ARTICLE

Maternity Service Delivery in Manitoba, Canada: A Retrospective Analysis of Three Maternity Care Provider Types

La prestation de services de maternité au Manitoba, au Canada : analyse rétrospective de trois types de fournisseurs de soins de maternité

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ABSTRACT

Background: Alleviating shortages in health workforce and delivery of efficient maternity care models are unresolved policy issues in Canada. In the province of Manitoba, obstetricians do the majority of maternity care, family practice physicians take care of low-risk women, and midwives continue to deliver care to about 5% of the low-risk pregnant women. The purpose of this study was to describe how maternity care is provided in Manitoba, based on a revised definition of Most Responsible Provider, and to compare maternal and perinatal outcomes by provider type.

Methods: Administrative data were used from the Manitoba Centre for Health Policy (MCHP) to select women who had a low-risk pregnancy. Descriptive statistics and logistic regression were used to examine differences in types of intervention, mode of delivery, and outcomes by provider type among low-risk women. Logistic regression models controlled for socio-demographic and birth-related covariates.

Results: From 2004/05 to 2012/13, there were a total of 132,918 births in Manitoba. Of those births, 47,083 were identified as high risk (35%), and 85,835 (65%) were identified as low risk. Key findings demonstrate midwifery care compared to obstetrical care was associated with lower odds of interventions such as cesarean section (0.47 [0.40–0.54]), induction (0.42 [0.39–0.49]), and episiotomy (0.48 [0.41–0.55]), but higher odds of postpartum hemorrhage (1.35 [1.18–1.55]), and shorter lengths of stay in hospital (-0.58 [-0.61-0.56]). Family practice physicians also had decreased odds of assisted vaginal delivery (0.82 [0.76–0.89]), epidural use (0.59 [0.57–0.62]) and third- and fourth-degree tears (0.82 [0.73–0.92]), but higher odds of augmentation (1.06 [1.01–1.11]). Results reported for midwives and family practice are compared to obstetricians.

Conclusions: A health workforce strategy that optimizes how to address the maternity care needs in the province of Manitoba is needed. There is suboptimal integration of midwifery services that could meet the low-risk population needs. Human health workforce development requires a good understanding of each provider's role, opportunities for collaboration and integration to be strengthened, and the potential to optimize the outcomes for mothers and infants.

KEYWORDS

maternity outcomes, most responsible provider, midwife, obstetrician, family practice, general practice, mixed provider, Manitoba, health workforce planning

This article has been peer reviewed.

RÉSUMÉ

Contexte : Bien que les sages-femmes de la plupart des provinces canadiennes et d'autres pays à revenu élevé puissent prescrire des contraceptifs, ce type de prescription ne s'inscrit pas dans le champ d'exercice de la pratique sage-femme en Ontario.

But : Présenter le champ de pratique des sages-femmes au Canada et dans d'autres pays à revenu élevé en matière de contraceptifs et examiner les résultats des soins de contraception prodigués par des médecins par rapport à ceux offerts par des fournisseurs qui n'en sont pas.

Méthodes : Nous avons effectué une analyse du contexte au moyen d'une recherche de la littérature grise, dans le but de résumer les champs de pratique des sages-femmes dans les provinces canadiennes et dans d'autres pays à revenu élevé en matière de contraceptifs. Nous avons ensuite examiné la portée d'essais contrôlés randomisés (ECR) qui avaient comparé les résultats des soins de contraception selon qu'ils avaient été prodigués par des médecins ou des fournisseurs qui n'en étaient pas. Enfin, nous avons résumé les données recueillies.

Constatations : Notre analyse du contexte a révélé que le Québec et l'Ontario sont les seules provinces canadiennes où les sages-femmes ne peuvent pas prescrire des moyens contraceptifs. Dans les pays

industrialisés suivants, les sages-femmes ayant reçu la même formation que celles de l'Ontario sont en mesure de le faire : la Nouvelle-Zélande, l'Australie, les États-Unis, la Suède, la Norvège, les Pays-Bas, la Finlande et la France. Notre examen d'ECR révèle que, pour la plupart des indicateurs de compétence, les résultats des soins de contraception sont semblables, qu'ils aient été donnés par un médecin ou un fournisseur qui n'en est pas un.

MOTS-CLÉS
contraception, examen de la portée, pratique sage-femme, médecins, partage des tâches

Cet article a été évalué par un comité de lecture.

BACKGROUND

Regulated midwifery was introduced into the health care system in Manitoba in 2000.[1] It was anticipated then that midwifery would provide women with more choice in primary maternity care services closer to women's homes and would help address predicted shortages in maternity care providers.[1] Manitoba's 1998 Human Resource Strategy for Midwifery projected that the overall birth rate would decline and that 80% of births would be low risk.[2] It was anticipated that obstetricians would mostly care for high-risk women (about 20% to 30% of all pregnant women), family practice physicians would be responsible for 30% of women or fewer, and registered midwives would attend 50% to 60% of births. However, a 2015 study found that from 2001/02 to 2009/10, midwives attended 4.8% of the births in Manitoba.[1] From 2001/02 to 2009/10, the number of practicing midwives increased from 26 to 40.[1] Whereas that study showed that there was a slight increase of midwife-attended births over time, the growth was much slower than the original projection—namely, that midwives would attend 14% of all births within 2.5 years of professional regulation.[2]

Our overarching objective in this study was to understand better who is involved in maternity care health service delivery, nearly 20 years after the regulation of the midwifery profession, and the associated outcomes in Manitoba. No such summary of maternity care provision has been conducted in the province previously.

