

Comparison of Costs and Associated Outcomes Between Women Choosing Newly Integrated Autonomous Midwifery Care and Matched Controls: A Pilot Study

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Abstract

Objective: In response to consumer demand and a critical shortage of Canadian maternity care providers, provinces have integrated or are in the process of integrating midwives into their health care systems. We compared the costs and outcomes of newly integrated, autonomous midwifery care with existing health care services in the province of Alberta.

Methods: Alberta Health and Wellness cost data from (1) physician fee-for-service, (2) outpatient, and (3) inpatient records, as well as outcome data from vital statistics records, were compared between participants in a midwifery integration project and individually matched women who received standard perinatal care during the same time period. Records of births occurring within the same time frame were matched according to risk score, maternal age, parity, and postal code.

Results: For women who chose midwifery care, an average saving of \$1172 per course of care was realized without adversely affecting maternal or neonatal outcomes. Cost reductions are partially realized through provision of out-of-hospital health services. Women who chose midwifery care had more prenatal visits ($P < 0.01$) and fewer inductions of labour ($P < 0.01$); their babies had greater gestational ages ($P < 0.05$) and higher birth weights ($P < 0.05$) than controls. The sample size was insufficient to compare events associated with extremely high costs, or rare or catastrophic outcomes.

Conclusion: Regulated and publicly funded midwifery care appears to be an effective intervention for low-risk women who make this choice. When compared with existing care, autonomous care by newly integrated midwives does not increase health care costs.

Key Words: Midwifery costs, midwifery outcomes, midwifery integration, maternal care

Competing Interests: None declared.

Received on September 21, 2009

Accepted on January 13, 2010

Résumé

Objectif : En réponse aux demandes des consommateurs et à la pénurie criante de fournisseurs de soins de maternité au Canada, les provinces ont intégré (ou sont en voie de le faire) les sages-femmes dans leurs systèmes de santé respectifs. Nous avons comparé les coûts et les issues des soins de sage-femme autonomes nouvellement intégrés aux services de santé existants en Alberta.

Méthodes : Les données de l'*Alberta Health and Wellness* quant aux coûts provenant des dossiers (1) de la rémunération à l'acte des médecins, (2) des services externes et (3) des services hospitaliers, ainsi que les données quant aux issues provenant des dossiers de l'état civil, ont été comparées pour ce qui est des participantes à un projet d'intégration de la pratique des sages-femmes et pour ce qui est de femmes personnellement appariées qui ont reçu des soins périnataux standard pendant la même période. Les dossiers des naissances étant survenues pendant la même période ont été appariés en fonction du score de risque, de l'âge maternel, de la parité et du code postal.

Résultats : En ce qui concerne les femmes qui ont choisi les soins prodigués par des sages-femmes, des économies moyennes de 1 172 \$ par période de traitement ont été réalisées sans exercer d'effets indésirables sur les issues maternelles ou néonatales. Des réductions de coûts ont été partiellement réalisées grâce à l'offre de soins de santé externes. Les femmes qui ont choisi les soins prodigués par des sages-femmes connaissaient un plus grand nombre de consultations prénatales ($P < 0,01$) et un moins grand nombre de déclenchements du travail ($P < 0,01$); l'âge gestationnel ($P < 0,05$) et le poids de naissance ($P < 0,05$) de leurs enfants étaient supérieurs à ceux des témoins. La taille de l'échantillon ne permettait pas de comparer les événements associés à des coûts extrêmement élevés ou encore les issues rares ou catastrophiques.

Conclusion: Les soins de sages-femmes réglementés et bénéficiant d'un financement public semblent constituer une intervention efficace pour ce qui est des femmes n'étant exposées qu'à de faibles risques qui font ce choix. Lorsqu'ils sont comparés aux soins existants, les soins autonomes prodigués par des sages-femmes nouvellement intégrées ne causent pas de hausse des coûts de santé.

