

Outcomes of the Introduction of the MORE^{OB} Continuing Education Program in Alberta

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Abstract

Objective: In 2004, the three-module, three-year long patient safety program, Managing Obstetrical Risk Efficiently (MORE^{OB}), was introduced to all clinicians providing obstetrical services in Alberta. We report on an outcomes evaluation of this initiative.

Methods: Provincial hospital discharge abstracts for each mother and infant were obtained from 2003 through 2008. A pre-post design with a multivariate analysis was conducted for each relevant maternal and fetal outcome.

Results: For maternal outcomes, third- and fourth-degree tears and length of stay were significantly decreased. For newborn outcomes, severe morbidity was significantly reduced.

Conclusion: The MORE^{OB} program was associated with improvement in selected maternal and fetal health outcome indicators. When a patient safety program is introduced as an intensive, long-term continuing education and quality improvement initiative, health outcomes can be significantly impacted.

Résumé

Objectif : En 2004, le programme de sécurité des patientes Approche multidisciplinaire en prévention des risques obstétricaux (AMPRO^{OB}) d'une durée de trois ans et comptant trois modules a été offert à tous les cliniciens prodiguant des services obstétricaux en Alberta. Nous signalons une évaluation des issues de cette initiative.

Méthodes : Les comptes rendus sur les congés des patientes des hôpitaux provinciaux pour chacune des mères et chacun des nouveau-nés ont été obtenus pour la période allant de 2003 à 2008. Un modèle « avant-après » et une analyse multivariée ont été menés pour chacune des issues maternelles et fœtales pertinentes.

Résultats : Pour ce qui est des issues maternelles, les déchirures du troisième et du quatrième degrés et les durées d'hospitalisation ont connu une baisse significative. Pour ce qui est des issues néonatales, la morbidité grave a connu une baisse significative.

Conclusion : Le programme AMPRO^{OB} a été associé à une amélioration en ce qui concerne certains indicateurs d'issues liés à la santé maternelle et fœtale. Lorsqu'un programme de sécurité des patientes est offert sous forme d'initiative d'éducation permanente et d'amélioration de la qualité intensive et à long terme, les issues de santé peuvent s'en trouver influencées de façon significative.

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INTRODUCTION

Following the attention that was paid to adverse events in several countries, including Canada,¹ the Society of Obstetricians and Gynaecologists of Canada developed a patient safety program for obstetric clinicians. The society piloted the program, Managing Obstetrical Risk Efficiently (MORE^{OB}), in several provinces.^{2,3} In 2004 the government of Alberta, in association with the obstetric community and with facilitation from the Alberta Perinatal Health Program, made plans to offer the program to all birth centres in the province. The goal was to achieve a uniform degree of excellence in all delivery centres across the province.

Continuing education in obstetric care has been tried with varying approaches and evaluated in a number of different settings. From the systematic review by Black and Brocklehurst in 2003⁴ and a formal search for any articles published since, we identified 10 evaluations. Most were descriptions of a single intervention (self-study, lectures, simulations, and interactions and team training) with no comparators.⁵⁻¹¹ All of these studies showed that providers' attitudes and practices can be changed, at least over a limited time. Three studies measured practice pattern changes or outcomes in

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Table 1. Maternal outcomes: list of variables included in the models

Independent variables	Dependent variables			
	Length of stay \leq 2 days	Tear	Postpartum hemorrhage and hysterectomy	Postpartum infection
Before/after MORE ^{OB}	x	x	x	x
Health region	x	x	x	x
Level of care	x	x	x	x
Year of delivery	x	x	x	x
Age of mother	x	x	x	x
Previous term deliveries	x	x	x	x
Previous preterm	x	x	x	x
Previous spontaneous abortions	x	x	x	x
Previous therapeutic abortions	x	x	x	x
Multiple gestation	x	x	x	x
Forceps or vacuum	x	x	x	x
Breech	x	x	x	x
Preterm	x	x	x	x
Post term	x	x	x	x
Induction	x	x	x	x
Caesarean section	x		x	x
PROM and preterm	x	x	x	x
Tear (laceration)	x		x	x