Manitoba Maternity Care

There are three main providers of maternity care in Manitoba: midwives, obstetricians, and family practice physicians. Midwives provide primary care to women during pregnancy, labour, and delivery, and they remain primary care providers to the women and infants for up to 6 weeks after birth. Postpartum women will see a midwife approximately six times until the time of discharge and more often if required. Family physicians and obstetricians also provide standard courses of care throughout the prenatal, intrapartum, and postpartum periods. Physicians typically see postpartum women at discharge from hospital and then at 6 weeks, unless there is an identified risk for more immediate follow-up. In Manitoba, some family physicians attend births, but others only initiate prenatal care and then, at some point during the prenatal period, transfer the woman to an obstetrician or a midwife to complete the course of care through delivery.

Midwifery in Manitoba provides low-risk women with choice of birth place, informed-choice discussions, and continuity of care,[3] and it targets priority populations, variously defined as single parturiants, adolescents under 20 years of age, immigrants and newcomers, Aboriginal persons, socially isolated, those living in poverty, and other at-risk pregnant people.[2]

Although maternity care in Manitoba is shared among providers, a clear definition of "most responsible provider" has not been tested for all regional health authorities in the province, and the resulting maternal and neonatal outcomes have not been ascribed to these providers, based on their involvement throughout the childbearing year.

We recently published a pilot study to understand how outcomes around the time of birth differed by three different provider types: obstetricians, family physicians, and midwives.[4] Our study revealed that

> Midwifery care resulted in higher breastfeeding rates and lower perinatal mortality rates.

midwifery care was associated with lower odds of interventions (such as episiotomy, epidural use, neonatal resuscitation, Neonatal Intensive Care Unit admission, assisted vaginal delivery, and cesarean section) than those associated with births attended by obstetricians. Midwifery care also resulted in higher breastfeeding rates and lower perinatal mortality rates. We observed that midwives and family physicians used fewer resources and had lower cesarean section rates, and their patients were more likely to initiate breastfeeding.[4]

Summary of Literature

The majority of outcomes studies compare midwives to physicians without specifying the type of physician involved (e.g., obstetricians as opposed to general [family] practice physicians).[5–7]

Many maternity outcome studies use administrative data to answer research questions.[4–10] While administrative data are reliable and allow a researcher to link and analyze large data sets to understand trends in population health, there are limitations, such as incomplete data or coding discrepancies and disagreements.[10–16] Additionally, depending on the data source, it may not be possible to understand processes preceding clinical interventions and factors that could explain differences in outcomes between maternity care providers. For example, administrative data may not include the availability of technology (resources) in a facility, the providers' skill levels, and the philosophy of care.[8,9]

The assignment of the most responsible provider (MRP) to outcome varies as well. For example, the MRP may be designated on the basis of point of care.[8] Aubrey-Bassler et al. assigned a variable of MRP for women in their sample to a family physician group if a family physician was listed at any point as the health care provider.[8] If an obstetrician was listed as the delivery provider, the women were placed in the obstetrician group. Midwives were not included in the study. The authors found no significant difference in outcomes by provider type. In another study, MRP was assigned according to which provider had conducted at least two-thirds of the prenatal visits.[7] A study in British Columbia compared outcomes in hospital births attended by midwives with those attended by physicians, using data from the British Columbia Perinatal Data Registry.[5] Patients were identified as having midwife-attended births as long as "midwife" was listed as their caregiver when admitted. Although the Canadian National Discharge Abstract Database defines "most responsible provider" as the provider responsible for most care in a facility, it does not consider events prior to or after hospital admission.[17] The definition of MRP—as identified in health administration data, the extent of care given, and the role of the MRP in relation to the outcome—required more clarity. Therefore, before beginning this provincial study, we conducted a chart review in an urban setting to compare how MRP was assigned in the chart and how it was assigned in our administrative data in our initial pilot study.[18] One of our findings was that the provider at birth had made more than two-thirds of the prenatal visits, and there was a 3% error in provider-type allocation due to transfer of care at birth.[18] We did not analyze charts from rural or remote areas preceding this current study.

This study had the following two aims: (1) to describe how maternity care is provided in Manitoba, based on a revised definition of MRP, and (2) to compare maternal and perinatal outcomes by provider type This description of trends in maternity care health service delivery can inform proposed changes in maternity health workforce planning in Manitoba.