J Obstet Gynaecol Can 2010;32(7):650-656

INTRODUCTION

Alleviating shortages in health human resources is a Canadian and an international priority. A focus of the World Health Organization for the decade of 2006 to 2016 is to examine the distribution of the health workforce, including profiling of health workers.¹ Conservative estimates suggest that Canada needs 5000 more physicians in active practice.² The president of the Association of Faculties of Medicine of Canada recently stated that changing the models of care and increasing efficiency of the health care system will not be enough to alter this substantial shortfall.²

This shortage is particularly felt with respect to maternity care in Canada. There is a greater need, especially in rural areas, than can be met by available physicians.³ The Society of Obstetricians and Gynaecologists of Canada supports “the continuing process of establishing midwifery in Canada as a regulated publicly funded profession.”⁴

In 1994, Ontario became the first province in Canada to legislate and publicly fund midwifery. Before this, midwifery was unregulated and midwives were not remunerated within the publicly funded health care system or permitted to provide primary care for hospital births. With legislation, midwives in most provinces and territories are obliged to attend births of their low-risk clients in whatever setting the client prefers (hospital, home, or birth centre). Canadian midwives provide primary care and accept responsibility for clinical decisions and care management within their scope of practice. As a result of the Ontario legislation, the number of hospital births attended by a midwife increased.⁵ Twenty percent of midwife-attended births still take place at home in Ontario,⁶ but this rate varies from province to province.⁷ In Ontario, where midwifery integration is well established within the health care system, a large retrospective cohort study comparing midwife-attended low-risk planned home births with midwife-attended low-risk hospital births was conducted using the Ontario Ministry of Health database.⁸ All midwife-attended births and their outcomes are recorded in this database. According to the authors of this study, favourable outcomes of midwife-attended births resulted from multiple factors, including good self-regulation and good integration of midwifery into the health care system, with access to emergency services and appropriate consultation and transfer of care when needed.⁸ Another Canadian study that investigated outcomes of planned home birth revealed rates of perinatal death that were low and comparable to hospital attended births, and reduced rates of obstetric intervention and adverse maternal outcomes.⁹ The authors stated that the findings of the study should add confidence to the safety of home birth in a context in which registered midwives have a baccalaureate degree or equivalent and are an integral part of the health care system.⁹ Before

April 2009, when this study took place, Alberta women who chose midwives for maternity care received publicly funded inpatient and outpatient services but had to pay their midwife. During the Integration of Midwifery Services Evaluation Project (IMSEP), three separate research projects were conducted. The objectives of the project reported here were (1) to compare maternity care costs of women choosing primary care from midwives with those of women choosing primary care from other providers, and (2) to compare associated maternal and neonatal outcomes. At the time of the study, the Medical Association of Alberta would not permit physicians to attend home births. We believe we are the first in Canada to evaluate the midwifery integration process.

To ensure a fair evaluation of the integration of midwives within a publicly funded health care system, several conditions were met before the IMSEP studies began. Midwives were granted privileges for hospital admissions and were permitted access to consultants through public funding. As Alberta midwives were not publicly funded at the time, they were remunerated through the IMSEP grant, thus simulating public funding within an integrated service for the term of the project.

