over this time period?
4. How do BCGH's newborn outcome rates compare to provincial, national and international trends?

Methodology

Description of the community

The Bella Coola Valley is located within the rugged coastal mountains of northwestern British Columbia (BC).[13,14] Highway 20 provides the main access to the Valley. The BCGH is located in the town of Bella Coola and serves a geographic region that includes the communities of Bella Coola, Hagensborg, Firvale, Stuie, Anaheim Lake and Nimpo Lake. BCGH is one of the most isolated health care facilities in BC. The closest referral hospital is over 450 km by road to Williams Lake or a 2-hour flight to Vancouver.

According to the 2001 Census, 2289 people live in the Bella Coola Valley.[15,16] At least 40% of the population are Aboriginal, most being of Nuxalk decent. The Nuxalk Nation is a tribe of Salish-speaking Coastal Indians who settled in the Valley but formerly lived throughout the surrounding BC Central Coast area.[14,17–19]

Study population

The study population consisted of women beyond 20 weeks' gestation who delivered at BCGH between Mar. 7, 1940, and June 9, 2001, inclusive. Specific information collected from the labour and delivery case room record book included Aboriginal status, date of delivery, birth weight, newborn mortality and newborn morbidity or complications. Information used to determine Aboriginal status of these women is described in detail in the accompanying Original Article[12] on page 13.

Newborn condition

Apgar scores were not used until Sept. 11, 1971. Prior to 1971 the physician would describe the condition and colour of the infant. A scoring system was set up to describe the condition of the infant in a simple manner over the entire study period (Table 1).

Ethics

This research project was carried out in a participatory fashion, following the recommendations outlined in the Society of Obstetricians and Gynaecologists of Canada (SOGC) 2001 policy statement "A Guide for Health Professionals Working with Aboriginal Peoples.[20–22] Prior to collecting data we

obtained letters of support from the Nuxalk Band Council, from the Bella Coola Transitional Health Authority and the Central Coast Regional District for a comprehensive study on a broad range of determinants of health for people living in the Bella Coola Valley. Ethics approval to collect these data was then obtained from research ethics committees located at both the University of British Columbia, and the University of Northern British Columbia. The results and the manuscript were reviewed and approved for publication by both Nuxalk Health professionals and health professionals from the United Church Health Services, which owns and operates BCGH.

Results

Birth trends

There were 2373 deliveries involving 2361 women (12 twin births) between Mar. 7, 1940, and June 9, 2001, at the BCGH. There was a steady increase in births until the early 1960s, and then a decline throughout the '60s and '70s, with another increase in the early '80s, followed by a gradual decline thereafter. Data were missing for the time period Mar. 21, 1967, through to Jan. 7, 1969, inclusive. That is, there was an entry on Mar. 20, 1967, and the next entry was on Jan. 8, 1969. Aboriginal and non-Aboriginal deliveries are summarized in Table 2.

Gravida status was available for the majority of women (2318/2361). From the 1940s to 1960s average gravid score was between 3.6 and 3.8 for the entire population. This dropped to 2.4–2.6 between the 1970s and 2001. Aboriginal women had higher gravida scores compared to other women, though this difference has declined over time (Table 3).

Table 1. Newborn morbidity scoring system

Physician description	Apgar score	Morbidity score
Good or Excellent	8,9,10	1
Fair, Slow to breathe, or Cyanosed	6,7	2
Poor, Difficult breathing, or Resuscitated	≤ 5	3
Stillbirth	0	4

Twin data

According to the available data, there were 12 sets of twins; 9 sets born to non-Aboriginal women (Table 4). Four (1 Aboriginal female, 1 non-Aboriginal female, and 2 non-Aboriginal males) of the 24 twin newborns died. These deaths all occurred between 1955 and 1969. Two of the 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 premature Aboriginal female, who died 7days after delivery.

Perinatal mortality

PMRs are summarized in Table 5. Newborn mortality rates declined from approximately 4.7% in the 1940–1954 time period to 0.7% in the 1970–1984 time period and have remained around that level ever since.

Since BCGH lacks the numbers to calculate a true PMR, a calculation was performed to get the

Table 2. Summary of Aboriginal and non-Aboriginal deliveries during the study period, 1940 to 2001

	Time period			
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

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

PMR for BCGH during the study period: the number of perinatal deaths was divided by the number of live births (including twin births), and then multiplied by 1000. Perinatal mortality included stillbirths, antenatal deaths, intrauterine deaths and deaths up to a week after birth (see Table 6).

Newborn condition at birth

Information on condition of newborns at birth is summarized in Table 7. The data below show that the condition of the vast majority of newborns (approximately 90%) was described as being "good" at birth over most of the study period.