METHODS

Setting

Manitoba is a central Canadian province with a population, in 2016, of 1,339,308 people; First Nations persons either on or off reserve represented 8% (n = 101,492) of the total population.[19] The province has publicly funded health services, and these funds are distributed to five regional health authorities.[19]

Source of Data and Time Period

We used anonymized and de-identified administrative data from the Manitoba Population Research Data Repository at the University of Manitoba's Manitoba Centre for Health Policy under project #2015:346 (HIPC#2015/2016-32). All approval processes were obtained prior to commencing this study.[20]

The following databases were required for this analysis: (1) the Manitoba Health Insurance Registry, (2) hospital separation data, (3) Drug Programs Information Network drug data, (4) medical claims, (5) Provider Registry data, (6) Midwifery Summary Reports, (7) census data, and (8) vital statistics. Fiscal years 2004/05 to 2012/13 constituted the period of observation.

Exclusion and Inclusion Criteria

Our retrospective sample consisted of all low-risk women giving birth in all Regional Health Authorities of Manitoba to ensure the study sample reflected the midwifery model of care that targets a low-risk population. We excluded women who had complications of pregnancy (e.g., pregnancy-induced hypertension, intrauterine growth restriction, placenta previa, and placental abruption) and medical complications (e.g., diabetes type I and cardiac disease). We used the same three criteria from our first study in a single Regional Health Authority[4] to characterize the low-risk-indicators cohort for this provincial study: (1) definitions of maternity outcomes risk from the literature,[20] (2) low-risk criteria from tertiary care centre labour and delivery units,[21,22] and (3) home-birth criteria from the College of Midwives of Manitoba.[23] Low-risk indicators included singleton fetus, cephalic presentation, greater than 37 weeks' gestation, adequate prenatal care (i.e., three or more visits, including triage visits), parity less than or equal to 7, vaginal birth after cesarean section, and gestational diabetes (non-insulin dependent).

OUTCOMES OF INTEREST

Our primary perinatal outcome of interest was cesarean section, a mode of delivery selected because of its associated morbidity and mortality rates for women and infants and its resource costs. Secondary outcomes of interest were related to maternal and neonatal status. Maternal outcomes of interest were episiotomy, epidural or spinal anaesthesia, induction, augmentation, perineal status (intact, degree of tear [first, second, third, fourth]), postpartum hemorrhage, and maternal death. Neonatal outcomes of interest were Apgar score, resuscitation, admission to a neonatal intensive care unit, birth weight, length of stay (in hospital and out of hospital), initiation of breastfeeding, and perinatal death.

Exposure of Interest

Our research team agreed upon an algorithm to define the MRP, based on a Manitoba perinatal study[10] and findings from our chart review.[18] The MRP was defined as the provider to whom two-thirds of prenatal visits were attributed.[10] The number of prenatal care visits for each woman was determined by using the higher count of prenatal care visits calculated either from the Medical Services data or from the Hospital Abstracts data. If fewer than two-thirds of visits were attended to by a single provider, then a new category was assigned, that of "mixed provider," which could be a combination of provider types.

Statistical Analysis

All data were analyzed with SAS statistical software, version 9.4 (SAS Institute, Inc., Cary, NC).

Our analysis included basic descriptive statistics to describe the overall cohort by region and by provider type. We used univariate and multivariate generalized linear models (GLMs) to determine if differences in interventions and maternal and neonatal outcomes existed between provider types; a repeated statement was used in the GLM statement to account for correlations between births to the same woman. The key covariates for which the GLMs were adjusted included provider type, home birth, current maternal age, parity, income quintile, urban or rural residence, and adequacy of prenatal care. (Not all covariates were included in all models.)

RESULTS

All Births

From 2004/05 to 2012/13, there were 132, 918 births in Manitoba. Of those births, 47,083 (35%) were identified as high risk, and 85,835 (65%) were identified as low risk. From 2004 to 2013, the overall birth rate rose in Manitoba; the rate of high-risk births rose slightly more than the rate of low-risk births (Figure 1).

Prenatal Care and Birth, by Provider Type

To understand further the relationship between the prenatal care provider and the care provider at delivery, we did a cross-tabulation of MRP type by provider at delivery. Family physicians were the providers of prenatal care and of delivery for 67% of the women in their care (Table 1). Obstetricians provided care prenatally and at delivery for 99% of the women in their care. Midwives provided both prenatal care and delivery for 90% of the women in their care. The category of "mixed provider" at birth includes births facilitated by general surgery, internal medicine, or emergency medicine. "Mixed provider" includes any combination of providers.

Provider and Regional Distribution of Low-Risk Singleton Births

Most of the 85,835 low-risk births in Manitoba in our study period occurred in the Winnipeg Regional Health Authority (44,082 [51%]) and in Southern Health-Santé Sud (15,751 [18%]) (Figure 2). Physicians were responsible for 80,546 (94%) of the low-risk hospital births. Midwives were responsible for 134 births (0.2%) at the Winnipeg Birth Centre (opened in 2010), 529 (0.6%) births at home, and 4,626 (5%) hospital births.

