

The outcomes of perinatal surgical services in rural British Columbia: a population-based study

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Introduction: A substantial number of small surgical services in rural Canada have been discontinued in the past 15 years because of difficulties recruiting and retaining practitioners, health care restructuring and a lack of a coherent evidence base regarding the safety of small services. The objective of this study was to examine the safety of small perinatal surgical services.

Methods: We accessed perinatal data for singleton births that occurred in British Columbia between Apr. 1, 2000, and Mar. 31, 2007. We defined hospital service levels, population catchment areas surrounding each hospital and the postal codes linked to those catchment areas. Births were linked with specific catchment areas and amalgamated by service level. We made comparisons among service strata populations and adjusted for potentially confounding characteristics.

Results: A total of 87 294 births occurred during the study period. The births were distributed across 6 strata of services, which ranged from no local maternity services to services supported by obstetricians. Fifteen catchment areas were served by general practitioners with enhanced surgical skills (GPSSs), and 9174 births were included from this obstetric service level. Outcomes for surgical services provided by GPs compared favourably to those provided by obstetricians.

Conclusion: Our results suggest that small surgical services supported by GPSSs are a safe health services model to meet the needs of rural women and families.

Introduction : Plusieurs raisons expliquent la fermeture d'un nombre substantiel de petits services chirurgicaux en milieu rural ces 15 dernières années au Canada : difficulté à recruter et à fidéliser les médecins, restructuration des soins de santé et manque de preuves cohérentes à l'appui de la sécurité de ces services de petite taille. L'objectif de cette étude était de vérifier la sécurité des services chirurgicaux périnataux de petite taille.

Méthodes : Nous avons accédé aux données périnatales concernant les naissances simples survenues en Colombie-Britannique entre le 1er avril 2000 et le 31 mars 2007. Nous avons défini les niveaux de services hospitaliers, délimité les bassins de populations entourant chaque hôpital et identifié les codes postaux correspondants. Les naissances ont été assorties aux différents bassins de population, puis amalgamées par niveau de services. Nous avons procédé à des comparaisons entre les populations par niveau de services, puis effectué les ajustements nécessaires pour tenir compte de variables de confusion potentielles.

Résultats : En tout, 87 294 naissances ont eu lieu au cours de la période de l'étude. Les naissances ont été distribuées entre 6 niveaux de services allant de « absence de services locaux de maternité » à « services assurés par des obstétriciens ». Quinze des bassins de populations étaient desservis par des omnipraticiens ayant des compétences chirurgicales avancées et 9174 naissances ont été assorties à ce niveau de services obstétricaux. Au plan des résultats, les services chirurgicaux fournis par les omnipraticiens se sont comparés favorablement aux services offerts par les obstétriciens.

Conclusion : Nos résultats donnent à penser que les petits services chirurgicaux assurés par des omnipraticiens ayant des compétences chirurgicales avancées constituent un modèle de services de santé sécuritaire pour répondre aux besoins des femmes et des familles des milieux ruraux.

INTRODUCTION

Rural maternity services are being discontinued in British Columbia and across rural Canada, often because of the loss of local surgical services.¹ Without immediate access to operative backup, many rural care providers experience substantial stress related to the uncertainties of providing intrapartum care.² Because many rural catchment areas are too small to support specialist surgeons, yet are large enough to need local access to surgical care, general practitioners with enhanced surgical skills (GPSSs) and GP anesthetists play important roles in providing operative care in these circumstances. These practitioners can provide operative backup for perinatal surgical care, in spite of a relatively low procedural volume, because they can provide generalist primary care as the core part of their practices. The evidence base supporting GPSSs is not well defined; however, the literature published to date is supportive.³

Small surgical services in rural areas have not fared well in the past 15 years under regionalized health care management. Considerable pressure has been exerted to consolidate services in regional referral centres, which has led to the discontinuation of many smaller services. These service suspensions have had the most drastic impact on maternity care and have forced women and their families to leave their communities for care, sometimes travelling great distances to referral communities. The negative outcomes incurred by this population have been documented.^{4,5} Consequently, there is renewed interest in sustaining these small surgical services in rural areas, both at a community and a systems level.

