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1 Departments of Obstetrics and Gynecology and Health Research Methods, Evidence, and Impact, Faculty of Health Sciences, McMaster University, Hamilton, Ontario, Canada

2 Clinical Epidemiology Unit, Department of Medicine, Solna, Karolinska Institutet, Sweden

3 Patient author, Canada

4 Public representative, Birth Trauma Canada, Saint John, New Brunswick, Canada

5 Department of Obstetrics and Gynaecology, University of British Columbia, Vancouver, British Columbia, Canada

6 School of Population and Public Health, University of British Columbia, Vancouver, British Columbia, Canada

Correspondence to: G M Muraca
muracag@mcmaster.ca

Maternal and neonatal trauma during forceps and vacuum delivery must not be overlooked

Giulia Muraca and colleagues argue that Canada's high rates of maternal and neonatal trauma following operative vaginal delivery warrant urgent recognition, transparency, and action

Giulia M Muraca, [1,2] Laura E Ralph, [3] Penny Christensen, [4] Rohan D'Souza, [1] Roxana Geoffrion, [5] Sarka Lisonkova, [5,6] K S Joseph [5,6]

Operative vaginal deliveries—forceps and vacuum assisted deliveries—are recommended as safe, acceptable alternatives to caesarean delivery for women in the second stage of labour when descent of the fetal head is arrested, there is imminent risk to the baby, or there are conditions that contraindicate pushing (expulsive) efforts. [1-3] Although available data on maternal and neonatal mortality and morbidity show no clear advantage of operative vaginal delivery over caesarean delivery, such comparisons often fail to recognise the impact of maternal trauma, the most common injury associated with operative vaginal delivery. [3] This is particularly pertinent in Canada, which has the highest rate of maternal trauma after operative vaginal deliveries among high income countries (fig 1). [4]
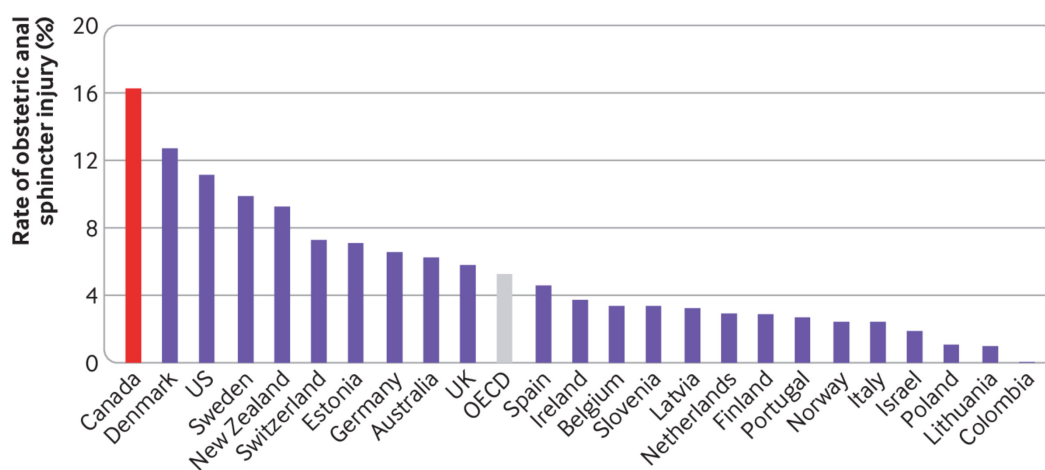

Fig 1 | Rate of obstetric anal sphincter injury from operative vaginal deliveries (forceps and vacuum assisted combined) in 24 Organisation for Economic Cooperation and Development (OECD) countries, 2019[4] *OECD=average among the 24 OECD countries

Each year, more than 35 000 singleton infants are born after attempted operative vaginal delivery in Canada. One in four (25.3%) attempted forceps deliveries and one in eight (13.2%) attempted vacuum deliveries result in maternal (obstetric) trauma, most commonly obstetric anal sphincter injury. [5] Additionally, severe neonatal trauma occurs in one in 105 (9.6/1000) infants following attempted forceps or vacuum birth, with brachial plexus injury the most common trauma and neonatal death the most serious adverse outcome. [5 6]

