



Understanding the Limitations of Maternity Cost Studies: Why Context Matters

Comprendre les limites des études des coûts liés à la maternité : l'importance du contexte

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ABSTRACT

Background: Limited, publicly available evidence exists to inform maternity care workforce planning in Manitoba as well as elsewhere in Canada. This manuscript offers a discussion about how context is critical when considering how cost, efficiency, and efficacy data are used.

Methods: Our cost analysis of maternity care in Manitoba, Canada, focused exclusively on women with low-risk pregnancies from combined dates [2004/05 to 2008/09 and 2009/10 to 2012/13].

Results: Although our cost analysis found that maternity care provided by family physicians had the lowest overall expected cost, and that highest effectiveness, measured by avoided neonatal intensive care unit (NICU) admissions, midwives had the lowest hospital costs and similar cost-effectiveness to other provider types.

Interpretation: The context of how different maternity care professions are integrated into the system has a substantial impact on the assessment of overall cost. Caution must be used in interpreting these findings from significantly different models of care. The roles of providers are rarely articulated in cost study analyses to capture the breadth of services beyond “in-patient” costs.

KEYWORDS

midwifery, cost-effectiveness, health services, maternity care, Manitoba

This article has been peer reviewed.

RÉSUMÉ

Contexte : Il y a peu de données probantes accessibles au public pour éclairer la planification de la main-d'œuvre affectée aux soins de maternité au Manitoba et ailleurs au Canada. Le présent article se penche sur l'importance du contexte lorsqu'on examine la manière dont les données sur les coûts, l'efficacité et l'efficacités sont utilisées.

Méthodes : Notre analyse des coûts des soins de maternité au Manitoba, au Canada, s'est concentrée exclusivement sur les soins donnés aux femmes ayant connu des grossesses à faible risque selon des dates combinées [de 2004-2005 à 2008-2009 et de 2009-2010 à 2012-2013].

Résultats : Bien que notre analyse des coûts ait constaté que les soins de maternité offerts par les médecins de famille entraînaient les coûts prévus globaux les plus faibles et qu'ils étaient les plus efficaces si l'on tient compte des admissions évitées à l'unité néonatale de soins intensifs (UNSI), les soins donnés par les sages-femmes engendraient les coûts hospitaliers les plus faibles et avaient un rapport coût-efficacité semblable à ceux prodigués par d'autres types de fournisseurs.

Interprétation : Le contexte dans lequel les différentes professions des soins de maternité sont intégrées le système a une incidence considérable sur l'évaluation du coût global. La prudence est de mise quand on interprète les constatations relatives à des modèles de soins très différents. Le rôle des fournisseurs est rarement précisé dans les études d'analyse des coûts pour rendre compte de l'envergure des services au-delà des coûts d'hospitalisation.

MOTS-CLÉS

pratique sage-femme, rapport coût-efficacité, services de santé, soins de maternité, Manitoba

Cet article a été évalué par un comité de lecture.

INTRODUCTION

Health workforce planning should be driven by a desire to meet the needs of a whole population while being cost-effective or providing the most optimal workforce per dollar spent. Midwifery is commonly portrayed as “less costly” to health care systems than maternity care provided by physicians, which is one reason to expand its services. While there is evidence that this may be true in some parts of Canada, the interplay of payment structures, practice scope, and outcomes, as well as infrastructure, facility, and capital costs, bears further exploration. As Bourgeault and Merritt have noted, understanding the scope of professional practice is essential to health workforce planning and related cost analyses.¹

There are few Canadian studies on the cost-effectiveness of maternity care and, by extension, limited evidence on how this information is used to inform maternity services. Two recent studies from Ontario and British Columbia demonstrate cost savings with midwives’ providing maternity care, compared to other providers.^{2,3} In addition, the results from a matched case-control design study using administrative data in Alberta showed a cost savings of \$1,172 per course of midwifery care as compared to standard physician care.⁴ A Quebec case-control study matching physician and midwifery care also found that physician care was slightly more expensive than midwifery care [\$3,020 and \$2,294, respectively].⁵ Other Canadian studies analyzed various aspects of maternity care but did not compare costs among provider types.^{6,7} Finally, one study in northern Canada that compared the costs of midwifery birthing services in a community birth centre to the costs of transferring women out of their community to hospitals projected that a minimum of 25 births were needed per year to be cost-effective.⁸ However, the findings from these studies may not be generalizable to Manitoba because of the manner in which midwifery is integrated into Manitoba’s health system. Specifically, midwives are compensated as employees of regional health authorities, with a different model of practice.⁹ This may have unique cost implications.