A GPSS is a general practice physician who has undertaken advanced procedural training. Although skill sets vary depending on the physician's practice, common procedures include cesarean delivery, appendectomy, endoscopy, hand surgery, dilation and curettage, and herniorrhaphy.⁶⁻⁸ In 2011, 40 GPSSs were practising in BC; about two-thirds of these were trained outside of Canada.⁹ The lack of Canadian-trained GPSSs could be due to the limited training opportunities in Canada. Currently, Canada has only one training program, based in Saskatchewan, which graduates 2 GPSSs per year.¹⁰

Rural surgical teams are made up of GPSSs, GP anesthetists and operating room nurses. These teams have supported small community hospitals in rural BC and across northern Canada for the past

50 years. They have shown remarkable resilience in the face of challenges that include a lack of a consistent standardized and accredited training program for GPSSs, mixed support from specialty surgical disciplines,² a lack of a portable system of credentialing for GPSSs, and fiscal pressures to cut costs in small hospitals associated with regionalized governance.¹¹

To date, there have been a number of studies that have documented good outcomes for the selected populations that receive surgical services in these small communities. For example, several studies have assessed the outcomes of cesarean deliveries performed by GPSSs, and researchers have found comparable outcomes for procedures performed by GPSSs and surgical specialists.¹²⁻¹⁵ Deutchman and colleagues¹² found that family physicians met or surpassed reference standards for cesarean deliveries based on surgical complication rates, use of blood transfusion, Apgar scores and length of postoperative stay. Kriebel and Pitts¹³ concluded from a retrospective chart review that rural hospitals are indeed capable of providing high-quality obstetric services without the availability of specialist surgeons, and similar conclusions have been made by researchers in rural Australia.¹⁴ Research conducted in Ontario has illustrated that safe obstetric care was available in rural hospitals where cesarean deliveries were regularly performed, and perinatal mortality rates did not significantly differ between hospitals with specialists and GPSSs.¹⁵ Not only are the outcomes for cesarean deliveries performed by GPSSs comparable to those for specialist-led procedures, but they also allow for a higher proportion of women to deliver locally and have been associated with lower rates of preterm birth.¹⁶

Further evidence in support of small surgical services comes from a comparison of outcomes related to appendectomy. These results have also been favourable. Iglesias and colleagues¹⁷ compared appendectomies performed by GPSSs and specialists ($n = 4587$ procedures) across various outcome measures (i.e., mortality, diagnostic accuracy, perforation rate, length of postoperative stay, repeat laparotomy and transfer to another acute care facility). The authors found no significant differences between the 2 types of providers with respect to mortality, length of stay or diagnostic accuracy. They concluded that appendectomies performed by GPSSs were safe to be provided in rural hospitals.¹⁷ Another study in rural BC also concluded that there was no significant difference in outcomes

between appendectomies performed by GPESSs and specialists.¹⁸

This growing body of evidence on the safety and efficacy of practice by GPESSs supports this model of care as a reasonable health service delivery model. However, current data are largely a comparison of outcomes between selected populations as opposed to catchment areas. Research to date has partially accounted for referral bias by adjusting for patient complexity through regression analysis. However, an alternative method is to link and examine perinatal outcomes by population, based on maternal residence. This is the approach we have taken in the current study.

The purpose of this paper is to present findings from a population-based comparison of rural maternity care by level of service provided, with a focus on perinatal outcomes of women and newborns who reside in communities served by GPESSs.

METHODS

We conducted this retrospective population-based cohort study in BC. Using Perinatal Services BC's British Columbia Perinatal Data Registry, we accessed data for singleton births that occurred between Apr. 1, 2000, and Mar. 31, 2007.¹⁹ These data are systematically collected annually from each of the hospitals in BC and are supplemented by data for home births attended by registered midwives.¹⁹ The data represent 98% off all births in BC. We excluded data for women with residential postal codes of large urban centres of BC, specifically, Vancouver, Lower Mainland, Fraser Valley, Victoria and southern Vancouver Island. In addition, we excluded from the analysis newborns with congenital anomalies and multiple gestations.