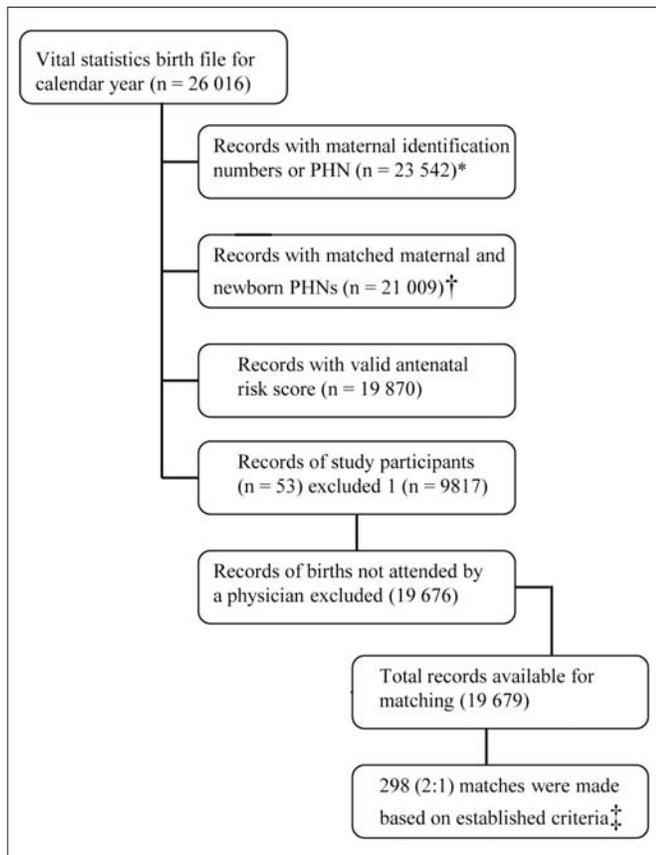
There were several challenges to comparing midwifery costs and associated outcomes with those of existing services. Internationally, models of midwifery practice and funding vary greatly.^{10,11} While it has been consistently reported that midwifery care in a variety of birth settings is safe in higher income countries,^{12–17} this contention continues to be challenged, particularly with respect to the practice of attending out-of-hospital births.^{18,19} Ascertaining actual health care costs is complex, especially when additional benefits or costs might be accrued later but were initiated by a particular health care approach.²⁰

METHOD

Four Alberta health regions were involved; two were primarily rural and two were urban regions that included large metropolitan areas (populations over 1 000 000 residents). The costs of integration were examined using relevant data provided by Alberta Health. A matched control design was used to assess these costs and associated outcomes of newly integrated midwifery care.

Following provincial and institutional ethical approval, provincial government records of all who volunteered for newly integrated midwifery care ($n = 146$) were compared with those of a 1:2 matched sample of Alberta women ($n = 292$) who gave birth during the 8.5 month study period. Two who gave birth within the same three-month period were individually matched with each study participant to become part of the control group. Individuals

Selection process for matching individual records of control group to records of study population



*Vital Statistics information was matched against information from Alberta Health and Wellness data to obtain a personal health number (PHN). Only data when these matches could be made were used.

†If newborn's PHN (and therefore his/her records) could not be found, then maternal records were excluded. Reasons for this include neonatal death, multiple birth, registration or input error.

‡Matching was based sequentially on the following criteria:

1. antenatal risk score,
2. maternal age within five years,
3. parity,
4. postal code.

Data of birth was within three months for study and matched records. Of these, the records of 17 cases were dropped because no information could be found on the baby. These 17 were placed with other matches.

independent of the research project (but not blinded) at Alberta Health accessed provincial databases to provide the groups using deterministic linkage to ensure adequate statistical power to compare outcomes recorded on vital statistics records between groups (i.e., $\beta > 0.80$). The selection process for the control group is shown in the Figure.

Three rounds of matching occurred sequentially, beginning with antenatal risk score, followed by maternal age, parity, and postal code. Postal code was selected to reflect rural/urban residence and because it is moderately correlated with socioeconomic status.²¹ To assess the impact of this variable,

parity was entered as a control variable in multiple linear regression analyses of costs.

Costs

All available health-related costing and statistical data for each participant from 300 days (10 months) before and 180 days (6 months) after the index birth were retrieved from Alberta government databases, including practitioners' fee for service claims, ambulatory care fees, and provincial costing project data attached to hospital morbidity records. Comprehensive physician (fee for service) claims data were available for participants from all four participating health regions. However, hospital and outpatient costing data were not available for the two smaller regions. There were also 11 individuals from the larger regions whose hospital and outpatient cost records could not be retrieved. Sample mean costs were imputed to these individuals, a procedure which is consistent with the current costing methodologies employed by the Canadian Institute of Health Information.²²

Cost data were analyzed by multiple linear regression. Since cost data were skewed and had different variability between the study and control groups, a bootstrap procedure was used to estimate the standard errors of cross-classified cost data and of regression coefficients.²³ Specifically, each triad consisting of a midwife-assisted birth and two matched controls was randomly sampled 500 times with replacement and analyses performed on the bootstrap sample. For regression analyses, this ensured that the correlational structure introduced by the matching procedure was maintained in the analysis. For each cost component and in two blocks, the effects of study group (block 1), midwife-attended out-of-hospital birth, and rural births (birth outside the Edmonton and Calgary metropolis) with hospital cost imputed (block 2) were examined as independent variables. Parity and maternal age were entered as control variables.

