Preventable Obstetrical Interventions: How Many Caesarean Sections Can Be Prevented in Canada?

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Abstract

Public health authorities have been alarmed by the progressive rise in rates of Caesarean section in Canada, approaching one birth in three in several provinces. We aimed therefore to consider what were preventable obstetrical interventions in women with a low-risk pregnancy and to propose an analytic framework for the reduction of the rate of CS.

We obtained statistical variations of CS rates over time, across regions, and within professional practices from MED-ÉCHO, the Quebec hospitalization database, from 1969 to 2009. Data were extracted from a recent systematic review of the cascade of obstetrical interventions to calculate the population-attributable fractions for each intervention associated with an increased probability of CS. We thereby identified expectant management (as an alternative to labour induction) and planned vaginal birth after CS as the leading strategies for potentially reducing rates of CS in women at low risk. For vaginal birth after CS, an increase to its 1995 level could lower the current CS rate of 23.2% (2009 to 2010) to 21.0%. Other alternatives to obstetrical interventions with a potential for lowering CS rates included non-pharmacological pain control methods (such as continuous support during childbirth) in addition to usual care, intermittent auscultation of the fetal heart (instead of electronic fetal monitoring), and multidisciplinary internal quality assessment audits. We believe, therefore, that the concept of preventable CS is supported by empirical evidence, and we identified realistic strategies to maintain a CS rate in Quebec near 20%.

Key Words: Caesarean section, obstetrical interventions, health services, health organization

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Résumé

Les autorités en matière de santé publique ont été alarmées par la hausse graduelle des taux de césarienne (CS) au Canada (près d'une naissance sur trois dans plusieurs provinces). Nous avons donc cherché à identifier les interventions obstétricales qui pouvaient être évitées chez les femmes qui connaissent une grossesse les exposant à de faibles risques, ainsi qu'à proposer un cadre analytique pour la réduction du taux de CS.

Les variations statistiques, entre 1969 et 2009, des taux de CS avec le temps, d'une région à l'autre et en fonction des pratiques professionnelles ont été tirées de MED-ÉCHO (la base de données

sur l'hospitalisation au Québec). Des données ont été tirées d'une récente analyse systématique de la cascade d'interventions obstétricales en vue de calculer les fractions étiologiques du risque pour chacune des interventions associées à une probabilité accrue de CS. Nous avons ainsi identifié la prise en charge non interventionniste (à titre de solution de rechange au déclenchement du travail) et l'accouchement vaginal planifié après CS comme étant les principales stratégies pouvant permettre la réduction des taux de CS chez les femmes exposées à de faibles risques. Pour ce qui est de l'accouchement vaginal après CS, une hausse jusqu'à son niveau de 1995 pourrait faire passer le taux actuel de CS de 23,2 % (de 2009 à 2010) à 21,0 %. Parmi les solutions de rechange aux interventions obstétricales qui présentent le potentiel d'abaisser les taux de CS, on trouvait les méthodes non pharmacologiques de maîtrise de la douleur (comme l'offre d'un soutien continu pendant l'accouchement) s'ajoutant aux soins habituels, l'auscultation intermittente du cœur fœtal (plutôt que le monitorage électronique du fœtus) et les audits internes multidisciplinaires de la qualité. Nous estimons donc que le concept de la CS évitable est soutenu par des données empiriques et nous avons identifié des stratégies réalistes permettant d'assurer le maintien, au Québec, d'un taux de CS se situant près de 20 %.

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BACKGROUND

When the Quebec Minister of Health and Social Services asked the National Institute of Excellence in Health and Social Services (formerly the Agency for Health Technology and Health Intervention Assessment) to make evidence-based recommendations for reducing rates of Caesarean section, the implicit assumption that a number of these interventions could be prevented needed to be substantiated and verified. Surprisingly, the initial search on this topic did not identify a single reference to a definition or a model for "preventable interventions" in obstetric care, although numerous editorials and commentaries recognized this entity.[1]

The concept of preventable interventions in health care has, in recent years, mostly focused on the prevention of hospital general admissions and readmissions.[2,3] Hospital admission is, however, only one of the numerous consequences of unnecessary or sub-optimal diagnostic and/or therapeutic interventions. Large published randomized trials whose objectives are to show equivalence (non-superiority) between an intervention and no intervention are few and require strong clinical support. In obstetrics, the issue of episiotomy became prominent after the publication of a randomized controlled trial showing that this formerly popular intervention for preventing vaginal tears was leading to more surgical repairs than no intervention.[4,5] Before this scientific evidence became available, the concept of "preventable" episiotomy existed only in the minds of individual experienced clinicians who were alarmed by the high prevalence of this intervention.