The residential postal code of each mother was the defining variable for inclusion in the study. The postal code was linked with specific hospital service catchment areas using a mixed approach based on geographic information system mapping, cross-referenced with Google Maps.^{20–22} The distance between postal code centroids and nearest maternity services was the basis of the catchment area definition.

Service level for each hospital was established using Perinatal Services BC data, supplemented by telephone calls to local facility administrators to verify level of obstetric service in the community, where there was ambiguity in the data. When a facility changed its level of services during the study time frame, we assigned the affected years to the

appropriate service level. We used 6 obstetric service levels in this study: 1) no local services (> 60 min from maternity services), 2) primary care (no local cesarean delivery [maternity care provided by family physician]), 3) GPESS (cesarean delivery provided by GPESS only), 4) mixed model (cesarean delivery provided by GPESS or specialist), 5) general surgeon (cesarean delivery provided by general surgeon) and 6) obstetrician/gynecologist (cesarean delivery provided by obstetrician). Service level 6 (cesarean delivery provided by obstetrician) was the reference category for analysis of odds ratios (ORs).

We calculated *p* values for maternal characteristics, labour and delivery outcomes, and newborn outcomes across service levels, using 1-way analysis of variance for continuous variables and the χ^2 goodness-of-fit test for categorical variables.

Bivariate analysis was supplemented by logistic 2-step regression analysis to identify the odds of 1) perinatal mortality and 2) prematurity in each service level, compared with the highest level of service (i.e., cesarean delivery performed by obstetrician). We accounted for differences in maternal characteristics and risk status by controlling for maternal age, parity, lone parent status, pregnancy complications, proportion of First Nations people in the catchment area and level of social vulnerability in the catchment area. Challenges related to adjustments for socioeconomic status and ethnicity were addressed at an ecological (area) level, because case-linked

Table 1. Distribution of births and catchment areas, by obstetric service level

Service level	Definition	No. catchment areas	No. births
1. No local services	> 60 min from maternity services	55	4 672
2. Primary care	No local cesarean delivery (maternity care via family physician)	16	4 569
3. GPESS	Cesarean delivery provided by GPESS only	15	9 174
4. Mixed model	Cesarean delivery provided by GPESS or specialist	8	10 295
5. General surgeon	Cesarean delivery provided by general surgeon	2	3 870
6. Obstetrician/gynecologist	Cesarean delivery provided by obstetrician	17	54 714
Total		113	87 294

GPESS = general practitioner with enhanced surgical skills.

data were unavailable owing to privacy issues.

The Behavioural Research Ethics Board at the University of British Columbia and Perinatal Services BC gave ethics approval of this study.

RESULTS

Over the 7 years of the study, we accumulated data on 87 294 births. Table 1 summarizes the distribution of births across the service strata, as well as the number of catchment areas included at each service level. Figure 1 depicts the proportion of women from each service level who delivered in their local

hospital, and in referral hospitals with and without neonatal intensive care unit (NICU) beds. Neonatal intensive care unit beds are categorized as level 2 (low acuity) and level 3 (high acuity).²³ Only 25% of women delivered in their local hospital when no local surgical services were available. Communities supported by GPESs supported almost 80% of the population to deliver locally. Figure 1 shows that less than 60% of women delivered in their local hospital if served by a general surgeon model.