Outcomes

Using chi-square analysis or paired *t* tests, groups were compared on important pregnancy outcomes available in vital statistics records of primary outcomes. Odds ratios and 95% confidence intervals were calculated for significant effects. All tests were two-tailed with $P < 0.05$ indicating statistical significance. We used SPSS version 13.0 for Windows (SPSS Inc., Chicago, IL) for data management and analysis. In cohort studies, Apgar scores of < 7 at one and five minutes after birth are associated with an increased risk of neonatal morbidity and mortality.²⁴ We recoded Apgar scores dichotomously as ≥ 7 or ≤ 6 before making between group comparisons.

The antepartum risk score is assessed on admission to antenatal care and again at 36 weeks' gestation. A weighted score based on the perceived importance of factors thought to influence pregnancy outcome is part of the Alberta

Table 1. Comparison of total care costs charged to the Alberta health care system

Source, \$	Midwifery care*			Control group
	Hospital births Mean (95% CI)	Out of hospital births Mean (95%CI)	Total Mean (95% CI)	Total Mean (95% CI)
Fee for service: mother	904 (749 to 1059)	682 (562 to 802)	773 (673 to 873)	1684 (1579 to 1790)
Fee for service: baby†	265 (176 to 354)	104 (80 to 128)	170 (130 to 209)	337 (298 to 377)
Hospital	3322 (2580 to 4064)	0	1356 (958 to 1754)	3368 (2712 to 4024)
Outpatient care	290 (139 to 441)	56 (0 to 112)	152 (78 to 225)	228 (170 to 286)
Total	4781 (3916 to 5646)	842 (708 to 976)	2450 (1976 to 2924)	5617 (4855 to 6380)

*Midwifery costs were determined by reimbursement provided for total course of care, in this case provided by the study grant.

†Physician fee for service only.

Perinatal Record. The intrapartum risk score is part of the Alberta Delivery Record—Part 1, and items related to intrapartum conditions are assigned a weighted score based on perceived importance of a prevalent factor thought to affect pregnancy outcome adversely (e.g., labour at < 34 weeks is assigned a score of 2, and fever and bleeding are each assigned a score of 1). Variables including birth location, birth attendant, and maternal and newborn characteristics were extracted from provincial government vital statistics records.

RESULTS

Each match was identical with respect to risk score, maternal age (30.03 years in women who had midwifery care vs. 30.14 years in controls), and postal code in all cases except when parity was greater than three. In this case, after the match was made, mean parity was found to be higher in the control group (3 vs. 2; *P* < 0.001). However, the majority in both groups were experiencing their first (39%) or second (40%) delivery and for these, the match was exact. While all births in the control group took place in hospital, 90 (61.6%) of the study group births took place out of hospital (84 at home and 6 in a private birth centre). For these records, a hospital cost of \$0 was recorded for the birth event even if the participant paid to use a private birthing centre.

Costs

Costs from all sources with bootstrap-generated standard errors are shown in Table 1. It must also be noted that any additional costs to the participants other than the direct cost to the system were not included in calculations; e.g., any cost associated with using the private birth centre (n = 6) or incurred if an ambulance was used (n = 2) was borne privately by the women. Midwives were paid \$1995 from the research grant for each course of care. If payment to midwives was publicly funded at that rate, the average cost per course of care would increase to \$4445, and the difference between midwifery care and standard care would be reduced to

Table 2. Selected maternal characteristics of study group

Maternal characteristic (n = 146)	
Age, years, mean ± SD	30.55 ± 4.85
Age range, years	19.3–41.7
Race, %	
Caucasian	93.8
Aboriginal, Hispanic, Caribbean	6.2
Annual family income, \$	40 000–49 000
Marital status, %	
Married/ partnered	93.8
No partner	4.8
Gravidity, %	
1	29.3
≥ 2	70.7
Risk score, %*	
Low risk score (0–2)	91.0
Moderate risk score (3–6)	8.9

*Risk scores are determined by assessments of pre-pregnancy health, past obstetrical history, problems in current pregnancy and life style factors which are included on the standard antepartum risk assessment form (Alberta Prenatal Records [HS 001–125 {04/01}]).