Newborn weight data

Mean weights for newborns are summarized in Figure 1. The data show that mean weight for both Aboriginal and non-Aboriginal newborns has not really changed much over time.

Low birth weight

Low-birth-weight rate is defined as the proportion of live births with a birth weight less than 2500 g. For this study the birth weight data were available for 1793 newborns, beginning around 1951, except for the period from 1978–1984. Aboriginal women appeared to have a higher percentage of infants with birth weight of < 2500 g, but this percentage declined over time to the point where the rate is similar to non-Aboriginals, at around 5% (Table 8).

Discussion

The data presented in this paper provide detailed insights into the practice of rural obstetrics in one rural community over a 60-year period. Perinatal death rates for both Canada and the Bella Coola Valley have declined steadily since the 1950s (Table 9).[23–25] From 1940–1960, Bella Coola Valley's PMR is higher than Canada's, it is lower than

Table 4. Summary of data on twin births during study period

	Time period				
No. of twin births	1940–1954	1955–1969	1970–1984	1985–2001	Total
Aboriginal	1	1	0	1	3
Non-Aboriginal	2	3	4	0	9
Total	3	4	4	1	12

Table 5. Newborn mortality (total study population)

No. of newborns (and %)	Time period			
	1940–1954	1955–1969	1970–1984	1985–2001
Total no. of births	450	676	617	630
Stillborn	13 (2.9)	13 (1.9)	4 (0.7)	5 (0.8)
Died within 24 h	4 (0.9)	12 (1.8)	0 (0.0)	2 (0.3)
Died within 1–30 d	4 (0.9)	2 (0.3)	0 (0.0)	0 (0.0)
Total no. of deaths	21 (4.7)	27 (4.0)	4 (0.7)	7 (1.1)

Table 6. Perinatal mortality rates (PMR) for Bella Coola General Hospital, during the study period

	Decade					
	1940s	1950s	1960s	1970s	1980s	1990s
No. of women	251	443	425	368	475	399
No. of births*	253	447	426	370	478	399
No. of maternal deaths	0	0	0	0	0	0
No. of newborn deaths	11	22	14	4	6	2
PMR (no./1000 births)	43.8	49.2	32.9	10.8	12.6	5.0

*There were 12 sets of twins born during the study period.

Canada's in the '70s, higher in the '80s, and about the same for the '90s. Because of the relatively small number of births per year and within a decade, fluctuations in the PMRs are to be expected. Some authors believe such fluctuations make PMR a poor indicator of rural obstetrical care or safety.[26] These reductions are attributed to improved health, nutrition and living conditions for mothers; improvements in the level of prenatal care delivered; better parity distribution; and better cooperation between physicians and obstetricians within effective regionalization.[27]

Perinatal mortality is associated with low birth weight which, in turn, is associated with a great number of variables.[28] Identified maternal risk factors for low-birth-weight babies include: age < 18 or > 35; primiparity or parity of more than 3; being in manual or non-manual work; being less than 158 cm tall; attending antenatal care after 18 weeks' gestation; having diabetes or urinary tract infection; pre-eclamptic toxemia, antepartum hemorrhage; being a smoker; being of Asian origin; and having a history of infertility.[29] Other risk factors include bacterial vaginosis, high perceived stress, cocaine use, women living without partners, women with uterine or cervical anomalies, and asymptomatic bacteriuria.[30] A number of these risk factors can be modified if at-risk women are identified early or the woman makes changes in her lifestyle. Birth weight is thought to be a reflection of socio-economic status and the quality of medical care received before birth.[28] It is believed that communities with high rates of low-birth-weight babies can benefit from interventions and referrals to appropriate community resources.

Approximately 5% of BCGH newborns have birth weights < 2500 g, and this has not changed much over the years. Aboriginal women seemed to have a higher percentage of infants with birth weights of < 2500 g. The percentage has decreased over time, and the rate is now similar to that of non-Aboriginals. Studies of birth weight reveal higher average birth weight for North American native populations compared to other North American populations.[31] According to BC Vital Statistics Agency, the low-birth-weight rate for Aboriginal people in 2000 was 5.2% and for other British Columbians in 2000 it was 5.1%. BC Vital Statistics has information on low-birth-weight births among Status Indians dating back to only 1991. Prior to 1991, Vital Statistics did not routinely collect information on a newborn's Aboriginal status. Consequently, the comparison of Aboriginal birth-weight data to that of non-Aboriginals is problematic