Table 2 shows the maternal and catchment area characteristics of the 6 obstetric service levels. Table 3 presents maternal interventions and out-

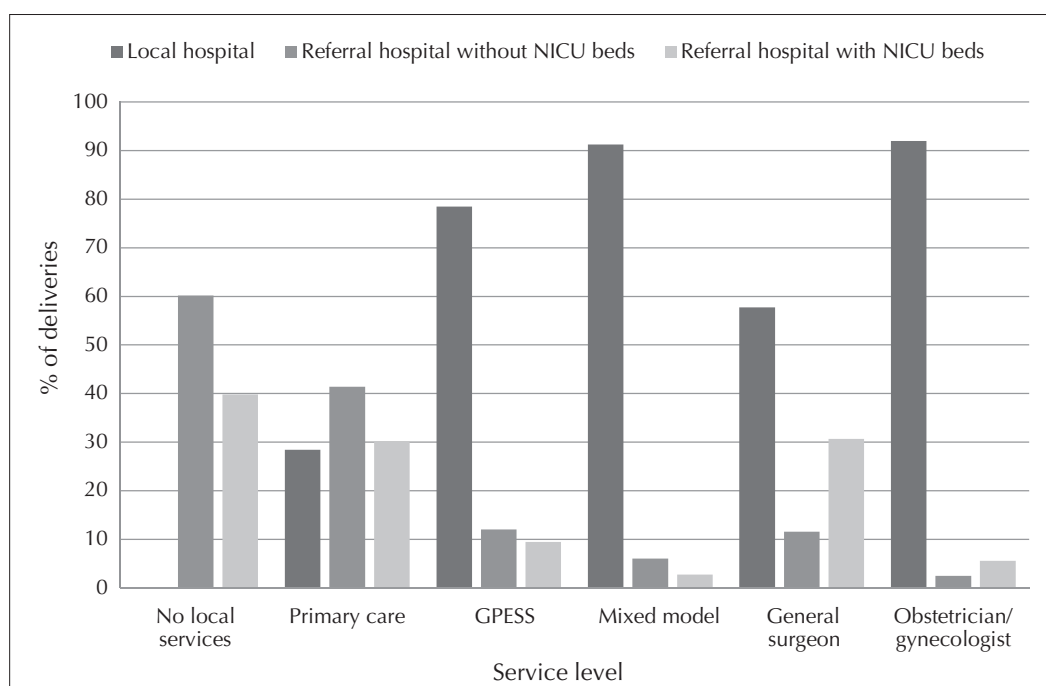


Fig. 1. Location of delivery by service level of the mother's catchment area. GPES = general practitioner with enhanced surgical skills; NICU = neonatal intensive care unit.

Table 2. Maternal and catchment area characteristics, by obstetric service level (n = 87 294)

Characteristic	Service level						<i>p</i> value
	No local services	Primary care	GPESS	Mixed model	General surgeon	Obstetrician/ gynecologist	
Maternal							
Age, mean yr	27.71	27.93	27.54	28.74	29.94	28.71	< 0.001
Nulliparous, %	39.7	40.2	38.6	42.2	46.1	42.9	< 0.001
Pregnancy hypertension, %	4.9	4.4	4.9	5.0	5.8	4.9	0.07
Gestational diabetes, %	3.0	2.9	3.1	2.4	3.3	3.5	< 0.001
Lone parent, %	9.4	6.0	7.2	6.8	4.2	7.5	< 0.001
Catchment area							
Level of social vulnerability*	0.22	0.25	0.22	−0.04	−0.17	0.15	< 0.001
Proportion of First Nations people	0.32	0.11	0.13	0.08	0.06	0.06	< 0.001

GPES = general practitioner with enhanced surgical skills.

*Catchment area level of social vulnerability for each service level is an average of BC Stats' weighed socioeconomic indices, calculated for each local health area in BC from 2000 to 2007. The index ranges from -1 (least vulnerable local health area) to 1 (most vulnerable local health area). Source: www.bcstats.gov.bc.ca/StatisticsBySubject/SocialStatistics/SocioEconomicProfilesIndices.aspx

comes, and shows significantly higher rates of cesarean delivery (OR 1.12, 95% confidence interval [CI] 1.03–1.22) for populations where surgical services are provided principally by general surgeons. Table 4 shows neonatal outcomes across the service levels. Perinatal mortality in this study was higher in primary care settings without cesarean delivery backup (OR 1.46, 95% CI 1.07–1.99) than in settings where cesarean delivery was provided by obstetricians. Prematurity was less frequent in the service level served by GPSSs (OR 0.87, 95% CI

0.79–0.95) than in the reference category. (Odds ratios for other comparisons are available from the corresponding author.) There was no difference in admission rates to level-3 NICUs, which support the most critically ill neonates who generally need ventilator support.