Table 2. Neonatal outcomes: variables included in the models

Independent variables	Dependent variables	
	Mortality	Severe morbidity
Before/after MORE ^{OB}	x	x
Year of birth	x	x
Sex of newborn	x	x
Health region	x	x
Levels of care	x	x
Breastfeeding	x	x
Preterm birth	x	x
Post term birth	x	x
Low birth weight	x	x
NICU admissions	x	x
Ventilation	x	x
Severe morbidity	x	

more detail. Birch et al. compared three types of one-day teaching initiatives: lecture-based, simulation-based, and a combination of lecture and simulation.¹² At a three-month follow-up, the results indicated that simulation-based teaching had the most favourable outcomes, measured by structural interviews and objective clinical examinations. Draycott et al.¹⁰ conducted a before–after study of a one-day training session consisting of workbook study, lectures, discussions, and skills drills. The outcomes measured were five-minute Apgar scores and cases of hypoxic ischemic encephalopathy. The results, measured by comparing outcomes in the two years prior to the intervention with outcomes in the two post-intervention years, showed a reduction in both indicators.¹³ Nielsen et al.¹⁴ conducted a multi-site randomized clinical trial of a series of lectures, videos, and interactive team training over three four-hour days. Maternal and child health outcomes over a 150-day post-intervention period did not show significant differences between an intervention and no intervention.¹⁴

The MORE^{OB} program was voluntarily adopted in all birth centres in Alberta. It is a three-year program implemented in a staggered manner across the province over a five-year

Table 3. Description of the study population for maternal outcomes

Variable	Frequency	Rate, %
Total deliveries at hospitals participating in MORE ^{OB}	210 570	100.00
2003/4	38 809	18.43
2004/5	39 247	18.64
2005/6	40 743	19.35
2006/7	44 338	21.06
2007/8	47 433	22.53
Descriptions of delivery		
Labour induction	50 072	23.78
Caesarean section	55 728	26.47
Forceps or vacuum	26 841	12.75
Multiple gestation	3722	1.77
Preterm deliveries (< 37 weeks of gestation)	16 915	8.03
PROM and preterm	6053	2.87
Postterm deliveries (≥ 41 weeks of gestation)	25 736	12.22
Breech	9584	4.55
Hysterectomy	441	0.21
Outcomes		
Length of stay ≤ 2 days	143 419	68.11
Tear (laceration) (3rd or 4th degree)	7426	3.53
Postpartum infections	1298	0.62
Postpartum hemorrhage and hysterectomy	154	0.07
Other variables		
Mothers by MORE ^{OB} module at delivery		
No modules	111 487	52.95
Module 1	52 144	24.76
Module 2	41 104	19.52
Module 3	5835	2.77
Level of care centre		
Level 1	45 301	21.51
Level 2	123 037	58.43
Level 3	42 232	20.06
Births by size of hospital		
≥ 5000 births	117 167	55.65
1000 to 4999 births	54 607	25.93
≤ 999 births	38 796	18.42
	Mean	SD
Characteristics of mothers (min-max)		
Age (13 to 55)	29	5.559
Previous term delivery (0 to 15)	0.887	1.151
Previous preterm delivery (0 to 11)	0.062	0.299
Previous spontaneous abortions (0 to 16)	0.328	0.740
Previous therapeutic abortions (0 to 13)	0.125	0.432

