Perinatal outcomes of midwife-led care, stratified by medical risk: a retrospective cohort study from British Columbia (2008–2018)

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Abstract

Background: Anecdotal evidence suggests that the profile of midwifery clients in British Columbia has changed over the past 20 years and that midwives are increasingly caring for clients with moderate to high medical risk. We sought to compare perinatal outcomes with a registered midwife as the most responsible provider (MRP) versus outcomes among clients with physicians as their MRP across medical risk strata.

Methods: This retrospective cohort study (2008–2018) used data from the BC Perinatal Data Registry. We included all births that had a family physician, obstetrician or midwife listed as the MRP (n = 425 056) and stratified the analysis by pregnancy risk status (low, moderate or high) according to an adapted perinatal risk scoring system. We estimated differences in outcomes between MRP groups by calculating adjusted absolute and relative risks.

Results: The adjusted absolute and relative risks of adverse neonatal outcomes were consistently lower among those who chose midwifery care across medical risk strata, compared with clients who had a physician as MRP. Midwifery clients experienced higher rates of spontaneous vaginal births, vaginal births after cesarean delivery and breastfeeding initiation, and lower rates of cesarean deliveries and instrumental births, with no increase in adverse neonatal outcomes. We observed an increased risk of oxytocin induction among high-risk birthers with a midwife versus an obstetrician as MRP.

Interpretation: Our findings suggest that compared with other providers in BC, midwives provide safe primary care for clients with varied levels of medical risk. Future research might examine how different practice and remuneration models affect clinical outcomes, client and provider experiences, and costs to the health care system.

In British Columbia, registered midwives are autonomous, primary health care providers, regulated and integrated into the publicly funded health care system. Midwives typically work in small-team continuity-of-care models, providing medical care during pregnancy, birth and up to 3 months postpartum in the community and in hospitals. Midwives hold hospital privileges and consult with physician colleagues as medically indicated.

Since the regulation of midwifery in BC in 1998, the number of pregnant people who are attended by midwives during birth has steadily increased, from 4.8% in 2004/05[1] to 15.6% in 2019/20.[2] In 2018/19, 1 in 4 childbearing people in BC (25.4%) had a midwife involved in their care at some point during their pregnancy, birth or postpartum period.[2]

Several studies have examined the safety of midwifery care in BC after regulation. Janssen and colleagues analyzed the outcomes of low-risk clients from 2000 to 2004, providing important evidence for the safety of midwife-attended planned home births in the early years after regulation.[3] Other researchers have described good perinatal outcomes for subsets of midwifery clients in BC, including those residing in rural areas[4] and those planning vaginal births after cesarean (VBAC) at home.[5] However, these studies focused on subsamples of childbearing people or did not use recent data.

The benefits of midwife-led care for clients with more complex needs are beginning to emerge in BC. Using BC perinatal data, McRae and colleagues[6,7] demonstrated that those affected by low socioeconomic position, substance use and mental illness had lower odds of small-for-gestational-age babies, preterm birth and low-birth-weight babies when they were cared for by midwives antenatally rather than by physicians.

This analysis is part of a larger mixed-methods study that aimed to better understand the changing profile of midwifery clients in BC and the implications this has for education, research and practice. The goal of the current analysis is to present complete and recent data from all births in BC that had a midwife, family physician or obstetrician listed as the most responsible provider (MRP). Specifically, we sought to document neonatal and maternal outcomes of childbearing people who had a midwife as their MRP compared with those who had a physician as the MRP, with similar medical risk profiles.

Methods

Study population

We acknowledge that not all pregnant birthers are women or mothers. We use gendered language when referring to the BC Perinatal Data Registry (BCPDR)[8] in order to accurately represent the source. The study population comprised births in BC from 2008 to 2018 and was drawn from abstracted medical chart data from the BCPDR, a quality-controlled registry containing data for 99% of all births, including home births.[9] We linked 4 data sets using a unique identifier: core mother data set, maternal health care providers and services, maternal diagnostic codes and the newborn data set. After each linkage, we checked the sample size and stratified by fiscal year, to verify the accuracy of the linkage and to ensure data were complete for each fiscal year.