Discussions with government personnel in the Province of Manitoba confirmed that there are limited cost analysis data to inform current

maternity health planning. We found no publicly available data-informed strategic health workforce plans for midwifery since it became a regulated profession in 2000. Heaman et al. found that inner-city Winnipeg integrated-care models that included midwifery demonstrated improved maternal and child outcomes and system cost savings.¹⁰ However, the profession has not been integrated in a way for it to optimally meet the needs of Manitoba women, as evidenced by a shortage of midwives in the workforce, by suboptimal caseloads, and by significant burnout,¹¹ all of which limit its capacity to serve the needs of the population. Cost studies are integral to how policy decisions are made; however, we suggest that context is critical to considering how cost data are used for midwifery workforce planning.

Aggregate costing data are not available to us in Manitoba. Costing data for all of Canada are based on estimates that are generated by using microcosting data from the source provinces. Therefore, the reported data reflect values associated with direct and indirect hospital costs with average salaries factored into the equation of the microcosting. These data reflect neither the full scope of care given at any one point of contact nor the nuances of models of care by provider type; for this reason, we do not report extensively on our findings. This article offers a discussion about how context is critical when considering how cost, efficiency, and efficacy data are used. To better inform health workforce planning, we developed a method to analyze the costs of maternity care, based on the roles of primary care professionals involved in perinatal care (obstetricians, family practice physicians, and midwives). We describe the methods we used to take scope of practice into account for maternity care analyses. Our ultimate goal is to inform decision making on appropriate planning to expand midwifery services and provide useful data to strengthen integration and inform policy.

COST STUDY LIMITATIONS

All cost studies have limitations. Most studies neither explicitly break down how services are costed nor describe the scope and role of the provider. This can be misleading in regard to how

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services are analyzed. For example, the Canadian Institute for Health Information (CIHI) costing methodology is based on microcosting data using patient- and record-level information from a small group of hospitals in Ontario, Alberta, and British Columbia. Patient-level data from these hospitals are used to generate cost estimates for different procedures as functions of patient characteristics such as age and comorbidity.¹² The Institute does not use patient-level information from any Manitoba facility to generate its cost estimates. Although we must assume that the patient-level data CIHI uses to generate cost estimates are applicable to the Manitoba context, Manitoba’s demographics may differ, and we may only be deriving a snapshot in time.¹³

CALCULATING MANITOBA’S MATERNITY CARE COSTS

Data used for this cost-effectiveness analysis came from anonymized or de-identified administrative data from the Manitoba Population Research Data Repository at the Manitoba Centre for Health Policy, in Winnipeg, Manitoba, following established protocols and data quality guidance.¹⁴ Cost data were obtained from CIHI, the physician fee schedule for Manitoba, and regional health authorities (RHAs) [for midwives’ salaries].

We assigned outcomes of care to a variable for most responsible maternity care providers – obstetricians, family physicians, and midwives–

during the child-bearing year. The determination of most responsible provider (MRP) is based on a Manitoba perinatal study and findings from a chart review we conducted earlier.¹⁵⁻¹⁷ The MRP was defined as the provider who was attributed with two thirds of all prenatal visits.¹⁶ All deliveries were assigned to a provider [family physician, obstetrician, or midwife]. If multiple maternity care providers were involved in prenatal care, then the MRP was assigned to the category of “mixed provider.”

Hospital and Physician Costs

We used the CIHI standard costing methodology to calculate in-patient costs.¹⁸ Total hospital costs include direct costs [nursing in-patient services, diagnostic imaging, etc.] costs and indirect costs [administrative and support services]. In-patient costs were calculated based on hospital separations [discharges], using the resource intensity weight (RIW) and the Cost per Weighted Case (CPWC)/ Cost of a Standard Hospital Stay (CSHS) for both midwifery and physician services. The RIW quantifies the relative intensity of hospital resources associated with diagnostics and procedures, based on the demographics of the individual receiving care, and are assigned to each hospitalization. By multiplying the RIW attached to a hospital record by the CWC for Manitoba, we were able to calculate the approximate costs associated with each hospitalization in the province.*

In-hospital physician costs were added, using

* CWCs are calculated by the Canadian Institute for Health Information, using microcosting data from select hospitals across Canada. The CWC provides the cost for a hospital visit having an RIW equal to 1.00. The CWCs are recalculated on an annual basis and are specific to each region.

fee-for-service tariff codes for services provided. Prenatal visits and one postnatal visit were added for each birth, also using tariff codes.