The objective of this review was to raise the concept of preventable obstetrical interventions, and to propose an analytic framework adapted to Caesarean sections.

ABBREVIATIONS

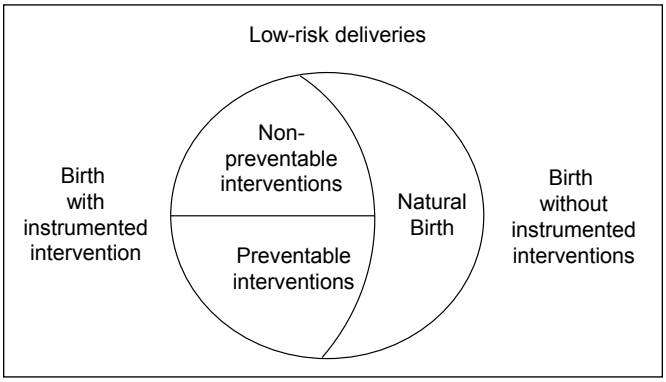
EFM	electronic fetal monitoring
INESSS	Institut d'excellence en santé et en services sociaux
RR	relative risk
VBAC	vaginal birth after Caesarean section

A MODEL OF PREVENTABLE OBSTETRICAL INTERVENTIONS

For the purpose of this review, a preventable obstetrical intervention was defined as an intervention using a technological approach (including pharmacological) for which there is a less invasive alternative (including no intervention) and that has equivalent results in terms of maternal and neonatal health outcomes and similar or superior results in terms of the patient's assessment of quality of care and satisfaction. Ideally, to be declared potentially preventable by this definition, an intervention should have been formally tested against its alternative(s), and health outcomes compared within specified clinical conditions. However, new technologies are often implemented faster than they can be evaluated, and once they are implemented, a formal evaluation is often deemed unethical unless there is strong pressure in favour of the alternatives. In the case of Caesarean section, such pressure from women and clinicians is sufficiently strong in Canada to consider the following model to be legitimate, at least at face value (Figure 1). In this simple model, all low-risk births are placed in three categories with regard to intervention (such as electronic fetal monitoring): no intervention, an intervention that is not preventable, and an intervention that is preventable.

For a CS to be categorized as a preventable intervention in this model, an alternative must first be identified; in this case, the alternative is a vaginal delivery or an attempt at vaginal delivery. Further, the choice between CS and its alternatives must be genuinely fair. In view of the uncertainty of an advantage for CS, this would favour the less risky alternative, a concept close to equipoise promoted by the late Canadian ethicist Benjamin Freedman[6] and adapted in the context of obstetrical interventions.[7–9] By this type of analysis, Caesarean sections would be identified as being without a clear benefit to the mother or the child to be born, and the alternative would not be identified as a missed opportunity to perform CS. In clinical practice, this situation can arise either from an erroneous perception on the part of

Figure 1. A model for preventable obstetrical interventions in low-risk deliveries



clinicians or patients that the intervention is beneficial when in fact it is not, or from a utilization of the intervention outside the scope of currently accepted clinical guidelines (such a situation can exist, for example, when guidelines are outdated with regard to new scientific evidence).[10] At the same time, the alternative (planned vaginal delivery) would carry a perceived risk lower than performing CS. One of these competing principles will be emphasized, partly on the basis of the experience of the clinical team to reach a balance between the expected benefits and risks of the different options at hand. Chaillet and Dumont[11] have shown in a meta-analysis that when the process of options analysis is integrated into clinical practice, the CS rate can be reduced by as much as 25% with no increase in maternal or perinatal mortality or morbidity.