Risk stratification

The antenatal risk score we used in this study is a validated scoring tool used by the Alberta Perinatal Health Program.[10,11] The 45-item antenatal risk assessment tool includes prepregnancy demographics and health conditions, past obstetric history and problems in the current pregnancy. Higher scores show a strong correlation with perinatal mortality and morbidity.[11]

We extracted the components of the risk score from the maternal diagnostic *International Classification of Diseases, 10th Revision* codes and variables in the BCPDR. Three prepregnancy items (symptomatic heart disease with no effect on daily living, blood pressure 140/90 or greater, antihypertensive drug use) and 1 past obstetric history item (Rh isoimmunization with an affected infant) could not be included in our version of the risk tool as they were not recorded in the databases available to us. However, we included a prepregnancy history of symptomatic heart disease with an effect on daily living in our analysis, as well as indicators of hypertensive disorders in the current pregnancy (i.e., gestational hypertension, proteinuria, eclampsia) and an obstetric history of isoimmunization (Appendix 1, Supplemental Table 1, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.220453/tab-related-content).

As instructed by the Alberta Perinatal Health Program,[10,11] we assigned a weighted value to each risk variable, and the total score was the sum of these weighted values. We recoded the score into the recommended risk categories:[10] low risk (scores of 0–2), moderate risk (scores of 3–6) and high risk (scores of 7 or higher).[11]

Group assignment

The focus of our analysis was perinatal outcomes of childbearing people for whom the MRP was a midwife, compared with outcomes of those with a family physician or obstetrician as MRP. Within the BCPDR, the MRP is defined as the care provider who is responsible for the care and treatment of the client for the greatest portion of time during the stay in the health care facility, including home births. The MRP assumes responsibility for any treatment resulting from their written or verbal orders.[12] Findings from a Canadian validation study indicate that the MRP type during hospital stay aligns with the prenatal provider type in most cases. For obstetricians, the percent agreement was 93%; for family physicians, the percent agreement was 98%; and for midwives, it was 94%.[13]

The MRP type is a mandatory field abstracted from medical charts by trained coding and informatics professionals after the client is discharged from hospital. The data are then sent to the Canadian Institute for Health Information. Data pertaining to community-based midwifery care, including the planned and actual place of birth (home, hospital or unknown), are abstracted from midwifery charts and included in the BCPDR. The Canadian Institute for Health Information employs a rigorous quality control process, including verification of individual data elements, cross-referencing of interrelated data elements and regular validation studies.[14] The BCPDR employs similar quality checks.[15]

Primary and secondary outcomes

We included 4 primary neonatal outcomes and 1 primary birth outcome: perinatal death (any stillbirth or neonatal death, as determined by the Canadian Institute for Health Information Discharge Abstract Database); low birth weight of less than 2500 g; preterm birth at less than 37 weeks; Apgar of less than 7 at 5 minutes; and cesarean delivery (all types). Secondary outcomes included labour induction with oxytocin, VBAC, assisted vaginal delivery (vacuum, forceps or both), spontaneous vaginal birth (SVB), third- or fourth-degree perineal tears, and breast- or chest-feeding initiation within 1 hour of birth.

Confounders

We used most maternal prenatal confounding variables available in the BCPDR to create the prenatal risk score. We examined the remaining variables and selected those that either have a known association with adverse neonatal outcomes (i.e., prenatal substance use, rural residence, antenatal hospital admissions, history of mental health condition) or are routinely controlled for in perinatal research studies (i.e., parity).

Statistical analysis

We present descriptive statistics for each outcome across exposure groups, followed by adjusted absolute differences and relative risks and 95% confidence intervals (CIs). We obtained adjusted absolute and relative risks using logistic regression modelling, which represent marginal values obtained by averaging estimates over the adjusting variables.[16] We report relative risks rather than odds ratios to avoid inflated effects for common outcomes such as SVB.[17,18] For

each outcome, we present 8 comparisons. We applied the Tukey–Kramer correction to *p* values and CIs to maintain the family-wise error rate within each outcome.