Table 4. Description of variables for neonatal outcome analysis

Variable	Frequency	Rate, %
Total newborns	215 118	100.00
Year		
2003/4	39 704	18.46
2004/5	40 151	18.66
2005/6	41 685	19.38
2006/7	45 291	21.05
2007/8	48 287	22.45
MORE ^{OB} module completed		
None completed	113 308	52.67
Module 1 completed	53 398	24.82
Module 2 completed	42 299	19.66
Module 3 completed	6113	2.84
Level of care centre		
Level 1	42 512	19.76
Level 2	126 175	58.65
Level 3	46 431	21.58
Size of hospital		
≥ 5000 births	122 481	56.94
1000 to 4999 births	56 717	26.37
≤ 999 births	35 920	16.70
Characteristics		
Male	110 086	51.17
Breastfed	186 857	86.86
Preterm births	18 670	8.68
Postterm births	22 578	10.50
Low birth weight (< 2500 g)	14 493	6.74
NICU admissions	30 177	14.03
Ventilation	7061	3.28
Newborn outcomes		
Mortality	871	0.40
Severe morbidity	15 469	7.19

period. The availability of a population database maintained by Alberta Health and Wellness, the provincial health department, provided a unique opportunity to evaluate the impact of the program on neonatal and maternal health outcomes. We provide here an assessment of outcomes after the first four years of the program's implementation.

METHOD

The program included three modules that were implemented by each site over a three-year period.³ Prior to the start of the program, the SOGC trained regional core teams

Table 5. Outcome indicators for MORE^{OB}: pre-program indicators, post-module ORs, and 95% CIs

Indicator	Pre-MORE ^{OB}	Post module 1	Post module 2	Post module 3
Maternal				
Tears (3rd and 4th degree)	3.58%	0.89 (0.81 to 0.97)*	0.84 (0.75 to 0.95)*	0.76 (0.64 to 0.92)*
Length of stay ≤ 2 days	66.21%	1.13 (1.08 to 1.19)*	1.18 (1.11 to 1.25)*	0.77 (0.69 to 0.84)*
Postpartum infection	0.67%	0.84 (0.69 to 1.02)	0.84 (0.64 to 1.10)	0.93 (0.61 to 1.42)
Postpartum hemorrhage with Caesarean section	0.07%	1.02 (0.59 to 1.77)	0.62 (0.28 to 1.37)	0.30 (0.06 to 1.50)
Newborn				
Fetal mortality rate	0.40%	0.84 (0.61 to 1.16)	0.87 (0.54 to 1.34)	0.94 (0.50 to 1.77)
Severe morbidity rates	7.08%	0.96 (0.89 to 1.03)	0.83 (0.74 to 0.92)*	0.82 (0.69 to 0.97)*

* indicate significance with $P < 0.05$

(who were in-house staff). They, in turn, facilitated the three modules, one per year. The modules included self-study of a curriculum, self-tests, emergency drills, skills drills, and annual one-day workshops. The program covered various situations and drills, including labour induction, breech presentation, multiple gestation, and pre- and postterm labour. Most of the topics were covered in module 1, which also included a workshop and some skills drills. The program continued with the workshops and skills drills in modules 2 and 3 and added emergency drill practices. In addition to the education content, program activities focused on patient safety and enhancing teamwork. The centres that started first began module 1 in 2004 and completed the program by 2007; those that began last were expected to complete the final module in early 2010.

We based our analysis on the framework developed by the Canadian Perinatal Surveillance System,¹⁵ which we revised according to advice provided by members of the expert evaluation committee. The maternal indicators included third- and fourth-degree tears, early discharge (length of stay ≤ 2 days), postpartum hemorrhage with hysterectomy, and postpartum infection. Neonatal indicators included mortality and an index of severe morbidity (see Appendix for definitions). Definitions for these variables using International Classification of Diseases¹⁶ and Canadian Classification of Intervention (CCI)¹⁷ codes are shown in the Appendix.