Seventeen percent (14,861) of women traveled outside of their region of residence to give birth during this time period. The largest number of women who traveled outside their region for birth were from Southern Health-Santé Sud (5,123

Figure 1. All births by risk type in Manitoba, 2004/05 to 2012/13

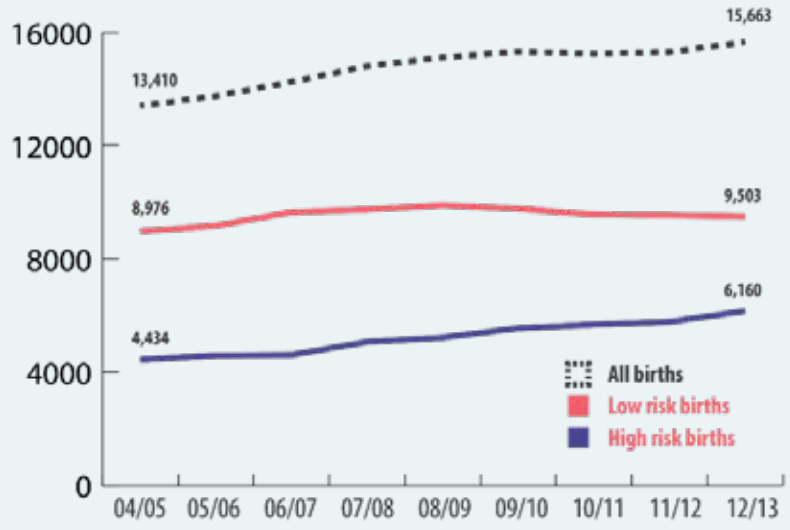
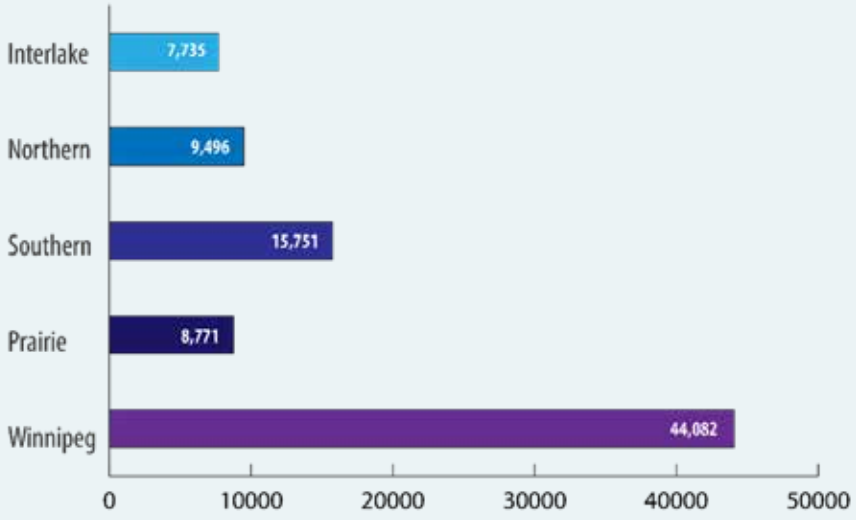


Table 1. Provider Type at Birth, by Prenatal Care

Provider at Birth	Prenatal Care Provider: Family	Obstetrician	Midwife	Mixed
Family	66.51%**	0.39%	1.49%	10.10%
Obstetrician	32.1%	99.49%**	8.38%	85.63%
Midwife	0.19%	0.11%	89.87%**	4.11%
Mixed*	1.21%	0.00%	0.26%	0.15%

*Includes general surgery, internal medicine, and emergency medicine.
**Dark shading denotes provider at birth also provided the majority of prenatal care.

Figure 2. Total low-risk singleton births in Manitoba from 2004/05 to 2012/13, by health authority

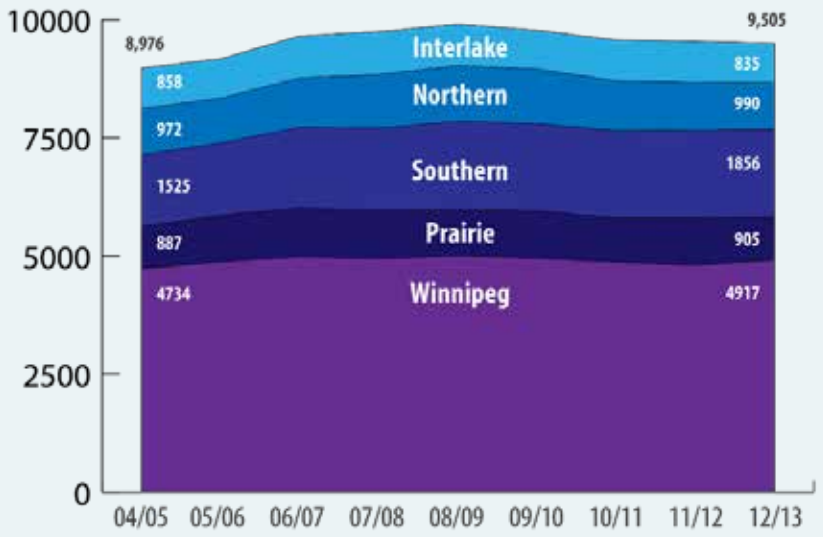


[33%]). Northern Manitoba had the second highest number of women who traveled outside their region of residence to give birth (2,516 [27%]).