EMPIRICAL EVIDENCE

Temporal Variations

The first empirical evidence leading to a model of preventable Caesarean sections comes from the decline in maternal and perinatal mortality rates that accompanied the rise in rates of CS beginning in the early 1970s. In Quebec, this rise was almost linear between 1969 and 1985, doubling every five years (Figure 2). At the same time, the perinatal mortality rate also fell in linear fashion by 10 per 1000 births, with the two curves intersecting perfectly in the centre. The sharp rise in rates of CS followed the increased availability of epidural analgesia in each region (MED-ÉCHO database, the Quebec Health Ministry administrative database on all hospitalization, including one-day admissions). The decline in the perinatal mortality rate cannot be attributed solely to the increase in CS rate because it is the end of a secular decline throughout the 20th century, from a rate of over 100 per 1000 births before 1920 to approximately 7 per 1000 in 1992 and remaining at this level thereafter in Quebec.[12] In fact, there are no reliable data on the contribution of CS to the decline in perinatal mortality.

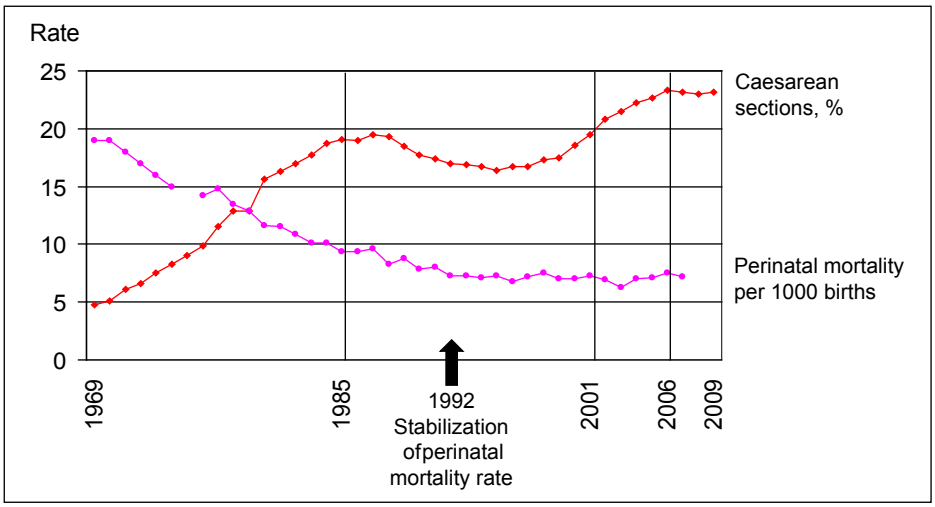
Nevertheless, the second wave of increase in rates of CS, from 16.4% in 1995 to 23.3% in 2006 (a net increase of 6.9%), occurred with no change in perinatal mortality (Figure 2). The argument is similar with regard to the maternal mortality rate, which also declined throughout the 20th century; the rate fell from almost 600 per 100 000 live births at the beginning of the century to stabilize at less than 6 per 100 000 live births after 1990, by which time CS rates had reached 17.7%. Again, there is no question that Caesarean sections continue to save the lives of mothers and babies and contribute to reducing morbidity in deliveries at risk, particularly in low and very low birth weight deliveries. While there have been recent changes in the distribution of risk factors, such as increasing maternal age, body mass index, and primiparity, those trends are insufficient to explain the rapid increase in CS rates between 1985 and 2006. For instance, deliveries between 37 and 41 weeks of gestation have represented almost 91% of all pregnancies during that period, and the steady rise in CS rates has been observed in all categories of gestational age. There are no statistics in Canada indicating the frequency of Caesarean sections performed at the request of women without a medical indication (also known as Caesarean section on maternal request), but their contribution to the recent rise in CS rates is believed to be low.[13]

Geographic Variations

Rates of CS in Quebec have been stable since 2006 at between 23% and 23.3%. This is below the Canadian average of 26.8% for the year 2009 to 2010.[14] Manitoba and Saskatchewan have rates below those of Quebec (20.2% and 22.1%, respectively), but all other provinces have rates above 27%, with British Columbia, Newfoundland and Labrador, and Prince Edward Island having rates above 30%. For the same period, regional rates in Quebec ranged between 19.1% and 28.7%, mimicking the variability across Canada. Of the three regions in Quebec with the highest rates, one is a remote region (Gaspésie-Iles-de-la-Madeleine) and two are adjacent to a University Health Centre (Chaudières-Appalaches and Outaouais).