DISCUSSION

Our results demonstrate that the GPSSs included in this study provided safe maternity care to the

Table 3. Maternal interventions and outcomes, by obstetric service level (n = 87 294)

Variable	Service level; % of deliveries*						p value
	No local services	Primary care	GPSS	Mixed model	General surgeon	Obstetrician/gynecologist	
Epidural†	19.9	14.8	16.0	20.6	24.1	26.5	< 0.001
Induction†	23.6	21.7	22.6	25.2	24.6	24.1	< 0.001
Logistics as reason for induction†	1.9	0.8	0.8	0.4	0.7	0.3	< 0.001
Augmentation†	40.1	38.7	42.7	40.6	34.2	39.2	< 0.001
Cesarean delivery (all types)	23.0	23.4	24.9	25.6	31.2	27.2	< 0.001
Planned cesarean delivery	8.0	9.7	9.7	10.4	12.5	10.3	< 0.001
Emergency cesarean delivery	15.0	13.7	15.2	15.2	18.8	16.9	< 0.001
Assisted vaginal delivery	2.2	2.1	1.0	1.7	2.4	2.9	< 0.001
Episiotomy	8.7	12.0	9.5	11.9	12.0	12.1	< 0.001
Unplanned out-of-hospital birth‡	1.5	0.8	0.4	0.4	0.3	0.3	< 0.001
Postpartum length of stay, mean h	53.6	49.5	54.0	58.3	56.5	56.6	< 0.001
Postpartum length of stay (cesarean delivery only), mean h	83.3	75.4	78.1	84.2	80.8	81.9	< 0.001
Postpartum length of stay (vaginal delivery only), mean h	44.6	41.5	45.8	49.2	45.3	47.0	< 0.001
Transfer from another hospital	8.2	8.1	5.1	1.4	8.3	1.2	< 0.001
Transfer to another hospital	3.4	7.4	3.8	1.7	3.4	1.3	< 0.001
Postpartum hemorrhage	7.0	6.5	6.5	5.9	5.0	5.6	< 0.001
Postpartum wound infection	0.5	0.2	0.5	0.3	0.4	0.4	0.002

GPSS = general practitioner with enhanced surgical skills.

*Unless stated otherwise.

†Excludes planned cesarean deliveries.

‡Excludes home births attended by a registered midwife.

Table 4. Neonatal outcomes, by obstetric service level (n = 87 294)

Outcome	Service level; no. per 1000 births						p value
	No local services	Primary care	GPSS	Mixed model	General surgeon	Obstetrician/gynecologist	
Perinatal mortality	8	10	8	7	5	7	0.05
Stillbirth	6	9	6	6	4	5	0.02
Late neonatal death (age < 1 mo)	0	0	1	0	0	0	0.4
Infant death (age 1–12 mo)	3	3	3	2	1	2	0.2
Birth weight < 2500 g	36	40	36	37	34	39	0.4
Gestational age < 37 wk	87	66	68	69	68	76	< 0.001
Admissions to NICU-2	33	38	23	8	20	32	< 0.001
Admissions to NICU-3	6	4	4	3	3	4	0.3
Total length of stay in NICU-2, d*	262	260	179	83	169	225	< 0.001
Total length of stay in NICU-3, d*	71	35	38	32	34	49	0.6

GPSS = general practitioner with enhanced surgical skills; NICU-2 = neonatal intensive care unit, level 2 (low acuity); NICU-3 = NICU, level 3 (high acuity).