The low-risk birth rate increased annually. Southern Health-Santé Sud had the highest increase in low-risk births, from 1,525 to 1,856 (Figure 3).

Finally, we analyzed the distribution of low risk-births by provider type in Manitoba (Figure 4). Family practice physicians were the MRPs for low-risk women in both the Southern Regional Health Authority (69% [n = 10,934]) and the Prairie Mountain Regional Health Authority (75% [n = 6,602]). Most of the maternity care for low-risk women in the Northern Regional Health Authority was provided by a mix of providers (44% [n = 4,129]). Most maternity care for low-risk women in the Winnipeg Regional Health Authority (63% [n = 27,661]) was provided by obstetricians; a mix of

Figure 3. Annual birth rates for low-risk singleton birth, by health authority, 2004/05 to 2012/13



providers (18% [n = 7,851]) made up the second MRP type for low-risk maternity care. Midwives were the MRPs for 1% (Interlake) to 9% (Prairie Mountain) of low-risk births in health authorities.

Characteristics of Low-Risk Women Giving Birth

We found statistical differences in the characteristics of women in regard to provider type for women younger than 19 years of age, as well as urban residence location and income quintile (i.e., lowest income quintile) (Table 2). Out-of-hospital births were statistically significant, as only midwives conduct them. There were differences in gestational age at birth, 1- and 5-minute APGAR score, and birth weight between provider types. In regard to the mode of delivery, there were no differences in cesarean section or spontaneous vaginal delivery (Table 3); however, there were differences in assisted vaginal birth. We found statistical differences between provider types with induction of labour, augmentation, epidural, perineal tears (any, first-degree, second-degree), postpartum hemorrhage, neonatal intensive care unit (NICU) admission, breastfeeding initiation, and length of stay.

Outcomes by Provider Type

Because obstetricians provide most of the maternity care in Manitoba, we used the obstetrician as the MRP of comparison for midwives, family physicians, and mixed providers. In Manitoba, midwives and family physicians consult with and transfer women to obstetricians when indicated.

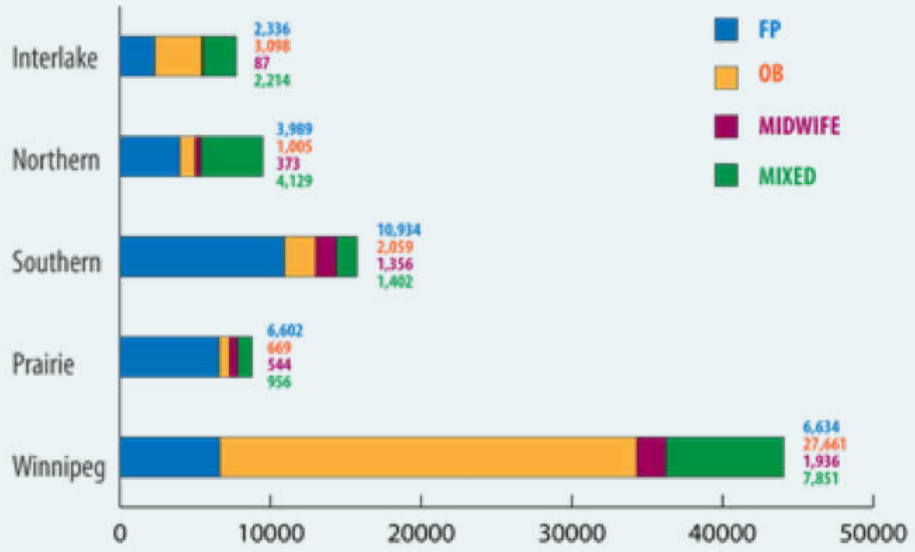
We controlled for sociodemographic and birth-related confounding variables. Table 3 summarizes outcomes for the four provider types. Comparing them revealed similar outcomes for midwives and family physicians. Midwives and family physicians had lower odds of assisted vaginal delivery. Midwives family physicians, and the mixed provider group all presented lower odds of epidural and spinal anaesthesia.

The mixed provider group had higher odds of perineal tears, as did the midwives. Midwives and the mixed group had higher odds of resuscitation. The mixed group had higher odds of NICU admissions but higher odds of breastfeeding initiation, as did the midwifery group. On average, compared to infants born to women cared for by obstetricians, infants born to women cared for by either a midwife or a mix of providers had higher birth weights, respectively).

Women attended to by family physicians had lower odds of third- and fourth-degree tears versus first- and second-degree tears. However, they had higher odds of augmentation.