Salary Costs

Manitoba midwives are salaried employees in RHAs⁹ to ensure that midwives set aside practice time for priority populations (immigrant, socially isolated, adolescent, Indigenous, and other populations), as well as to ensure midwives are compensated for time spent on interprofessional and regulatory committees and on supervising students¹⁹ (Table 1). Whereas the principle tenets of midwifery are the same across the country, the method of payment, model of practice, and the way practices are organized are different.⁹ For example, unlike midwives in other provinces, midwives in Manitoba are not paid additionally to precept students or do committee work; these are considered part of their salaried position and professional obligations.⁹ In Manitoba, family physicians and obstetricians can provide a full scope of care to people, and most are paid according to provincial schedules for antepartum, intrapartum, and postpartum care. Physicians in private practice are responsible for their own operating costs, insurance fees, and other professional expenses.

For midwives, salaries were derived from the annual global budget that each RHA has to provide for midwifery services in the region. To determine the proportion of salary to be allotted to each delivery, this figure [the annual global budget] was divided by the annual number of deliveries midwives were assigned as MRPs, as is frequently done to calculate the cost of midwifery care. Of note, this does not account for other requirements of their time in their salaried employment agreement, as discussed later in this paper. Despite initial projections at the time of regulation, there are only 54 practicing midwives in the province, and most positions are concentrated in one urban region.

Salary costs for physicians are determined by summing fees received from the province for every service or procedure performed during a typical course of treatment. We used administrative data to determine the prevalence of any procedures that might only be necessary in a fraction of the cases. We analyzed the actual cost of care per hospital

birth by provider type (including prenatal visits plus one postpartum visit). Calculating the basic costs of prenatal care, postpartum care, and hospital birth provides only one aspect of health care cost to a system. We used a decision tree, which maps out all paths with the likelihoods and costs of different events (for example, postpartum hemorrhage) occurring, to compare the cost-effectiveness of each provider type, with probabilities derived from actual rates by maternity provider type in Manitoba.²¹ We measured effectiveness by the number of births by provider type that did not result in admission to a neonatal intensive care unit (NICU). Thus, our unit of comparison was the cost of care per one birth that did not get admitted to the NICU. In keeping with Walters et al.,² we chose this as our measure of effectiveness because we can thereby compare results and because this is readily available in the administrative data. We plotted tornado diagrams to show how the cost-effectiveness of each provider type changes incrementally as probabilities and costs change for different variables [e.g., spontaneous vaginal birth with or without epidural, patient load, etc.].²⁰ Finally, probabilistic sensitivity analysis allowed us to validate the conclusions of the cost-effectiveness analysis.²⁰ Probabilistic sensitivity analysis uses probability distributions for different parameters, rather than point estimates, reflecting the fact that there is usually uncertainty around parameter values used in a cost-effectiveness analysis.

WHAT WE FOUND

Our study produced interesting and mixed findings. In both rural and urban regions, midwives had significantly lower hospital costs as measured by RIW, but cost-effectiveness was similar to that of other provider types. Family physicians who provided maternity care had the lowest expected cost, highest effectiveness, and therefore were more cost-effective than the other two provider types. Our one-way sensitivity analyses on all our variables [costs and probabilities] demonstrated that only an increased patient load and increased rates of spontaneous vaginal birth changed our results for improving cost-effectiveness with midwives.