For the period between 1990 and 2005, regional CS rates in Quebec have been strongly and inversely correlated when compared with the rate of vaginal birth after Caesarean (Pearson coefficient = −0.50; $P = 0.05$) (Figure 3). In fact, all regions with high VBAC rates had the lowest CS rates and vice versa, except for the Outaouais region. This region neighbours a region in South-Eastern Ontario with a similarly high CS rate (28.8% for the year 2006).[14]

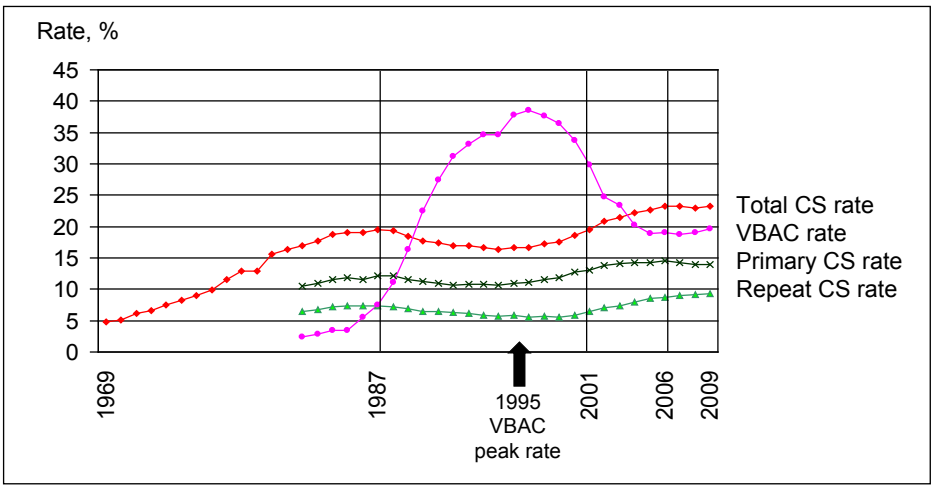
Figure 2. Caesarean section and perinatal mortality rates in Quebec 1969 to 2009



Sources: Caesarean section rates from the Quebec hospitalization database (MED-ÉCHO); perinatal mortality from Quebec Institute for Statistics (1976 to 2009) and Statistics Canada (1921 to 1974)

Perinatal mortality: Annual number of stillbirths and early neonatal deaths (deaths in the first week of life) per 1000 total births (includes stillbirths). Stillbirths are defined as occurring at a gestational age of ≥ 28 weeks.

Figure 3. Caesarean section and VBAC rates in Quebec 1969 to 2009



Sources: Caesarean section rates from the Quebec hospitalization database (MED-ÉCHO)

*Rate per 100 births from women who had a previous CS

This is also illustrated by the sharp rise in VBAC rates that peaked at 38.5% in 1995 and fell rapidly thereafter, and was exactly mirrored by CS rates that reduced from a historic high of 19.5% in 1987 to 16.4% in 1995 before rising again (Figure 3).

A similar pattern was observed in the United States at the same time.[15] These observations provide support to the argument that the promotion of a single measure such VBAC can reduce CS rates by a few percentage points. Obviously, the correlation cannot be interpreted as cause and effect because it does not account for variations in medical indications and standard of care for Caesarean sections in Canada during that period of time. In Quebec, no change in the indications recorded for Caesarean sections has been observed since 1982, with approximately 40% being performed in women with a previous CS, 25% for dystocia, 15% for breech presentation, 10% for fetal distress, and 10% for other reasons (MED-ÉCHO). The relationship between CS and VBAC rates might simply be coincidental, but is consistent with the concept of preventable interventions.

Table 1. Distribution of pregnancies and Caesarean section rates in Quebec 2009 by Robson category[20] (total number of births = 84 375)

Robson category*	Prevalence in category, %	Caesarean section rate, %	Contribution to Caesarean section rate, %
All births	100	23. 2	23.2
Primiparous singleton cephalic ≥ 37 weeks and spontaneous labour Multiparous without previous CS singleton cephalic ≥ 37 weeks and spontaneous labour	58.5†	4.8†	2.8†
Primiparous singleton cephalic ≥ 37 weeks with labour induced or CS before labour Multiparous without previous CS and singleton cephalic ≥ 37 weeks and labour induced or CS before labour	24.9	16.3	4.1
Multiparous with previous CS and singleton cephalic ≥ 37 weeks	11.5	80.4	9.3
Primiparous, all breech presentations Multiparous, all breech presentations	4.4	92.6	4.1
All multiple pregnancies	3.1	61.3	1.9
All presentations other than cephalic or breech	2.5†	45.2†	1.1†
All premature labour ≤ 36 weeks	6.9	34.9	2.4

Data from the Quebec hospitalization database (MED-ÉCHO).