*n = 74 697; only births from fiscal years 2001/02 to 2006/07 are included for NICU outcomes.

populations they served. This was the case both in GPESS-only communities and in mixed-model communities where GPESSs worked alongside specialist surgeons. Rates of cesarean delivery for populations served by GPESSs were comparable to those of communities served by obstetricians only. Rates of premature birth for populations served by GPESSs were actually lower than for populations served by obstetricians. The steady erosion of GP-led surgical services over the past 5 years is difficult to understand in the context of these findings.

There was an increased rate of perinatal mortality in populations served by primary care with no local surgical capability. This finding is of concern. On careful examination of the individual communities, however, we found that a number of the deaths occurred in communities that were in crisis during the study period and transitioning into closure. Furthermore, at least 2 of the services in this situation were actually large enough to support maternity services with local capability for cesarean delivery.²⁴ This misalignment of services with population need may have contributed in part to the adverse outcomes.

Admission rates to level-2 NICUs varied because many of the newborns were admitted for short-stay transitional care. Admission often depends on the availability of an NICU-designated bed at the birthing hospital and the associated presence of a pediatrician on staff. Admission to a level-3 NICU bed is subject to more stringent admission criteria, which diminishes the variability. Statistical analysis of length of stay per 1000 births in level-3 NICU units is confounded by lack of normal distribution of data (i.e., one infant can count for a disproportionate number of days).

This population-based study included data on a large enough rural population over a sufficient period to support reasonable confidence in the comparisons. In this way, we can account for not only overt patient complexity and comorbidity, but also issues that are more difficult to measure, such as late presentation and unusual variation in clinical status.

Limitations

A weakness of the analysis is our inability to adjust for patient vulnerabilities at the case level, owing to privacy issues and data limitations. Consequently, we have used an ecological approach. There are a limited number of services in BC in which cesarean delivery is provided by general surgeons.²⁵ In these models, the surgeon provides the operative techni-

cal service, rather than an obstetric consult. Consequently, the locus of decision-making rests with the family physician or midwife, without the benefit of an obstetrically balanced consult. In our study, this model was associated with outcomes in which less than 60% of births occurred in the mother's home community, and the rate of cesarean delivery was high. Because of limited general surgery sites in BC, however, caution must be used in generalizing these findings. Although our sample was relatively large (deliveries attended by GPESSs = 9174), small differences in rare outcomes (e.g., rates of perinatal mortality in communities served by GPESSs compared with communities with cesarean delivery provided by obstetricians) are difficult to detect. Our team is currently engaged in an analysis of perinatal outcomes across service levels in 3 Canadian provinces. This amalgamation of data will result in a larger sample and may strengthen our confidence in the findings.

CONCLUSION

The population outcomes for small surgical services staffed by GPESSs were as good as the population outcomes for referral services staffed by obstetricians. These findings may help with the prioritization of health services planning.

Competing interests: None declared.

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Life, death and whatever else ... snippets from a medical life

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SPIRIT GIFT

Aurora borealis sears
Arctic night.
Illuminates a world
Pure white.
Domain to ptarmigan
To Arctic fox.
Earth's creatures silent
As silence pierced.
By newborn's cry
Fragile, precious
A spirit gift
For humankind.

RED BERRY TARTS

She is terminal within this
terminal life
A life of burned bridges
Unvoiced regrets
She seeks comfort
Not cure

Red berry tarts she offers
As a prior appeasement
Seal this deal
To manage her pain
Her anguish

Admittance is her final
admission
To life spent of all chances
Pain and anguish now less
constant
For shared time over red
berry tarts

I AM

It is time
For this form
A blueprint transcribed
From an ancient code
Born of primordial seas
Now weightless and caressed
Within a custom made universe
Of fluid comfort
Life giving rhythm

It is time
For that intangible tension
Reverberating
Ever more forceful
Through this universe
No longer weightless
Nor caressing
No longer fluid comfort

It is time
Familiar darkness now
Torn away by harsh light
Stunned gasp as
A wail splits time
It is time
And I am.