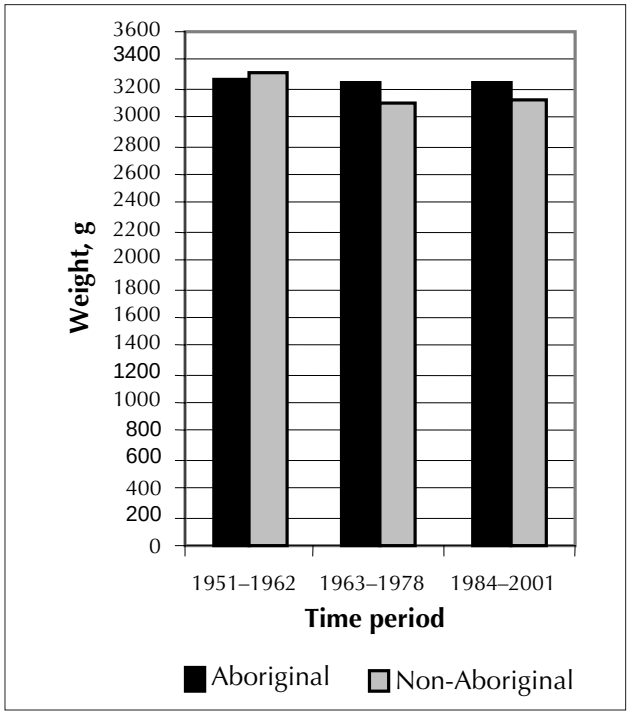


Fig. 1. Weight at birth for Aboriginal and non-Aboriginal newborns

Table 7. Condition of newborn at birth, born at Bella Coola General Hospital during the study period

	Decade					
	1940s	1950s	1960s	1970s	1980s	1990s
Total no. of births	253	447	426	370	478	399
Condition of newborn, % of total						
Good	91	90	90	84	92.5	96
Fair	2	3	3	8	5	3
Poor	2	3	3.5	2	0.4	1
Stillborn	3.5	2.5	1.4	0.5	1	0
Information missing	1.5	1.5	1.9	6	1	0.25

because no one is really sure what should be considered normal for Aboriginal people.[31,32]

Data presented in this paper suggest rural hospitals such as the BCGH have been offering, and continue to offer, relatively safe obstetric and neonatal services to local residents. The absence of immediate specialist back-up and advanced technological support has not resulted in an obvious lowering of perinatal care. Such data support the position that neonatal care should be provided as close as possible to the rural patient's home.[7,18,33] The current trend toward 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 care of health care strangers may not actually be in their best interests.[34–36]

Our results 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 home and deliver has many benefits, including 1) avoidance of travel and accommodation risk and costs; 2) the avoidance of unnecessary specialist consultation; and 3) lower rates of some adverse perinatal outcomes.[6,7,10,11]

Limitations

Our historic data set has some limitations. First of all, definitions and perceptions of 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.[24,25] Since there was no way of knowing in what term week the stillbirth occurred (and therefore it is just listed as "stillbirth" on the labour and delivery sheets), all stillbirths listed in the data were included in the calculations. It was assumed that 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 second limitation pertains to mortalities that may have occurred beyond the early postpartum 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 postdelivery but we do not know how comprehensive or uniform the recording of these later deaths was. Finally, since Apgar scoring did not come into effect until 1971 — over 30 years after our data collection begins — it is impossible to know how accurately the 4-point scoring system describes infant condition over the entire study period. We do believe that the scoring system intuitively makes sense, and encourage others to use it so that comparisons can be made with other historic data sets.

Conclusion

Women giving birth in the low technology environment of the BCGH experienced acceptable neonatal

Table 8. No. of infants born during the study period who weighed < 2500 g (i.e., low birth weight)

	Time period		
Ethnicity and no. of infants	1951–1962	1963–1978	1984–2001
Total no. of Aboriginal infants	254	285	334
No. (and %) < 2500 g	21 (8)	16 (6)	15 (5)
Total no. of non-Aboriginal infants	300	275	345
No. (and %) < 2500 g	14 (5)	13 (5)	15 (4)

Note: Weight information for the years 1978 and 1984 was incomplete or unavailable.

Table 9. Comparison of Bella Coola General Hospital (BCGH) and Canadian perinatal mortality rates (PMRs) during the study period

	Decade					
PMR (no./1000)	1940s	1950s	1960s	1970s	1980s	1990s
Canada	24–30	37.9	28.4	12.8–21.8	8.7–10.9	8
BCGH	43.8	51.6	32.9	10.8	12.6	5

outcomes. Trends in perinatal mortality, morbidity and low-birth-weight rate mirror those recorded for Canada.

Competing interests: None declared.

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