*Categories are not mutually exclusive; groupings differ from original publication according to data availability.

†Values calculated or estimated.

Variations Between Professional Groups

Rates of CS also vary between obstetrical practices.[16] In Quebec, obstetricians attend two thirds of all births, family physicians attend approximately one third, and midwives attend 2.0% (MED-ÉCHO data 2009 to 2012 and communication from the *Ordre des sages femmes du Québec* for the period 2010 to 2012). At initiation of midwifery pilot implementation projects in Quebec, primiparous women attended by a midwife accounted for one half of the CS rate compared with women attended by a family physician (10.8% and 19.8%, respectively) after controlling for mothers' age, parity, geographic area, education, and obstetrical risk.[17] Similar results have been obtained more recently in British Columbia and in the United Kingdom, where the lower recourse to technology by midwives in low-risk births was not accompanied by increases in perinatal mortality or morbidity.[18,19] The authors of these reports have concluded that the lower use of obstetrical technology and recourse to CS in low-risk women could not be entirely explained by differences in the level of obstetrical risk (which was partly accounted for in these studies), and that continuous intrapartum support to women probably accounts for a large part of the differences observed in CS rates.

SUMMARY OF EMPIRICAL EVIDENCE

A method for summarizing empirical evidence in support of our preventable obstetrical interventions model has been proposed by Robson[20] and recommended in a systematic review published by WHO representatives.[21] This method combines local statistics on CS rates organized in 10 categories representing different potential strategies for reducing the overall rates (Table 1). The calculation of each category's contribution to the overall CS rate is the product of the prevalence in each category multiplied by its specific CS rate. For example, the prevalence of women with a previous CS in Quebec is 11.5% of all deliveries, and the CS rate in that group is 80.4% (2009 to 2010), meaning that this group contributes 9.3% of the overall CS rate of 23.2%, or two out of five Caesarean sections in Quebec (Table 1). As shown in Table 1, this category represents by far the largest contribution to CS rates, followed by induction of labour and breech presentation (4.1% each).

This calculation helps us appreciate the potential impact of different types of interventions for reducing CS rates. An increase in the rate of VBAC to the 1995 level would decrease the specific CS rate in that category to 61.5% (instead of 80.4%, Table 1) and would lower the contribution of VBAC to the overall CS rate to 7.1%, 2.2% less than the 9.3% calculated for the year 2009. This same calculation can be done for low-risk pregnancies without a previous CS, estimated in 2009 to 2012 at a prevalence rate of 58.5% of all deliveries in Quebec, with a specific CS rate of 4.8% and a contribution of 2.8 Caesarean sections per 100 births (Table 1). Lowering the specific CS rate in that category by

Table 2. Measures of associations between obstetrical interventions and Caesarean section rates in low-risk pregnancies

Intervention	Prevalence* %	Alternative	Meta-analysis Year of RCTs	Relative risk† (95% CI)	Attributable fraction in population‡
Electronic fetal monitoring	72	Intermittent auscultation	Bix et al. (2005)[23] 1997 to 2001	1.2 (1.0 to 1.4)	12.6
Epidural analgesia (as part of usual care)	70	Usual care + UCPC	Rossignol et al. (2012)[22] 1990 to 2010	1.6 (1.2 to 2.2)	29.6
Labour induction	27	Expectant management	Alfirevic et al. (2009)[24] 1977 to 1999	1.2 (1.0 to 1.4)	5.1
			Gulmezoglu et al. (2012)[25] 1969 to 2005	0.9 (0.8 to 1.0)	−2.8
			Caughey et al. (2009)[26] 1975 to 2007	0.8(0.7 to 0.9)	−5.7
Labour augmentation	27	Expectant management	Wei et al. (2009)[27] 1987 to 2005	0.9 (0.8 to 1.0)	−2.8
Planned CS	23.2	Planned vaginal delivery:	Chaillet and Dumont (2007)[11]		
		Quality assessment	1991 to 1998	1.4§ (1.3 to 1.4)	8.5
		Multiple strategies	1988 to 1996	1.4§ (1.3 to 1.4)	8.5
		Clinical audits	1984 to 2000	1.2§ (1.1 to 1.3)	4.4

UCPC: upper cerebral pain control techniques, such as direct patient support and breathing and relaxation techniques, that are added to standard care (which includes access to epidural analgesia upon request)

*Prevalence of intervention in Quebec 2009 from hospitalization database (MED-ÉCHO)—labour augmentation estimated from reference 29.