Ethics approval

The study was approved by the University of British Columbia Behavioural Research Ethics Board (# H20-00806).

Results

There were 438 739 linked mother–baby pairs during the study period. We excluded births that were not delivered by a midwife or physician and those with unknown or no attendants (Figure 1). Twins and multiples (*n* = 7098) were included and duplicate mother IDs removed from the analysis so that each mother was linked to only 1 baby.

Of the 425 056 births included in this study, 63 151 (14.9%) had a midwife as their MRP, 189 679 (44.6%) a family physician and 172 226 (40.5%) an obstetrician. Less than 1% (*n* = 2677) had other MRPs, such as general surgeons or maternal–fetal medicine specialists, and we excluded these clients from analysis. The antenatal risk score ranged from 0 to 23, with a median score of 2. The proportion of births that had a midwife listed as MRP increased from 9.2% to 19.8% over the study period. In 2018, midwives were listed as MRP for 24.3% of low-risk, 14.3% of moderate-risk and 7.9% of high-risk births in the province, representing an absolute increase of 9.1% (low risk), 7.7% (moderate risk) and 5.7% (high risk) between 2008 and 2018.

Of the 12 169 births that took place at home during the study period, 9776 (80.3%) had low medical risk, 2329 (19.1%) moderate risk, and 64 (0.5%) were in the high-risk category. As the risk score increased, so did the proportion of midwifery and family physician clients who were delivered by obstetricians (Table 1). More family physician than midwifery clients had babies delivered by obstetricians across all risk strata (Table 1). Characteristics of clients across MRP groups are presented in Table 2.

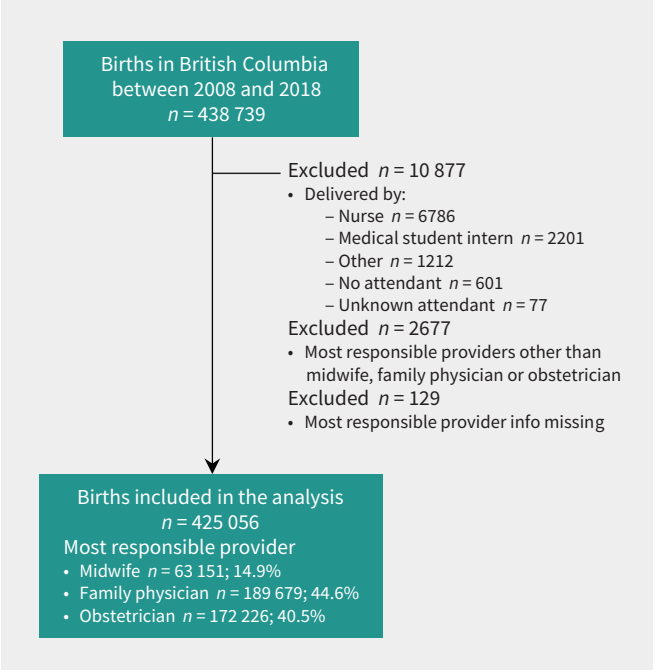

Figure 1: Flowchart showing selection of births used in the analysis.

Primary outcomes

The risk of perinatal death for midwifery clients across risk strata was similar to the risk of those under the care of family physicians (Table 3). Compared with obstetrician-led care, low- and moderate-risk clients with midwife-led care were significantly less likely to experience a perinatal death (Table 3), but the adjusted absolute risk differences were very small (Appendix 2, Supplemental Table 2, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.220453/tab-related-content). In the high-risk group, there was no significant difference in the rate of perinatal death between midwife-led and physician-led care (Table 3).