\$1172 per course. With a 6% home birth delivery rate and 40 000 births per year in Alberta, this would result in yearly provincial savings of over \$2.8 million.

The regression analyses showed the following:

- Total costs corrected for mother’s age, parity, and imputation were lower in the midwife attended group than in the control group by an average of \$3167 (*P* < 0.05).
- Midwife-attended home deliveries were significantly less costly than the midwife-attended hospital deliveries (by an average of \$3939), and midwife-attended hospital deliveries were an average of \$836 less costly

Table 3. Women and newborn clinical outcomes

Outcomes	Study group (n = 146)	Control group (n = 292)	Statistical significance
Women			
Prenatal visits	10.4 (SD 2.3)	8.6 (SD 3.2)	$P < 0.001$
Induction	11 (8%)	54 (24.8%)	OR 3.95; 95% CI 1.80 to 18.66
Newborn			
Gestational age, weeks	39.7	39.4	$P = 0.01$
Weight, g	3681	3565	$P = 0.03$
Head circumference, cm	35.5	35.0	$P = 0.01$

than deliveries in the control group, although this difference was not statistically significant.

- This same pattern of findings was present for total non-hospital costs. Midwife-attended hospital births cost an average of \$612 more ($P < 0.05$) than midwife-attended home births, and control births cost an average of \$842 more ($P < 0.05$) than midwife-attended hospital births.
- No differences emerged in these analyses for those deliveries where mean hospital costs were substituted for missing cost data.

Outcomes

There were no between-group differences in the incidence of Caesarean section or assisted births. There were no differences between groups in the number of term, low birth weight, or small for gestational age babies or in Apgar scores. Rare and catastrophic events did not occur. Selected maternal characteristics of the women who received funded midwifery services are shown in Table 2. The outcomes for mothers and newborns are presented in Table 3. An average of 10.4 (± 2.3) prenatal visits was reported for the study group and 8.6 (± 3.2) for the control group ($t = 6.3$, $df = 355.4$, $P < 0.001$). Visits with the midwife for members of the study group lasted from 45 to 60 minutes. A greater number of prenatal visits was associated with a greater gestational age in the study group ($F = 8.77$, $df = 2$, $P < 0.001$) and with a trend toward a higher birth weight ($F = 2.88$, $df = 2$, $P = 0.057$).

Controlling for other variables (e.g., birth weight, model of delivery, number of prenatal visits), the rate of induction of

labour for women in the control group was higher than for those in the study group (OR 3.95; 95% CI 1.80 to 18.66).

DISCUSSION

In our study, women who chose midwifery care for their pregnancy realized an average saving to the system of \$1172 per course of care. Outcomes for a newly integrated professional group must meet the existing high maternity care standards in Canada. Compared with women receiving standard (physician and hospital based) care, midwifery clients had more prenatal visits, were less likely to have labour induced, and were more likely to have services provided out of hospital. Their gestational age was slightly greater and their babies weighed slightly more.

Our findings are similar to those of other larger Canadian studies^{8,9} that found established integrated midwifery care resulted in rates of perinatal and neonatal mortality and serious morbidity that were not different from the rates resulting from standard care. Women who planned home births and chose midwifery care also used fewer intrapartum interventions. Before the time of this study, midwives did not have an “in hospital” management option.

Hutton and colleagues note that self-regulation of midwives (by statutory Colleges of Midwives) to ensure standards and regulations are followed is essential to effective midwifery care and its integration into the health care system and to subsequent practice.⁸ Effective April 1, 2009, Alberta Health and Wellness and the Alberta Association of Midwives announced the public funding of midwifery services. The introduction of midwifery care into the publicly funded system was seen as a means of addressing increasing demands for maternity care in Alberta.²⁵ As a newly integrated and publicly funded service, midwifery will have an initial impact on provincial health care costs. A study in the United States reported an 18% increase in utilization of midwifery services when midwifery services were insured.²⁶ The additional costs of funding midwifery care could, however, be offset if women who previously used physician-based care choose midwifery care. Another consideration is that the small number of women who prefer to give birth without the services of a skilled birth attendant might agree to use funded midwifery care.