†Summary relative risks reported in the meta-analyses for low-risk women.

‡Attributable fraction in population (PAF) is the proportion of the prevalence of an intervention that would be prevented if all interventions were replaced by their alternative(s) and is calculated with the formula PAF = PP (RR−1) / (1+(PP (RR−1) where PP is the population prevalence and RR is the relative risk (source: http://www.med.uottawa.ca/sim/data/PAR_e.htm)

§Relative risk of planned vaginal delivery versus planned CS, not the reverse.

only 1% (the variation observed between 2004 and 2009) would represent a potential reduction in contribution of 1.7%. Those two examples illustrate that a small change in a category with a high CS prevalence rate will have a greater impact on overall CS rates than a large change in a category with a low prevalence. By the same reasoning, it can therefore be argued that much of the rise in CS rates in recent years could be explained by a small increase in rate in the two categories with the highest prevalence rates: women with a low-risk pregnancy and women with a history of previous CS. Although the effect of targeting these contributions would seem small (rates reduced by 2.2% and 1.7% respectively), it is the combined effect of several strategies and their potential synergy that will succeed in reducing and stabilizing CS rates in the long term.

THE CASCADE OF OBSTETRICAL INTERVENTIONS

Another strategy in support of the preventable obstetrical interventions model is found in the inventory of statistical associations between intrapartum obstetrical interventions and CS rates in low-risk women. If an intervention is statistically associated with an increase in CS rates when compared with its alternative, then its replacement or prevention would have the potential to avert Caesarean sections. Some of the results from a systematic review of meta-analyses (published by the National Institute of Excellence in Health and Social Services in Quebec[22]) that identified all associations between intrapartum obstetrical interventions and CS rates in women with a low-risk pregnancy are summarized in Table 2.[11,22–27] From the relative risks reported in meta-analyses, an attributable fraction can be calculated using the specific prevalence for each intrapartum intervention. For example, when continuous electronic fetal monitoring is compared with intermittent auscultation of the fetal heart, its recommended alternative in low-risk pregnancies, it is associated with a 20% increase in CS rates with borderline statistical significance (RR 1.2; 95% CI 1.0 to 1.4).[23] The authors of this study reported that 30% of EFM at admission in the randomized trials included in their meta-analyses was continued throughout labour; therefore, the relative risk above would apply to women who had EFM instituted on admission and include those in whom it was maintained throughout labour (continuous EFM). The corresponding prevalence of EFM in the Canadian postpartum survey[28] was estimated at 72% for women in Quebec, which gives an attributable fraction of 12.6%. This means that if all EFM was

replaced by its alternative (intermittent auscultation), CS rates would be reduced by 12.6%, giving a net reduction in rate of 2.9%. If one half of women having EFM had intermittent auscultation instead, the net reduction would be approximately 1.5%.