Clients who had a midwife as the MRP were significantly less likely to experience preterm birth and have a low-birth-weight baby across all risk strata, compared with those with a physician as the MRP. The adjusted relative risk of an Apgar score of less than 7 at 5 minutes was significantly lower for clients of midwives than for clients with physicians as MRP, for 7 of the 8 comparisons (Table 3). The cesarean delivery rate among midwifery clients in the low-risk group was 7.2% compared with 12.2% for family physician clients and 42.3% for obstetrician clients. Cesarean delivery rates increased for midwifery clients as medical risk increased, and were significantly lower than physician rates across all risk strata (Table 3). Low-risk clients had an absolute risk reduction of 34.4% for cesarean delivery when their MRP was a midwife compared with an obstetrician. The absolute risk difference increased to 55.3% for clients with moderate prenatal risk and 42.2% for high-risk clients (Appendix 2, Supplemental Table 2).

Table 1: Proportion of clients who were delivered by obstetricians across most responsible provider* groups (*n* = 425 056)

Risk category	No. (%) of midwife MRPs	No. (%) of family physician MRPs	No. (%) of obstetrician MRPs
All	10 229/63 151 (16.2)	40 567/189 679 (21.4)	169 044/172 226 (98.2)
Low risk (0–2)	6268/46 632 (13.4)	23 125/132 309 (17.5)	74 931/76 694 (97.7)
Moderate risk (3–6)	3438/15 437 (22.3)	14 449/51 519 (28.0)	75 934/77 142 (98.4)
High risk (≥ 7)	523/1082 (48.3)	2993/5851 (51.2)	18 179/18 390 (98.9)

Note: MRP = most responsible provider.
*MRP definition: a provider who is responsible for the care and treatment of the client for the greatest portion of the clieint's length of stay in the health care facility. The MRP assumes responsibility for any treatment provided resulting from their written or verbal orders. They may not be physically present in the health care facility. 2022 DAD Abstracting Manual: https://secure.cihi.ca/estore/productSeries.htm?pc = PCC78.

Table 2: Characteristics of clients across most responsible provider groups (*n* = 425 056)

Characteristic	No. (%) of midwife MRPs *n* = 63 151	No. (%) of family physician MRPs *n* = 189 679	No. (%) of obstetrician MRPs *n* = 172 226
Nulliparous	29 156 (46.3)	90 705 (48.1)	78 781 (46.0)
Maternal residence*			
Northern Health Authority	2022 (3.2)	21 803 (11.5)	8583 (5.0)
Interior Health	8103 (12.8)	32 931 (17.4)	18 846 (10.9)
Island Health	17 395 (27.5)	32 159 (17.0)	12 035 (7.0)
Fraser Health	19 380 (30.7)	69 943 (36.9)	76 987 (44.7)
Vancouver Coastal Health	16 016 (25.4)	31 061 (16.4)	54 410 (31.6)
Unknown health authority, or out-of-country or out-of-province residence	235 (0.4)	1782 (0.9)	1365 (0.8)
History of mental health condition†	17 564 (27.8)	34 722 (18.3)	25 280 (14.7)
Substance use during pregnancy‡	1600 (2.5)	10 284 (5.4)	5083 (3.0)
Antenatal hospital admissions (1 or more)§	2474 (3.9)	15 594 (8.2)	17 073 (9.9)
Prenatal medical risk category			
Low risk (0–2)	46 632 (73.8)	132 309 (69.8)	76 694 (44.5)
Moderate risk (3–6)	15 437 (24.4)	51 519 (27.2)	77 142 (44.8)
High risk (≥ 7)	1082 (1.7)	5851 (3.1)	18 390 (10.7)

Note: MRP = most responsible provider.
*The Health Authority of usual residence, as determined by resident postal code.
†Any history of mental illness (depression, previous postpartum depression, anxiety, bipolar disorder, other, or unknown type) before or during the current pregnancy.
‡Mother used any of the following substances at any time during the current pregnancy: heroin or opioids, cocaine, methadone, solvents or marijuana; *or* care provider lists use of prescription, "other," or unknown other drug as a risk to the pregnancy.
§Total previous inpatient hospital admissions, to any facility, for any reason, during the current pregnancy (excluding current delivery admission).