Finally, women attended to by midwives

Figure 4. Low-risk singleton births, 2004/05 to 2012/13, by regional health authority and provider type



FP, family practice physician; OB, obstetrician

had lower odds of cesarean section, induction, and episiotomy, but higher odds of postpartum hemorrhage.

Women who were cared for by midwives had shorter lengths of stay in hospital by almost a day.

DISCUSSION

Our findings indicate that maternity care with midwives as the MRPs is associated with lower odds of interventions such as cesarean section, induction, and episiotomy, but higher odds of postpartum hemorrhage. Notably, midwifery care was associated with shorter lengths of stay in hospital, which is likely to be important to health care planning. When a mix of providers was involved, our study showed increased odds of breastfeeding initiation and decreased odds of assisted vaginal delivery and epidural use. Care provision by family physicians also led to decreased odds of assisted vaginal delivery, epidural use, and third- and fourth-degree tears but to higher odds of augmentation. It should be noted that very few midwives in the province have augmentation privileges.

Evidence from other studies supports our findings of lower interventions associated with midwifery care.[4,7–9] Women cared for by midwives had lower odds of cesarean section, induction, episiotomy, epidural and spinal anaesthesia, shorter lengths of stay, higher birth weights, and higher odds of breastfeeding initiation. Our study differs in that it includes the category of mixed provider and demonstrates favourable outcomes for care by mixed providers (e.g., lower odds of spinal or epidural anaesthesia use, higher birth weights, and higher odds of breastfeeding initiation).

Our first outcomes study only took into account one urban regional health authority,[4] and we used the MRP definition from the Discharge Abstract Database to allocate outcomes.[17] There were some differences in outcomes in this province-wide study after we applied our revised definition of MRP. We found that midwives had higher odds of resuscitation and postpartum hemorrhage, that more resuscitations occurred in out-of-hospital births than in hospital births (7% vs. 6%), and that a higher proportion of the resuscitation cases were attributed to 41 weeks' gestation (8%) and to 42 or more weeks' gestation (10%).

Evidence supports the notion that postpartum hemorrhage rates could be influenced by the

Table 2. Characteristics of Low-Risk Women Giving Birth in Manitoba, 2004/05 to 2012/13, by Provider

	Midwife (*N* = 4,296) (5.0%)	Obstetrician (*N* = 34,492) (40.2%)	Family Physician (*N* = 30,495) (35.5%)	Mixed (*N* = 16,551 (19.3%)	*p*-Value
Characteristics of Mothers					
Mother's age at delivery (yrs) Age ≤19 Age 20–34 Age 35+	 202 (4.7) 3,644 (84.8) 450 (10.5)	 2,706 (7.8) 26,730 (77.5) 5,056 (14.7)	 2,861 (8.3) 24,940 (81.9) 2,694 (8.3)	 2,421 (14.6) 12,583 (76.0) 1,547 (9.3)	 <.0001
Mother's age (mean +/- SE)	28.4	28.3	26.8	26.3	<.0001
Urban Manitoba (Winnipeg/Brandon)	2,308 (53.7)	28,033 (81.3)	8,622 (28.3)	8,208 (49.6)	<.0001
Income quintile Q1 (lowest quintile) Q2 Q3 Q4 Q5 NF (quintile unknown)	 717 (16.7) 858 (20.0) 993 (23.1) 902 (21.0) 815 (19.0) 11 (0.26)	 8,499 (24.6) 6,522 (19.0) 5,965 (17.3) 6,559 (19.0) 6,863 (19.9) 84 (0.51)	 6,984 (23.0) 6,414 (21.0) 6,672 (21.9) 5,973 (19.6) 4,358 (14.3) 94 (0.3)	 5,852 (35.4) 3,283 (19.8) 2,344 (14.2) 2,705 (16.3) 2,327 (14.1) 40 (0.2)	 <.0001
Out-of-hospital birth (home or birth centre)	634 (14.8)	0	0	0	<.0001
Number of prenatal visits (mean +/- SE)	11.2	11.4	10.8	11.0	<.0001
1: Primapara	1,235 (28.7)	15,349 (44.5)	11,792 (38.7)	6,890 (41.6)	<.0001
Gestational age (weeks) at time of delivery (mean +/- SE)	39.7	39.5	39.6	39.4	<.0001
Birth weight at time of delivery (mean +/- SE)	3,626.9	3,505	3,558.6	3,535	<.0001
1-minute Apgar score at time of delivery (mean +/- SE)	8.2	8.2	8.2	8.1	<.0001
5-minute Apgar score at time of delivery (mean +/- SE)	9	8.9	9	8.9	<.0001
Delivery and Post Partum					
Assisted vaginal	112 (2.6)	2,870 (8.3)	1,869 (6.1)	1,290 (7.8)	<.0001
Cesarean section	188 (4.4)	3,782 (11.0)	3,193 (10.5)	1,583 (9.6)	...
Spontaneous vaginal	3,992 (93.0)	27,840 (80.7)	25,433 (83.4)	13,678 (82.6)	...
Induced labour	377 (8.8)	5,944 (17.2)	5,785 (19.0)	3,277 (19.8)	<.0001
Augmentation of labour	939 (21.9)	7,470 (21.7)	6,925 (22.7)	3,326 (20.1)	<.0001
Epidural	634 (14.8)	17,466 (50.6)	10,845 (35.6)	6,897 (41.7)	<.0001
Episiotomy	263 (6.1)	5,520 (16.0)	3,857 (12.6)	2,251 (13.6)	<.0001
Any perineal tear	2,137 (50.0)	15,960 (46.1)	12,707 (41.7)	6,366 (38.5)	<.0001
1st-/2nd-degree tear	2,012 (46.9)	14,587 (42.1)	11,880 (39.0)	5,847 (35.4)	<.0001
Postpartum hemorrhage	327 (7.6)	1,851 (5.4)	1,942 (6.4)	992 (6.0)	<.0001
NICU admission	77 (1.8)	682 (2.0)	514 (1.7)	393 (2.4)	<.0001
Breastfeeding initiation	4,056 (94.4)	30,207 (87.6)	25,968 (85.2)	12,960 (78.3)	<.0001
Length of stay (mean +/- SE)	1.5	2.3	2.3	2.3	<.0001