In the case of epidural analgesia, INESSS[22] have proposed a different paradigm. Here the issue is not the replacement of usual care (including epidural analgesia) with an alternative, but is instead the addition of non-pharmacological options to standard care for the relief of pain early in labour. Indeed, there is currently no scientific evidence (specifically, high-quality RCTs) to compare epidural analgesia with non-pharmacological pain control methods. Instead, INESSS[22] present indirect evidence that in the absence of systematic availability of non-pharmacological pain control methods (including continuous support during labour, and breathing and relaxation techniques) in addition to usual care (which includes epidural analgesia on request), the relative risk of CS is 60% higher (OR 1.6; 95% CI 1.2 to 2.2). This increased risk translates into an attributable fraction of 29.6%. INESSS suggest that if all women in labour had access to individualized non-pharmacological methods for labour pain in addition to usual care (which includes epidural analgesia on request), then a significant proportion of Caesarean sections could be prevented.[22] This would be equivalent to a net reduction of 6.9%. Again, if one half of women in labour had such access and opted for it, the CS rate would still decrease significantly to less than 20 per 100 births in Quebec. With regard to labour induction, RCTs including deliveries between 37 weeks and < 42 weeks show mixed results. The Cochrane review that included only the oldest RCTs (1977 to 1999)[24] showed an advantage of expectant management over induction of labour with regard to risk of CS. However, two meta-analyses including more recent RCTs (up to 2007)[25,26] showed the reverse, with fewer Caesarean sections associated with labour induction. According to the authors of these two meta-analyses, the lack of uniformity in the findings results from a lack of standardization in criteria and methods used for induction of labour. The same conclusion applies to augmentation of labour.[27] Currently, therefore, the lack of scientific evidence prevents us from targeting induction and augmentation of labour to reduce CS rates. However, because deliveries after labour induction or augmentation account for almost one in six Caesarean sections in Quebec, they (and VBAC) provide the largest potential targets for reducing CS rates.[29]

Finally, one meta-analysis[11] examined interventions aimed at reducing CS rates by replacing planned Caesareans with planned vaginal deliveries in low-risk women. In three types of interventions, clinical audit and feedback, clinical practice quality improvement, and multifaceted strategies, clinical decisions to perform CS are reviewed and discussed periodically in multidisciplinary meetings. The relative risks associated with these three interventions ranged from 1.2 to 1.4, were highly statistically significant (Table 2), and were attributed to practice changes resulting from these clinical decision review methods. Assuming that all planned Caesarean sections in low-risk births (including a previous history of CS) could be replaced by a planned vaginal delivery, the attributable reduction in CS rate is estimated at 4.4% to 8.5% or a potential CS rate reduction of 1% to 2%. As before, the different effects shown in Table 2 are not cumulative because they are not mutually exclusive in the individual RCTs included in meta-analyses. They provide a range of potential reductions which, regardless of feasibility and costs, identify provision of continuous support during labour (in addition to usual care) as the best strategy for reducing overall CS rates in low-risk births. This is followed by replacing EFM with intermittent auscultation of the fetal heart, and internal clinical practice audits.

DISCUSSION

The answer to the question "Are some Caesarean sections in Canada preventable without jeopardising maternal and newborn health?" is unambiguously "yes" for women with a low-risk pregnancy. Recent temporal and geographical trends support the concept of preventable Caesarean sections.

The next question, "How many Caesarean sections can be prevented in a given obstetrical practice?" is more difficult to answer with certainty. The WHO expert consensus has cited 15% as the potentially optimal CS rate.[30] We have identified two empirical clues for what would seem a realistic national goal for reducing CS rates. The first is based on the observation that there has been no concurrent change in maternal and perinatal mortality since the CS rate reached 18%. The second indication is provided by the fact that the lowest rate in Quebec was observed in a university hospital region (Cantons de l'Est), at 19.1%. The current CS rate in the province is 23.2%. Therefore, a goal of reducing CS rates in all regions of Quebec to 20% of births and maintaining rates at this level would appear to be realistic. The same reasoning could be applied to other Canadian provinces, assuming that the proportion of low-risk deliveries is similar between provinces. Three provinces are close to this target CS rate.

Our assessment provides several potential answers to the question "What strategies would contribute to achieving the goal of reducing the CS rate?" Increasing

the availability of VBAC has great potential for reducing CS rates. This would require appropriate identification of potential candidates (currently still a barrier), as well as specially trained professionals in centres that can ensure safety. An increase in the VBAC rate to its 1995 level could lead to a potential reduction in CS rates by 2.2%. Another set of strategies for reducing rates of CS would aim at replacing obstetrical interventions upstream by their respective alternatives in low-risk pregnancies. For instance, reducing the prevalence of EFM by 25% and increasing the availability of continuous support during labour by 25% could result in a reduction of the overall CS by 0.8% and 2.0% respectively. Strategies aimed at creating favourable environments for women with a low-risk pregnancy are emerging in developed countries,[31] but few have been formally evaluated for their potential to reduce CS rates. The results of Canadian experiences in promoting collaborative multidisciplinary care are encouraging[32] and show that the make-up of the obstetrical workforce is part of larger organizational and decision-making environments.[33,34]