Secondary outcomes

The analysis of secondary outcomes demonstrated that low-risk midwifery clients were significantly less likely to experience labour induction with oxytocin; however, high-risk midwifery clients were more than twice as likely to be induced with oxytocin than obstetrician clients (adjusted absolute difference 11.3%). Midwifery clients were significantly less likely to have an assisted vaginal birth across most risk levels than physician clients (Table 4) and they were significantly more likely to have an SVB across all risk strata. For example, low-risk clients who had a midwife as MRP were nearly twice as likely to have an SVB (adjusted absolute difference 42.7%) than obstetrician clients, and clients of moderate risk were nearly 4 times as likely to have an SVB (adjusted absolute difference 58.3%). Rates of VBAC among eligible individuals were significantly higher if a midwife was the MRP compared with a physician in 7 of 8 comparisons reported in Table 4. The relative and absolute differences were small when comparing midwifery with family physician clients, but larger when comparing midwives as MRP to obstetricians. For example, among childbearing people with low risk, the VBAC rate was 85.3% among midwifery clients, compared with 78.6% among family physician clients and 51.5% among obstetrician clients. The prevalence of adverse maternal outcomes (blood transfusion, intensive care unit admissions, uterine rupture and postpartum wound infection) were very low for midwifery clients across risk strata (Appendix 3, Supplemental Table 3, available at www.cmaj.ca/lookup/doi/10.1503/cmaj.220453/tab-related-content). Breast- or chest-feeding at birth was significantly more common among midwifery clients across all risk strata (Table 4). There were few significant differences in perineal tears across MRP groups.

Interpretation

We found that midwives and family physicians in BC were the MRPs for similar proportions of low-, moderate- and high-risk pregnant people, countering the common impression that midwives care for predominantly low-risk clients. As medical risk increases, both midwives and family physicians collaborate increasingly and appropriately with obstetrician specialists. The study provides evidence for the safety and efficacy of midwife-led care across medical risk strata in BC. These findings align with evidence from meta-analyses of midwife-led continuity models and the global literature on the medical benefits of midwifery care.[19,20]

We used different strategies to enhance the internal validity and interpretation of the study's findings. We stratified prenatal medical risk to reduce bias caused by the unequal distribution of medical risk factors across MRP groups; we adjusted each model for parity, maternal residence and other factors outlined in Table 2 that have the potential to bias the association between MRP and perinatal outcomes; we reported relative risks rather

Table 3: Primary outcomes — descriptive statistics and adjusted relative risks comparing midwives with family physicians and obstetricians (95% confidence intervals)