Most of the cost savings realized by those who chose midwifery care in our study resulted from a maternal decision to give birth at home. Women who are drawn to midwifery care may have attitudes and characteristics that are difficult to measure but that affect their use of health care resources in general, and that have implications for estimating the economic impact of funded midwifery care. Hutton and colleagues suggest that women who choose planned home birth are more likely to be a self-selected group of women

who are more motivated to avoid interventions such as epidural analgesia.⁸ Midwives typically use low-intervention strategies. For example, in a recent Canadian survey, it was reported that if the birth attendant was a midwife, a woman was more likely to experience medication-free pain management.²⁷

Midwives employed in a US health maintenance organization were found to reduce inpatient costs by seven percent with no change in outcomes.²⁸ In a study of the practices of obstetricians, family practitioners, and certified nurse-midwives in Washington, women who chose nurse-midwives used fewer resources and were less likely to experience continuous fetal monitoring, induction of labour, or Caesarean section.²⁹

Another important consideration in maternity care is addressing the needs and wishes of women and families throughout an extended perinatal period. In a review, beneficial effects of continuous care from the same provider were reported, but it was not clear if these effects were due to continuity of provider or midwifery care.³⁰ Our findings are similar to those reported in this review.

The number of women who were able to participate in our study group and receive funded midwifery care was determined by grant resources, and this is a limitation of the study. The follow-up period for variables for which we have comparative data is very short, and the sample size was too small to estimate with any accuracy the differential likelihood of an event (e.g., enormous cost or catastrophic outcome) that could affect costs and associated outcomes.

Only mothers in the control group who gave birth to live babies could be included, because the mother's unique health care identity number had to be matched with the identity number of her newborn; these numbers were not issued to stillborn babies or those who experienced an early neonatal death. This creates a potential bias in favour of the control group, because if a participant in the study group experienced a neonatal loss, she would still be included in the comparative analysis.

The potential for selection bias exists because controls were not randomly selected; however, matches were made by an individual blinded to the nature and purpose of the study. It is not clear which costs were related directly to maternity care and which to other health concerns that occurred during the study. Interactions between factors associated with pregnancy and existing medical conditions make it even more difficult to determine which health care costs were directly related to pregnancy and birth. For example, psychiatric claims could be linked to maternity issues or an ongoing condition. A further limitation was the error made in matching members of the study group for parity, if parity

was more than three. This was ameliorated by controlling for parity in the analysis.

As some members of the study group had home births, with no direct cost to the system, it was difficult to determine actual costs for two participants. Another 11 participants had no recorded claim, consistent with their having an uncomplicated home birth. Since laboratory costs are typically reimbursed by costing batches in Alberta rather than individuals (e.g., hematology, urinalysis), it was not possible to track individual laboratory costs.

CONCLUSION

The cost implications support a policy of midwifery integration into the existing system of maternity care. Our findings indicate that the wishes of families with regard to maternity care can be respected without anticipating increased costs to the health care system. As more publicly funded midwife-attended births take place in Alberta, a more comprehensive assessment will be possible. There is justification for a larger study of care delivery in which all maternal and neonatal outcomes, particularly those associated with rare, catastrophic, and costly events, can be evaluated.

ACKNOWLEDGEMENTS

The study was funded by Alberta Health and Wellness.

The authors wish to thank the women and their families who enrolled in IMSEP and took the time to fill out the surveys and to participate in focus groups, and the midwives who participated in IMSEP.

They also wish to thank the obstetricians, family practitioners, unit managers, obstetrical nurses, and public health nurses who participated in the focus groups; Katherine Lyman, and her assistant Jiahui Yao; research assistants Rosalie Zimmer, BScN, Kim Van Sickle, BScN, and Julia Hews, BScN; and Ms Jean Chaw-Kant for her technical expertise.

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