We conducted multivariate regression analyses to predict the impact of the program on outcomes. In Tables 1 and 2

we show the variables that we used in analyzing maternal and fetal outcomes. We included the following classes of variables: MORE^{OB} program indicators, hospital and region indicators, medical practice indicators, and individual health indicators. We measured the MORE^{OB} program indicators by comparing the month of birth with the month in which each child's birth centre completed module 1, 2, or 3. We developed dummy variables for this purpose. We used the hospital level of obstetric care, as defined by Health Canada in 2003.¹⁵ We used the year of delivery as a trend indicator.

Data were obtained from the Alberta Health and Wellness Discharge Abstract Database.¹⁸ The database contains discharge records collected and reported to Alberta Health and Wellness according to national standards developed in conjunction with the Canadian Institute for Health Information. Each record contains the date of delivery, diagnoses and procedures coded according to Canadian Institute for Health Information standards, and hospital and health region identifiers. We obtained maternal and fetal records (in anonymous form) for all provincial births from April 1, 2003, until March 31, 2008.

Because the introduction of MORE^{OB} was scattered over time by birth centres, we used a pre-post design to control for associations between time and the outcomes. Because the dependent variables were binary, we used logistic regressions to control for potential confounding variables.^{19,20} Calculations were conducted using STATA version 9.2 (StataCorp, College Station, TX). In Tables 1 and 2 we list the independent variables that were used in

each equation of outcome variables. Statistical results are expressed by the odds ratio or coefficient. We also report the 95% confidence intervals of each result and the value for each outcome variable prior to the implementation of the program.

RESULTS

In Table 3 we show the descriptive data for the maternal sample. In total, over the five-year period, data for 210 570 mothers who delivered were recorded. Of these, 111 487 delivered in the pre-MORE^{OB} period, while 5835 delivered after MORE^{OB} module 3. About 55% delivered in larger centres and about 20% in smaller centres. In Table 4 we show the descriptive data for the newborn sample. In total, data for 215 118 births were used in the analysis. Over half of the births occurred in the pre-MORE^{OB} period, and 95 697 births (or 44.5% of births) were recorded for sites that completed modules 2 and 3. Only 2.8% of births took place post module 3.

In Table 5 we show the results of the regression equations, focusing on the MORE^{OB} module indicators. Two variables, third- and fourth-degree tears and length of stay ≤ 2 days, were significantly changed after the MORE^{OB} period. There was a reduction in risk of third- and fourth-degree tears in all three modules and an increase in probability of early discharge (length of stay ≤ 2 days) in the first two modules. For example, 3.58% of all mothers had tears prior to the completion of module 1. Following the completions of modules 1, 2, and 3, the odds ratios for tears indicated a reduction to 89%, 84%, and 76% of the base (pre-program) amounts, respectively.

The pre-MORE^{OB} risk and post-MORE^{OB} OR for the newborn outcomes indicators are shown in Table 5. Both outcome indicators supported the MORE^{OB} program, but only one showed a statistically significant change. The pre-MORE^{OB} risk of severe morbidity was 7.08%, and this was reduced by 17% and 18% after modules 2 and 3, respectively.

DISCUSSION

We conducted an analysis of the impact on maternal and fetal outcomes of the three-year, three-module MORE^{OB} continuing education program, which was introduced into all birth centres in Alberta in a staggered manner beginning in the fall of 2004. Our results indicated that maternal third- and fourth-degree tears and length of stay were reduced throughout the program. With regard to newborn outcomes, severe morbidity was reduced.

Of the studies that have analyzed outcomes of continuing education programs, Draycott et al.¹³ showed an impact on

hypoxic ischemic encephalopathy (a variable we omitted from our analysis because of definitional and coding problems), while Nielsen et al.¹⁴ showed no effect. However, the MORE^{OB} program was much more intensive and long-lasting than the program that Draycott et al. analyzed, and we saw significant improvements in several areas. The MORE^{OB} program also focused on treatment patterns and had a considerable impact on length of stay for mothers.

These results are more comprehensive than those of previous studies, in that they cover the outcomes of an entire population in a large number of birth centres covering all levels of care. Our results show that a comprehensive and intensive continuing education program can have a considerable impact on outcome variables, for both the mothers and the newborn babies.