	No. (%) of midwife MRPs	No. (%) of family physician MRPs	No. (%) of obstetrician MRPs	Midwife compared with family physician		Midwife compared with obstetrician	
Risk score	**Numerator/denominator**			***N***	**RR (95% CI)***	***N***	**RR (95% CI)***
Perinatal death							
Low risk	115/46 632 (0.2)	321/132 309 (0.2)	403/76 694 (0.5)	178 941	1.046 (0.811–1.350)	123 326	0.482 (0.376–0.618)
Moderate risk	72/15 437 (0.5)	319/51 519 (0.6)	531/77 142 (0.7)	66 956	0.789 (0.581–1.071)	92 579	0.675 (0.503–0.906)
High risk	19/1082 (1.8)	127/5851 (2.2)	352/18 390 (1.9)	6933	0.863 (0.488–1.525)	19 472	0.941 (0.545–1.624)
All	206/63 151 (0.3)	767/189 679 (0.4)	1286/172 226 (0.7)	252 830	0.833 (0.693–1.002)	235 377	0.437 (0.366–0.521)
Low birth weight (< 2500 g)							
Low risk	448/46 438 (1.0)	1967/131 562 (1.5)	2096/76 299 (2.7)	178 000	0.694 (0.614–0.784)	122 737	0.392 (0.347–0.443)
Moderate risk	498/15 334 (3.2)	2899/50 866 (5.7)	5594/76 534 (7.3)	66 200	0.617 (0.552–0.690)	91 868	0.460 (0.414–0.513)
High risk	178/1066 (16.7)	1348/5693 (23.7)	5296/18 098 (29.3)	6759	0.755 (0.640–0.890)	19 164	0.609 (0.520–0.713)
All	1124/62 838 (1.8)	6214/188 121 (3.3)	12 986/170 931 (7.6)	250 959	0.574 (0.532–0.619)	233 769	0.244 (0.227–0.262)
Preterm birth (< 37 wk)							
Low risk	1476/46 005 (3.2)	5298/130 363 (4.1)	4297/75 587 (5.7)	176 368	0.823 (0.769–0.881)	121 592	0.593 (0.553–0.636)
Moderate risk	1136/15 168 (7.5)	5469/50 193 (10.9)	9435/75 450 (12.5)	65 361	0.720 (0.669–0.774)	90 618	0.607 (0.566–0.651)
High risk	260/1049 (24.8)	1818/5566 (32.7)	6889/17 548 (39.3)	6615	0.794 (0.698–0.904)	18 597	0.649 (0.573–0.735)
All	2872/62 222 (4.6)	12 585/186 122 (6.8)	20 621/168 585 (12.2)	248 344	0.708 (0.676–0.743)	230 807	0.387 (0.370–0.405)
Apgar < 7 at 5 min							
Low risk	756/45 966 (1.6)	2737/130 326 (2.1)	1696/75 604 (2.2)	176 292	0.778 (0.707–0.856)	121 570	0.734 (0.663–0.812)
Moderate risk	303/15 157 (2.0)	1381/50 167 (2.8)	1868/75 481 (2.5)	65 324	0.735 (0.635–0.851)	90 638	0.763 (0.661–0.881)
High risk	48/1048 (4.6)	325/5557 (5.8)	937/17 548 (5.3)	6605	0.781 (0.547–1.115)	18 596	0.791 (0.562–1.113)
All	1107/62 171 (1.8)	4443/186 050 (2.4)	4501/168 633 (2.7)	248 221	0.741 (0.686–0.802)	230 804	0.633 (0.586–0.685)
Cesarean delivery							
Low risk	3356/46 632 (7.2)	16 171/132 309 (12.2)	32 476/76 694 (42.3)	178 941	0.579 (0.555–0.605)	123 326	0.167 (0.160–0.174)
Moderate risk	2396/15 437 (15.5)	13 328/51 519 (25.9)	52 907/77 142 (68.6)	66 956	0.593 (0.566–0.622)	92 579	0.228 (0.218–0.239)
High risk	411/1082 (38.0)	2848/5851 (48.7)	14 783/18 390 (80.4)	6933	0.779 (0.709–0.855)	19 472	0.492 (0.450–0.538)
All	6163/63 151 (9.8)	32 347/189 679 (17.1)	100 166/172 226 (58.2)	252 830	0.564 (0.547–0.582)	235 377	0.169 (0.164–0.175)

Note: CI = confidence interval, MRP = most responsible provider, RR = relative risk.
*Adjusted for parity, maternal residence, history of mental health condition, substance use during pregnancy and antenatal hospital admissions (see Table 2 for definitions). RR > 1.0 denotes a higher risk in midwives; RR < 1.0 denotes a lower risk in midwives.

than odds ratios to avoid an inflation of effects for more prevalent outcomes like cesarean delivery or SVB; and we reported adjusted absolute risk differences in addition to relative risks, to help interpret the clinical importance of findings.

Although the proportion of clients with a midwife as their MRP in BC increased more than twofold from 2008/09 to 2017/18, Canada has among the lowest rates of midwifery coverage in the world[21] and rates of cesarean delivery continue to climb. In 2019/20, the cesarean delivery rate in BC was 36.6%, the highest in Canada.[2] Our findings suggest that more continuity-based midwife-led care in BC may have contributed to keeping operative delivery rates low without compromising safety. Provincial midwifery workforce surveys have identified numerous barriers to the expansion of midwifery in BC, including dissatisfaction with pay and working conditions, scope restrictions and lack of support when caring for clients with complex social and medical needs.[22,23] Midwifery expansion must therefore be accompanied by policies and payment structures that support retention, integration and interprofessional collaboration between midwives and their physician colleagues — what the International Confederation of Midwives considers an "enabling environment for midwives."[24]