NICU, neonatal intensive care unit; SE, standard error

Table 3. Adjusted Differences in Selected Interventions and Outcomes of Low-Risk Singleton Births, by Provider Type

Intervention or Outcome†	Midwife vs. OB/GYN aOR (95% CI)‡	GP/FP vs. OB/GYN aOR (95% CI)‡	Mixed vs. OB/GYN aOR (95% CI)‡
Dichotomous outcomes			
Assisted vaginal birth	0.39 (0.32–0.48)*	0.82 (0.76–0.89)*	0.99 (0.91–1.06)
Cesarean section	0.47 (0.40–0.54)*	0.98 (0.92–1.02)	0.97 (0.90–1.03)
Episiotomy§	0.48 (0.41–0.55)*	0.93 (0.87–0.99)	0.96 (0.90–1.03)
Epidural/spinal§	0.22 (0.20–0.24)*	0.59 (0.57–0.62)*	0.87 (0.83–0.91)*
Induction	0.44 (0.39–0.49)*	1.00 (0.95–1.05)	1.00 (0.95–1.06)
Augmentation	0.99 (0.91–1.08)	1.06 (1.01–1.11)*	0.99 (0.94–1.04)
Perineal tear§	1.21 (1.12–1.31)*	0.96 (0.92–1.00)	0.89 (0.85–0.93)*
3rd/4th-degree tear vs. 1st/2nd-degree tear	0.86 (0.70–1.07)	0.82 (0.73–0.92)*	0.99 (0.88–1.10)
Postpartum hemorrhage	1.35 (1.18–1.55)*	0.95 (0.87–1.03)	1.00 (0.92–1.09)
Low 5-minute Apgar (0–6 vs. 7–10)	1.27 (0.91–1.78)	0.87 (0.71–1.06)	1.16 (0.94–1.41)
Neonatal resuscitation	2.50 (2.19–2.86)*	0.95 (0.87–1.03)	1.19 (1.09–1.30)*
Admission to NICU	1.23 (0.95–1.62)	0.81 (0.70–0.96)*	1.35 (1.17–1.56)*
Breastfeeding initiation	3.44 (2.97–3.99)*	1.05 (0.99–1.11)	0.93 (0.88–0.99)*
Continuous Outcome	**Midwife vs. OB/GYN aβ(95% CI)**	**GP/FP vs. OB/GYN aβ(95% CI)**	**Mixed vs. OB/GYN aβ(95% CI)**
Birth weight	59.75 (45.55–73.95)*	4.08 (-4.00–12.15)	11.03 (2.85–19.22)*
Length of stay	-0.58 (-0.61–0.56)*	0.02 (-0.00–0.03)	-0.02 (-0.05–0.00)

aβ adjusted beta coefficient from generalized linear models; aOR, adjusted odds ratio; CI, confidence interval; FP, family practice physician; GP, general practice physician; NICU, neonatal intensive care unit; OB/GYN, obstetrician/gynecologist

Note: Population includes live births and still births.

†Mode of delivery (reference is spontaneous vaginal birth)

‡Logistic regression models included the following covariates: provider type, age of mother at birth, income quintile, urban/rural residence, home birth, primipara/multipara, adequate prenatal care (3+ visits, 0–2 visits, or missing), birth weight, gestational age, 5-minute Apgar score (7+, 0–6), and mode of delivery. (Not all covariates are included in all models.)

Generalized linear models included the following covariates: provider type, age of mother at birth, income quintile, urban/rural residence, home birth, primipara/multipara, adequate prenatal care (3+ visits, 0–2 visits, or missing), birth weight, gestational age, 5-minute Apgar score (7+, 0–6), and mode of delivery. (Not all covariates included in all models.