The sensitivity and probabilistic analysis

Table 1. Midwifery Unique Model of Care Responsibilities

Clinical Care
<p><i>Prenatal</i></p> <ul style="list-style-type: none">● Initial visit (1 hour)<ul style="list-style-type: none">○ Discussion of midwifery model of care, role of the midwife/practice partners, and principle of informed choice○ Possible discussion of place of birth (in hospital, out of hospital)○ Screening for risk factors as they relate to the midwifery scope of practice and need for consultations○ Comprehensive health history and clinical exam, including all laboratory work● Subsequent visits (approximately 30 minutes)<ul style="list-style-type: none">○ Every 4 weeks until 28 weeks; every 2 weeks until 36 weeks; every week until birth○ Longer in the third trimester, for birth preparation○ May occur in the client's home
<p><i>Intrapartum (Labour and Birth)</i></p> <ul style="list-style-type: none">● The midwife is on call for the entire pregnancy.● Triage assessment is by telephone and in person at the client's home, birth centre, and triage units in hospital.● Continuous one-to-one care is provided when the client is in active labour, regardless of birth setting.● When care of the mother is transferred to an obstetrician, the midwife may remain involved in a supportive care role.● The midwife will resume primary care (until 6 weeks post partum), once care is transferred back from the obstetrician.● The midwife remains the primary care provider of the normal newborn at time of birth and in follow-up periods, even when the mother is under care of an obstetrician.● A second attendant at midwifery births is required; may be a nurse in the hospital setting but is always a second midwife for an out-of-hospital birth.
<p><i>Postpartum</i></p> <ul style="list-style-type: none">● If there are no complications, the midwife remains the primary care provider for mother and infant for up to 6 weeks.● Midwives will make five to seven visits to the mother and infant.● During visits, midwives assess the well-being of mother and infant, provide breastfeeding support, order laboratory tests if needed, psychosocial support, and other teaching.● From intake to discharge, midwives spend extra time with their clients and their clients' families, having informed-choice discussions to facilitate shared decision making for clinical care.● Midwives are system navigators—they play many roles for each client: primary care provider, phlebotomist, case manager (to initiate and follow up all consultations and referrals), etc. They also make home visits and do initial assessments (generally completed by nursing staff for physicians) prior to full appointments.
<p><i>Other</i></p> <ul style="list-style-type: none">● Collaborative community clinics with physicians● Well-woman care [e.g., contraception and cervical smears]● Consultations and referrals● Follow-up on consultations● Triage for non-obstetrical issues and clients who cannot get care elsewhere● Chart reviews● Discharge letters● Identification of primary care provider for clients
<i>continued...</i>

Table 1. Midwifery Unique Model of Care Responsibilities *continued ...*

Nonclinical Care
<p>Committees</p> <ul style="list-style-type: none">• Regional health authority planning committees• Hospitals [e.g., perinatal review committee]• College of Midwives of Manitoba [standards, board]• College of Physicians & Surgeons of Manitoba [standards]• Midwives Association of Manitoba• Birth centre committees• Other
<p>Teaching/Orientation/Education</p> <ul style="list-style-type: none">• Neonatal Resuscitation Program instructors• Nursing orientation to midwives• Emergency Skills for Midwives workshop teaching• ALARM course instructors• Med III teaching• Orientation and supervision of new midwives• Student preceptorship• Prenatal class teaching [no longer provided by Public Health]• Continuing education
<p>Quality</p> <ul style="list-style-type: none">• Creation of guidelines [e.g., Midwifery Practice Council]• Review of other programs' guidelines• Operational guidelines for regional health authorities
<p>Administrative</p> <ul style="list-style-type: none">• Submitting hours, mileage, data submission• Discharging of summary forms• Returning of messages• Responding to emails• Filing documents into charts• Calling clients for appointments• Rescheduling clients.
<p>Miscellaneous</p> <ul style="list-style-type: none">• Travel time to client's houses to provide clinical care• Travel time between facilities to provide clinical care• Travel time for activities not related to nonclinical care [meetings, rounds, education, etc.]• Checking out of hospital equipment and supplies [for home visits]• Required return to hospital to complete medical records*

ALARM, Advances in Labour and Risk Management

*Regional health authority pays time, mileage, and parking costs for midwives to complete records.

allowed us to validate the conclusions of our cost-effectiveness analysis. For example, it tells us if any one event is more responsible for the costs or if it drove the cost. Our results were most sensitive to midwifery client load and spontaneous vaginal delivery. The probabilistic analysis shows all probabilities to be random. Further, it shows with

high certainty that our results are robust. Client load and out-of-hospital births are of key importance when considering cost-effectiveness for midwifery care. Provincial support and health workforce planning is critical to expand midwifery services in the Province.