Although the implementation of the program was staggered throughout the province, most program introductions occurred in the first 15 months. By the fourth quarter of 2006, 45 of the 62 centres, including all of the larger ones, had begun MORE^{OB}. The remainder, which were introduced to the program in 2007, left too small a sample for most key indicators to allow us to supplement the pre–post design with a case–control analysis. However, we adjusted the trend using a trend variable in our regressions.

Because of the limited timelines of the study, our analysis suffered from a small sample size after the third module. As a result, some variables which appeared to be non-significant may well have become significant with a sample size that was similar to those of modules 1 and 2. Because of this shortened observation period, we were precluded from making observations about the longer term impact of the program. We also note that our results were associations, and our statements refer to association, not causality.

During the five-year period of program implementation, Alberta experienced unprecedented population growth and associated increases in births. Hospital capacity and staffing levels were generally not increased to accommodate the increased demand, and this was complicated by difficulties in staff recruitment. The health system and staff were under considerable pressure, with high turnover noted in many facilities. Such pressures may have impacted length of stay decisions in some hospitals, as there may have been pressure towards reduced length of stay. If this was the case, the program impact on length of stay may have been somewhat overestimated, although we included an annual trend variable to account for time-dependent effects. On the other hand, high staff turnover may have reduced the program's impact and duration, because many staff members who were trained in the program may have moved on to other positions, to be replaced by new staff members who may not have had the program training. It should be noted, then,

that the program would possibly have had a greater impact under more stable operating conditions.

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REFERENCES

- Baker GR, Norton PG, Flintoft V, Blais R, Brown A, Cox J, et al. The Canadian Adverse Events Study: the incidence of adverse events among hospital patients in Canada. *CMAJ* 2004;170:1678–86.
- Milne JK. Managing risk, clinical error, and quality of care. *J Obstet Gynaecol Can* 2002;24:717–20.
- Milne JK, Lalonde AB. Patient safety in women's health-care: professional colleges can make a difference. The Society of Obstetricians and Gynaecologists of Canada MORE(OB) program. *Best Pract Res Clin Obstet Gynaecol* 2007;21:565–79.
- Black RS, Brocklehurst P. A systematic review of training in acute obstetric emergencies. *BJOG* 2003;110:837–41.
- Beasley JW, Damos JR, Roberts RG, Nesbitt TS. The advanced life support in obstetrics course. A national program to enhance obstetric emergency skills and to support maternity care practice. *Arch Fam Med* 1994;3:1037–41.
- Taylor HA, Kiser WR. Reported comfort with obstetrical emergencies before and after participation in the advanced life support in obstetrics course. *Fam Med* 1998;30:103–7.
- Bower DJ, Wolkowicz MS, Schubot DB. The effects of the ALSO course as an educational intervention for residents. *Advanced Life Support in Obstetrics. Fam Med* 1997;29:187–93.
- Patel RM, Crombleholme WR. Using simulation to train residents in managing critical events. *Acad Med* 1998;73:593.
- Cro S, King B, Paine P. Practice makes perfect: maternal emergency training. *British Journal of Midwifery* 2001;9:492–6.
- Draycott T, Broad G, Chidley K. The development of an eclampsia box and "fire drill." *British Journal of Midwifery* 2000;8:26–30.
- Jyothi NK, Cox C, Johanson R. Management of obstetric emergencies and trauma (MOET): regional questionnaire survey of obstetric practice among career obstetricians in the United Kingdom. *J Obstet Gynaecol* 2001;21:107–11.
- Birch L, Jones N, Doyle PM, Green P, McLaughlin A, Champney C, et al. Obstetric skills drills: evaluation of teaching methods. *Nurse Educ Today* 2007;27:915–22.
- Draycott T, Sibanda T, Owen L, Akande V, Winter C, Reading S, et al. Does training in obstetric emergencies improve neonatal outcome? *BJOG* 2006;113:177–2.
- Nielsen PE, Goldman MB, Mann S, Shapiro DE, Marcus RG, Pratt SD, et al. Effects of teamwork training on adverse outcomes and process of care in labor and delivery: a randomized controlled trial. *Obstet Gynecol* 2007;109:48–55.
- Health Canada. Canadian perinatal health report 2003. Ottawa: Minister of Public Works and Government Services; 2003.
- World Health Organization (WHO). International Statistical Classification of Diseases and Related Health Problems, 10th rev. (ICD-10). 2007. Available at: <http://apps.who.int/classifications/apps/icd/icd10online/>. Accessed May 16, 2010.
- Canadian Institute for Health Information. Canadian Classification of Health Interventions. 2009. Available at: http://www.cihi.ca/cihiweb/disPage.jsp?cw_page=codingclass_cci_e. Accessed May 16, 2010.
- Canadian Institute for Health Information. DAD abstracting manual 2008–2009. Ottawa: Canadian Institute for Health Information; 2008.
- Bland M. An introduction to medical statistics. Oxford: Oxford Medical Publications; 1995.
- Rosner B. Fundamentals of biostatistics. Belmont, CA: Wadsworth Publishing; 1995.