§Only vaginal births are analyzed for this outcome.

*$p < .05$

subjectivity of the provider estimating the value of blood loss. For example, studies have identified the clinical challenges of estimating blood loss in the postpartum period.[24] While there is a formal definition of postpartum hemorrhage (> 500 ml of blood), it is a subjective assessment that influences how this finding may be recorded.[25]

Our results show that, for both delivery and prenatal care, family physicians care for women only 67% of the time. A similar historical trend of family physicians providing less prenatal and intrapartum care is evident across Canada.[26] Finally, obstetricians cared for women 99% of the time for both prenatal care and delivery. This reflects the role of obstetricians as the primary providers for low-risk women in Manitoba. We

also found that providers in areas such as general surgery, internal medicine, or emergency medicine were at times involved in some maternity care. Rural and remote areas in Manitoba use general surgeons to perform cesarean sections where no obstetrical services are available.

One final finding in our study that warrants highlighting is the proportion of low-risk women who travelled outside their region to give birth (17%). The Southern Regional Health Authority had the highest percentage of women travelling outside their region to give birth (33%); the Northern Regional Health Authority had the second highest percentage (27%). In 2012, a Manitoba perinatal report revealed that 46.8% of women travelled outside their region to give birth. In addition, 50.6% of women travelled more than 46.7 km to give birth.[10] These are alarming rates, given the implications (cultural, social, physical, and financial) of giving birth away from home for women, their families, and their communities.[27] Various studies have identified outcomes such as increased rates of perinatal mortality, increased NICU stays, and increased moderate-to-severe stress for women who must travel to deliver.[28,29]

In preparation for the regulation of midwifery, the provincial government determined that the birth rate in the province was declining and that approximately 80% of births would be low risk.[2] Furthermore, it was suggested that obstetricians could focus on high-risk pregnancies (30%), family physicians could provide care to about 30% of women, and midwives could attend 50% to 60% of low-risk births.[2] There had been no other projections of this kind publicly released in Manitoba since the 1998 Health Resource Strategy for Midwifery planning document. Our current provincial study revealed a very different pattern of care than what was originally projected 20 years ago. During the study period, the overall birth rate rose, particularly the rate of high-risk births. We found that from 2004/05 to 2012/13, 65% of the total births were low risk and 35% were high risk. It would be reasonable to consider that obstetricians could meet this demand; however, they were in fact responsible for 40% of low-risk women as well, while family physicians were responsible for 36% of low-risk women and midwives were responsible for approximately 5% of low-risk women. This distribution of MRPs reflects a possible misalignment in health workforce planning: providers were not using their fullest scope or potential to meet the demands of the population's health. During out study's time frame, we calculated that midwives were responsible for 4% of all births (n = 4,296/132,918). This fell far short of the original projected goal of 14% of the total births, which would mean that midwives would have to have been responsible for 18,609 of the total 132,918 births.

In the urban regions of Manitoba, obstetricians were responsible for most maternity care, whereas in the rural regions, general and family practices were the most responsible providers of maternity care. In the remote Northern region, a mix of providers shared the care of women needing maternity care.

LIMITATIONS

Our study had several limitations. We continued to identify discrepancies in the data from the midwifery data set. However, we were always able to do a comprehensive data check against the other databases to validate the findings reported in this article. Our understanding of why midwives were 2.5 times more likely to resuscitate was limited. We did not have the capacity in this study to do further analysis. It would be interesting to investigate such issues as the degree to which an infant was resuscitated and the place of birth. In addition, it would be interesting to learn how midwives code resuscitation in relation to the actual definition in the database. Furthermore, our rates of maternal and perinatal mortality were too low to report. This is as would be expected in a low-risk cohort in which women have been carefully selected based on their low-risk status. We did not analyze why women left their regions to give birth or the distance they had to travel; we know that a woman's leaving the region can be attributed to such issues as preference, health of pregnancy changes, and lack of obstetrical services. Finally, due to the geographical distribution of services, women at times live closer to a health facility located in a health authority other than the one they actually reside in.

CONCLUSIONS

Currently, there is no health workforce strategy addressing the complexity of maternity care needs

in the province of Manitoba. Our findings highlight issues that need strategic efforts to initiate actions beyond the point of discussion and that will begin to address the maternity crisis happening across the province. Manitoba has an increasing high-risk population, suboptimal integration of midwifery services that could meet the needs of a low-risk population, and a lack of maternity care teams in rural and remote areas, which could keep birth closer to home and decrease the intrapartum care burden on the two tertiary care centres in the province. Finally, due to the nature and complexity of its rural and remote regions (many communities are fly-in only, for example), the province needs innovative health workforce strategies that will put childbirth back into the communities and use integrated models of maternity care. This type of strategy will accomplish the following: (1) relieve the burden of obstetric volume in the urban tertiary care centres, (2) integrate midwifery services in all regions and use midwives as key players in maternity care services, and (3) improve overall perinatal outcomes and meet the population health needs of childbearing women in the province.

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