Table 4 (part 1 of 2): Secondary outcomes — descriptive statistics and adjusted relative risks comparing midwives with family physicians and obstetricians (95% confidence intervals)

	No. (%) of midwife MRPs	No. (%) of family physician MRPs	No. (%) of obstetrician MRPs	Midwife compared with family physician		Midwife compared with obstetrician	
Risk score	**Numerator/denominator**			***N***	**RR (95% CI)***	***N***	**RR (95% CI)***
Labour induction with oxytocin							
Low risk	2986/46 632 (6.4)	13 859/132 309 (10.5)	10 758/76 694 (14.0)	178 941	0.609 (0.582–0.638)	123 326	0.474 (0.452–0.497)
Moderate risk	1898/15 437 (12.3)	8559/51 519 (16.6)	9411/77 142 (12.2)	66 956	0.741 (0.701–0.783)	92 579	0.994 (0.941–1.051)
High risk	198/1082 (18.3)	1089/5851 (18.6)	1541/18 390 (8.4)	6933	0.972 (0.827–1.142)	19 472	2.202 (1.878–2.581)
All	5082/63 151 (8.0)	23 507/189 679 (12.4)	21 710/172 226 (12.6)	252 830	0.644 (0.622–0.667)	235 377	0.622 (0.600–0.644)
Assisted vaginal delivery (vacuum, forceps or both)							
Low risk	2600/46 632 (5.6)	15 985/132 309 (12.1)	11 316/76 694 (14.8)	178 941	0.463 (0.440–0.486)	123 326	0.408 (0.388–0.430)
Moderate risk	788/15 437 (5.1)	5106/51 519 (9.9)	5482/77 142 (7.1)	66 956	0.520 (0.476–0.568)	92 579	0.732 (0.670–0.800)
High risk	51/1082 (4.7)	393/5851 (6.7)	884/18 390 (4.8)	6933	0.676 (0.476–0.959)	19 472	1.031 (0.734–1.448)
All	3439/63 151 (5.4)	21 484/189 679 (11.3)	17 682/172 226 (10.3)	252 830	0.477 (0.457–0.498)	235 377	0.524 (0.501–0.547)
Spontaneous vaginal birth							
Low risk	40 676/46 632 (87.2)	100 153/132 309 (75.7)	32 902/76 694 (42.9)	178 941	1.135 (1.129–1.141)	123 326	1.919 (1.892–1.945)
Moderate risk	12 253/15 437 (79.4)	33 085/51 519 (64.2)	18 753/77 142 (24.3)	66 956	1.265 (1.248–1.282)	92 579	3.846 (3.758–3.936)
High risk	620/1082 (57.3)	2610/5851 (44.6)	2723/18 390 (14.8)	6933	1.366 (1.259–1.481)	19 472	4.529 (4.163–4.927)
All	53 549/63 151 (84.8)	135 848/189 679 (71.6)	54 378/172 226 (31.6)	252 830	1.189 (1.182–1.196)	235 377	2.882 (2.838–2.926)
VBAC†							
Low risk	864/1013 (85.3)	1183/1506 (78.6)	669/1299 (51.5)	2519	1.101 (1.049–1.155)	2312	1.716 (1.575–1.869)
Moderate risk	1943/2353 (82.6)	3659/4659 (78.5)	2447/4545 (53.8)	7012	1.063 (1.030–1.096)	6898	1.584 (1.499–1.674)
High risk	167/213 (78.4)	525/685 (76.6)	524/901 (58.2)	898	1.027 (0.928–1.137)	1114	1.388 (1.238–1.557)
All	2974/3579 (83.1)	5367/6850 (78.4)	3640/6745 (54.0)	10 429	1.072 (1.045–1.099)	10 324	1.590 (1.513–1.671)

Table 4 (part 2 of 2): Secondary outcomes — descriptive statistics and adjusted relative risks comparing midwives with family physicians and obstetricians (95% confidence intervals)