LIMITATIONS OF OUR STUDY

A major limitation of our methods was that during the study time frame (2004/05 to 2008/09 and 2009/10 to 2012/13), we were unable to include data from Winnipeg's Birth Centre, due to low numbers in its early years. We thought that if we had an adequate volume of births to analyze from the birth centre, our findings would be similar to those of Janssen et al., who analyzed low-risk births and found significant cost savings for mothers delivering at home, both in terms of delivery and longer-term costs.³

We also recognize that in a cost study such as this we cannot fully capture the extent of what each provider does within their scope of care. Manitoba midwives, for example, are expected to do many non-care-related tasks. When significantly different models of care are compared, there needs to be caution regarding interpretation around cost, because the limited data on the provider type are not a true reflection of the time given per case, particularly in a resource-intensive model of care like midwifery.

DISCUSSION

Before researchers speculate on the "value" of different maternity care providers (i.e., obstetricians, family physicians, and midwives), they must take into account specific limitations. First, standard fiscal costs that are reported on limited microcosting data may not always be generalizable to every jurisdiction. Second, the roles of providers are rarely articulated in cost study analyses to capture the breadth of services beyond "in-patient" costs. In our study, we could not fully reflect the extent of what each provider does within their scope of care. Midwives have the ability to provide time-intensive prenatal and postpartum care in homes and in the community and are the primary health care providers for mothers and infants up to 6 weeks. The midwifery model of care also differs from that of physicians in the provision of direct care because of midwives' time-intensive care and attendance in labour. Other health care providers supplement physician care, especially in the intrapartum period, enabling physicians to attend more births because others (e.g., nurses) are providing care during labour. Previous research

established that Manitoba midwives successfully reach priority populations, and good outcomes are attributed to midwifery care.²¹ We also know that family physicians and obstetricians are trained to care for higher-risk populations. For these reasons, comparing significantly different models of care requires caution in interpreting costs.

In its current state, midwifery in Manitoba is suboptimally integrated, in that many of the original goals for implementing the service (such as province-wide availability for low-risk mothers) have not been achieved. The current means by which to analyze cost-effectiveness are limited, and thus midwifery in Manitoba may not appear to be a cost-effective service. Reducing costs per birth as measured by current CIHI data may not be the only goal. Looking beyond a single measure of effectiveness (e.g., NICU admissions) needs to be considered when placing value on a service. Restructuring the way maternity care is provided (including how midwives work within new models that may improve maternal and infant health) is worth considering. Adverse perinatal outcomes have longer-term cost implications not captured by present methods. The inability to include out-of-hospital births is a significant limitation in this study, given the trend to greater numbers of out-of-hospital births.²²

At the time of the writing of this article, Manitoba is moving towards a shared health authority with a mandate to "enable provincial planning and integration of services, improve patient care and provide coordinated support to regional health authorities across the province—including the recruitment and retention of health professionals..."²³ For optimized access (choice for women), good outcomes, and team-based maternity care delivery, it will be critical for health workforce stakeholders to consider midwifery an integral part of the health care delivery system. However, such decisions require contextualized data so that the true costs are understood.

ACKNOWLEDGEMENTS

The authors acknowledge the Manitoba Centre for Health Policy for use of data contained in the Population Health Research Data Repository under project H2015:346 [HS18908]. The results and conclusions are those of the authors, and no official endorsement by the Manitoba Centre for Health Policy, Manitoba Health, or other data providers is intended or should be inferred. Data used in this study are from the Manitoba Population Research Data Repository housed at the Manitoba Centre for Health Policy, University of Manitoba, and were derived from data provided by Manitoba Health.

A New Investigator Award from Research Manitoba supported this project. A Career Development Award from the Canadian Child Health Clinician Scientist Program supports Dr. Thiessen's research program.