APPENDIX

DEFINITIONS OF VARIABLES

Maternal	ICD-10 or CCI codes
Tears, including those in assisted vaginal births (AVB), and non-breech presentation	070 (perineum laceration during delivery) Assistance: 5.MD.53.^ (forceps traction and rotation delivery) 5.MD.54.^ (vacuum traction delivery) 5.MD.55.^ (combination of vacuum and forceps) Exclude: 5.MD.60.^ (Caesarean section delivery) 5.MD.56.^ (breech presentation)
Early maternal discharge from hospital after birth	Admit category = N Entry code = N Admission date Admission time Discharge date Discharge time
Severe maternal morbidity ratio, includes: <ul style="list-style-type: none"> • septic shock • hemorrhage requiring hysterectomy or transfusion • rupture of the uterus 	008.0 (septic shock) 070.^ (catastrophic uterine rupture) 072.^ (postpartum hemorrhage requiring hysterectomy or transfusion) Hysterectomy: 082.2, 1.RM.87, 1.RM.89, 1.RM.91 Rupture of the uterus: 071.0
Infections	085 (puerperal sepsis) 086 (other puerperal infections) 0753 (other infection during labour)
Newborn	ICD-10 or CCI codes
Fetal mortality	Discharge disposition = 07 Admit category = S Entry code = S Z37.1 (single stillbirth) Z37.3 (twins, one live born and one stillborn) Z37.4 (twins, both stillborn) Z37.6 (other multiple births, some live born) Z37.7 (other multiple births, all stillborn)
Admission to NICU	SCU number = 50 (Neonatal Intensive Care Nursing Unit)
Neonate on ventilation?	1.GZ.30.^ (resuscitation, respiratory system NEC) 1.GZ.31.^ (ventilation, respiratory system NEC) 1.GZ.32.^ (oxygenation, respiratory system NEC) 1.GJ.50.^ (dilation, trachea to keep airway open) 1.GJ.52.^ (drainage, trachea including aspiration, trachea)
Severe neonatal morbidity rate, includes: <ul style="list-style-type: none"> • severe respiratory distress syndrome • sepsis • severe intraventricular hemorrhage 	P22.^ (respiratory distress of newborn) P36.^ (bacterial sepsis of newborn) P38.^ (omphalitis of newborn with or without mild hemorrhage) P39.^ (other infections specific to the perinatal period) P10.1 (cerebral hemorrhage due to birth injury) P10.2 (intraventricular hemorrhage due to birth injury) P10.3 (subarachnoid hemorrhage due to birth injury) P52.^ (intracranial nontraumatic hemorrhage of fetus and newborn)