	No. (%) of midwife MRPs	No. (%) of family physician MRPs	No. (%) of obstetrician MRPs	Midwife compared with family physician		Midwife compared with obstetrician	
Risk score	**Numerator/denominator**			***N***	**RR (95% CI)***	***N***	**RR (95% CI)***
Third- or fourth-degree perineal tears‡							
Low risk	1674/28 554 (5.9)	4708/77 367 (6.1)	2941/31 814 (9.2)	105 921	0.964 (0.901–1.031)	60 368	0.650 (0.605–0.699)
Moderate risk	545/8551 (6.4)	1470/24 877 (5.9)	1263/16 755 (7.5)	33 428	1.107 (0.984–1.245)	25 306	0.910 (0.807–1.026)
High risk	22/407 (5.4)	85/1705 (5.0)	153/2219 (6.9)	2112	1.136 (0.651–1.982)	2626	0.936 (0.550–1.593)
All	2241/37 512 (6.0)	6263/103 949 (6.0)	4357/50 788 (8.6)	141 461	0.993 (0.937–1.053)	88 300	0.703 (0.661–0.747)
Breast- or chest-feeding initiation at birth							
Low risk	30 137/46 545 (64.7)	75 160/131 746 (57.0)	34 509/76 461 (45.1)	178 291	1.134 (1.122–1.146)	123 006	1.429 (1.409–1.448)
Moderate risk	9822/15 350 (64.0)	26 003/50 989 (51.0)	30 397/76 744 (39.6)	66 339	1.267 (1.243–1.291)	92 094	1.664 (1.632–1.697)
High risk	567/1057 (53.6)	2117/5704 (37.1)	4969/18 207 (27.3)	6761	1.464 (1.345–1.594)	19 264	2.000 (1.848–2.165)
All	40 526/62 952 (64.4)	103 280/188 439 (54.8)	69 875/171 412 (40.8)	251 391	1.180 (1.169–1.191)	234 364	1.618 (1.599–1.637)

Note: CI = confidence interval, MRP = most responsible provider, RR = relative risk, VBAC = vaginal birth after cesarean.
*Adjusted for parity, maternal residence, history of mental health condition, substance use during pregnancy, and antenatal hospital admissions (see Table 2).
†Denominator includes people with a previous cesarean scar who were identified as eligible for VBAC or eligibility is unknown or not documented, and current delivery was singleton, vertex presentation. Denominator excludes people with a delivery episode and a history of cesarean who were not eligible for VBAC per the chart or people with a previous scar and unknown or not documented VBAC eligibility who did not have a singleton vertex pregnancy.
‡Analysis is restricted to those with a vaginal birth.

Future research might examine how different practice and remuneration models affect clinical outcomes, client and provider experiences, and costs to the health care system.

Limitations

It is possible that the severity of risk is not adequately captured by the prenatal risk scoring system, which could lead to more clients in the obstetrician MRP group having more complex medical conditions not captured by this tool, explaining differences in outcomes. The MRP was determined by the provider who was responsible for the greatest proportion of care and treatment at the time of delivery, and not throughout the pregnancy. However, a Canadian validation study found that the MRP at the time of delivery was the prenatal provider in more than 90% of cases. Another unmeasured factor is the choice of childbearing people. Individuals who want a medicalized birth (including a cesarean delivery on request) are more likely to seek care from obstetricians, while those with physiologic birth intentions typically seek out midwifery care.[21,25] This self-selection bias is a major limitation in any study of this nature. Other unmeasured factors include additional biological, genetic, epigenetic and environmental risk factors that are associated with adverse perinatal outcomes. Finally, the prenatal risk scoring tool was not validated with childbearing people in BC and included 4 fewer components than the Alberta Perinatal Health Program scoring tool.

Conclusion

With this study we report midwifery outcomes at the population level in BC, without restricting analysis to childbearing people with low or moderate risk or disaggregating midwifery outcomes by place of birth. As such, the study provides population-level evidence that midwives provide safe primary care for clients with varied levels of medical risk. If scaled up, the expansion of midwifery in BC holds potential for meeting national mandates to lower obstetric intervention rates[26] and to increase access to midwifery care to under-served communities.[27]

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