REFERENCES

1. Bourgeault IL, Merritt K. Deploying and managing health human resources. In: The Palgrave international handbook of healthcare policy and governance. London: Palgrave Macmillan UK; 2015. p. 308–24.
2. Walters D, Gupta A, Nam AE, Lake J, Martino F, Coyte PC. A cost-effectiveness analysis of low-risk deliveries: a comparison of midwives, family physicians and obstetricians. *Healthc Policy*. 2015;11[1]:61–75.
3. Janssen PA, Mitton C, Aghajanian J. Costs of planned home vs. hospital birth in British Columbia attended by registered midwives and physicians. *PLoS One* [Electronic Resource]. 2015;10[7]:e0133524.
4. O'Brien B, Harvey S, Sommerfeldt S, Beischel S, Newburn-Cook C, Schopflocher D. Comparison of costs and associated outcomes between women choosing newly integrated autonomous midwifery care and matched controls: a pilot study. *J Obstet Gynaecol Can*. 2010;32[7]:650–6.
5. Reinharz D, Blais R, Fraser WD, Contadandriopoulos A. Cost-effectiveness of midwifery services vs. medical services in Quebec. [Reprinted with permission from *Can J Public Health*. 2000;91[1]:112–5.] *Neonatal Intensive Care*. 2000;13[5]:50–3.
6. Allen VM, O'Connell CM, Baskett TF. Cumulative economic implications of initial method of delivery. *Obstet Gynecol*. 2006 Sep;108[3 Pt 1]:549–55.
7. Sword W, Watt S, Krueger P, Thabane L, Landy CK, Farine D, et al. The Ontario Mother and Infant Study [TOMIS] III: a multi-site cohort study of the impact of delivery method on health, service use, and costs of care in the first postpartum year. *BMC Pregnancy Childbirth*. 2009 Apr;9:16.
8. Chamberlain M, Nair R, Nimrod C, Moyer A, England J. Evaluation of a midwifery birthing center in the Canadian north. *Int J Circumpolar Health*. 1998;57 Suppl 1:116–20.
9. Thiessen K, Haworth-Brockman M, Nurmi M, Demczuk L, Sibley K. Delivering midwifery: a scoping review of employment models in Canada. *J Obstet Gynaecol Can*. 2018 [cited 2019 Aug 21]. In press. Available from: <https://www-clinicalkey-com.uml.idm.oclc.org/#!/content/journal/1-s2.0-S1701216318307540>
10. Heaman M, Elliot L, Helewa M, Kingston D, Moffatt M, Sword W. Evaluation of the Partners in Inner-City Integrated Prenatal Care (PIIPC) Project-final report. Winnipeg, MB; 2017.
11. Thiessen K, Heaman M, Mignone J, Martens P, Robinson K. Barriers and facilitators related to implementation of regulated midwifery in Manitoba: a case study. *BMC Health Serv Res*. 2016;16:92.
12. DAD Resource Intensity Weights and Expected Length of Stay. Ottawa: Canadian Institute for Health Information; 2019.
13. The cost of hospital stays: why costs vary. Ottawa: Canadian Institute for Health Information; 2008.
14. Azimae M, Smith M, Lix L, Ostapyk T, Burchill C, Orr J. MCHP data quality framework. Winnipeg, MB: Manitoba Centre for Health Policy; 2018.
15. Thiessen, K., Haworth-Brockman, M., Nickel, N., Witt, J., Morris, M., Robinson, K., Bourgeault, I., Derksen, S. [2020]. Maternity service delivery in Manitoba, Canada: a retrospective analysis of three maternity care provider types. *Can J Midwifery Res Pract* 2020;19[2].
16. Heaman M, Kingston DA, Helewa M, Brownell M, Derksen S, Bogdanovic B, McGowan K, Bailly A. Perinatal services and outcomes in Manitoba. Winnipeg, MB: Manitoba Centre for Health Policy; 2012.
17. Thiessen K, Nickel N, Prior H, Morris M, Robinson K. Understanding the allocation of caesarean outcome to provider type: a chart review. *Healthc Policy*. 2018 Nov 30;14[2]:22–30.
18. MIS Patient Cost Database Methodology [Internet]. Ottawa: Canadian Institute for Health Information; 2019 [cited 2019 Aug 21]. Available from: <https://www.cihi.ca/en/document/mis-patient-cost-database-methodology>
19. Haworth-Brockman M. Delivering an alternative: an overview of the regulation of midwifery in Manitoba. Winnipeg, MB: Prairie Women's Health Centre of Excellence; 2002.
20. TreeAge Pro. Williamstown, MA: TreeAge Software; 2018.
21. Thiessen K, Nickel N, Prior HJ, Banerjee A, Morris M, Robinson K. Maternity outcomes in Manitoba women: a comparison between midwifery-led care and physician-led care at birth. *Birth*. 2016;43[2]:108–15.
22. Thiessen K, Heaman M, Mignone J, Martens P, Robinson K. Trends in midwifery use in Manitoba. *J Obstet Gynaecol Can*. 2015;37[8]:707–14.
23. Health, seniors and active living. Health system transformation [Internet]. Province of Manitoba; 2017 [cited 2019 Aug 20]. Available from: <https://www.gov.mb.ca/health/hst/>

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