Because these strategies offer the potential to reach the goal of reducing the provincial CS rate to 20% and maintaining it at this level, the final question is "How can these different strategies be implemented in practice?" The meta-analysis carried out by Chaillet and Dumont[11] showed that internal clinical audits of various forms have been successful in randomized trials in lowering CS rates by 4.6%, a figure that is consistent with our proposed goal. One key to those audits is their interdisciplinary nature, involving physicians and nurses to evaluate retrospectively the preventability of Caesarean sections and other obstetrical interventions. The Quarisma research project,[35] currently in progress at 32 obstetrical centres, compares 16 intervention sites in Quebec with 16 matched control subjects. This trial will provide further information on the various forms that this intervention can take and the results that can be expected from its application in various practice settings.

No proposal of this nature can be sold as being self-financing unless cost-benefit analyses of the different options and scenarios are undertaken. The replacement of Caesarean sections and other obstetrical interventions by less technological interventions is appealing for its cost-reduction potential. However, the equation is not straightforward because technology has partly replaced individualized one-to-one care and has somewhat reduced the time required for professionals to be involved in care. In terms of clinical feasibility, internal multidisciplinary audits can be integrated into existing quality improvement measures that are supported by scientific evidence and aimed at improving clinician compliance with guidelines.[36] However, the major argument against reducing the rate of CS remains the fear of legal action against clinicians for not intervening in the case of an adverse outcome. The Society of Obstetricians and Gynaecologists of Canada and their collaborative associations have taken the lead in publishing a joint policy statement on normal childbirth.[37] Such policies and guidelines are helpful for changing the community view of standard practices, which insurers such as the Canadian Medical Protective Association and the Canadian Nurses Protective Society use to make decisions.

Reducing the number of Caesarean sections required for maternal and newborn health in low-risk pregnancies has a direct impact on women's expectations. Caesarean section was an exceptional outcome for the generation of women who conceived up to the early 1980s, but more than a full generation has now experienced high CS rates as part of routine care. This will have a definite influence on future generations. Klein et al.[38] concluded from their survey of knowledge and attitudes about birth technology in primiparous Canadian women that many women reported uncertainty about the benefits and risks of common procedures used during childbirth, including CS, regardless of the type of care provider in attendance. Efforts will have to be made to update the information packages provided to pregnant women, specifically addressing the issue of preventing unnecessary Caesarean sections and other obstetrical interventions during labour, and the potential benefit for the health of mother and baby. Two key tasks are dispelling the misconception that preventing unnecessary obstetrical interventions reduces women's choice in health care, and clarifying the nature of adverse events associated with interventions that are not medically required.

The main limitation of the model presented for preventable obstetrical interventions is that it is entirely based on empirical data and the assumption that less intervention can lead to a better risk–benefit ratio. Results from randomized clinical trials cannot be transposed to the general population because of the highly selective process for including study subjects. Also, assessments of long-term risks after birth are often absent from any epidemiological study and poorly understood, which limits the scope of comparison between obstetrical interventions and their less technological alternatives. However, the Quarisma project[35] in Quebec, funded by the Canadian Institutes of Health Research and supported by the Society of Obstetricians and Gynaecologists of Canada, is a pragmatic trial that should provide a solid scientific base for developing clinical decision tools applicable to low-risk

pregnancies. Another limitation of trying to set a goal for reducing CS rates is the lack of data on how the different strategies interact with one another, synergistically or antagonistically.

As mentioned previously, feasibility and costs have yet to be estimated in the current obstetrical care structure. Strategies aimed at modifying or reinforcing guideline implementation and modifying perceptions of obstetrical technologies for women with low-risk pregnancies will require the participation of teaching and health care establishments. The quarterly availability of high quality statistics on interprovincial and inter-regional CS and obstetrical intervention rates is crucially important. The Robson model[20,39] provides a practical approach to presenting and interpreting statistics for clinicians. Pertinent information should be collected, including all types of obstetrical interventions during labour. In this respect, the Quebec obstetrical database currently falls short on several key elements and should be updated.

CONCLUSION

We propose a model of preventable obstetrical interventions from empirical evidence. This model is consistent with current epidemiological observations but must be tested in real obstetrical practice settings. It provides a framework for proposing a provincial goal of reducing the Caesarean section rate to 20% and maintaining it at this level, and strategies for reaching that goal.

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