Initiatives to decrease caesarean deliveries in North America that include scaling up training and use of operative vaginal deliveries need to acknowledge the serious safety concerns related to operative vaginal deliveries and ensure that women are informed of the risks of forceps, vacuum, and second stage caesarean delivery. The obstetric community should focus on reducing the high rates of trauma in Canada and shift the narrative around mode of delivery away from aiming to reduce caesarean delivery rates and towards transparent, evidence based, patient centred care and safe, positive birth experiences.

Reasons behind Canada's statistics

The rates of obstetric anal sphincter injury in Canada are almost three times higher than in the UK, which has rates close to the average for countries in the Organisation for Economic Cooperation and Development (fig 1). [4] Although differences in coding practices and data reporting between countries may have affected these comparisons, with under-reporting of obstetric trauma likely in some countries, estimates of maternal trauma rates in Canada have been repeatedly shown to be accurate. [7-9] Differing practice with regard to use of forceps and episiotomy (figs 2 and 3), training, and safety initiatives are all likely to have a role (box 1).
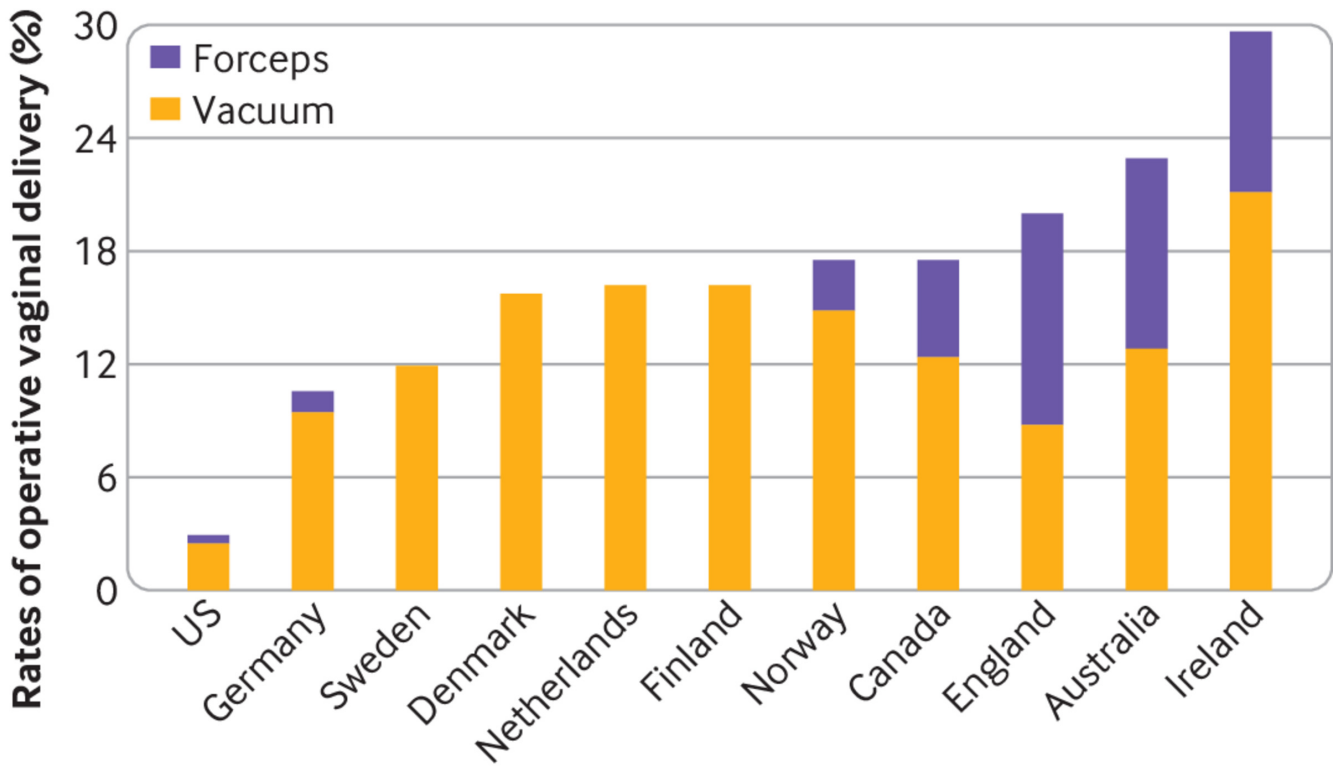
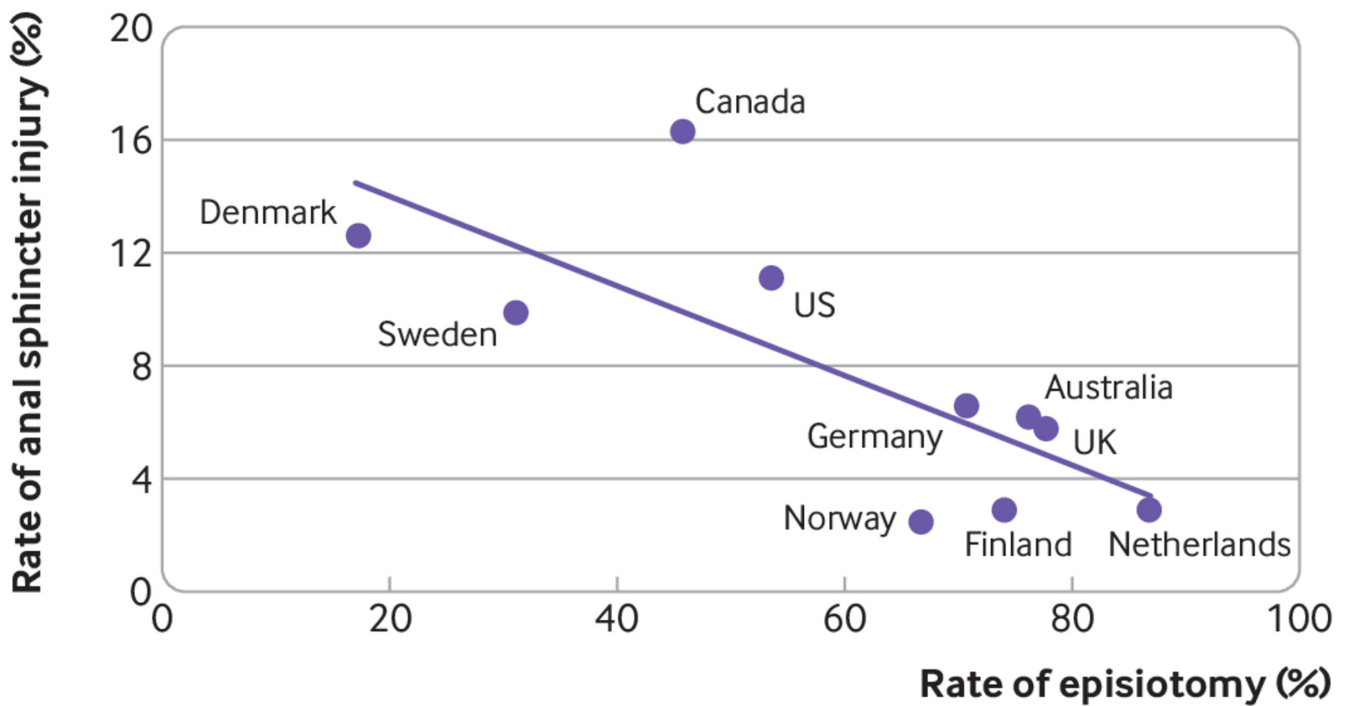Fig 2 | Rate of operative vaginal delivery by instrument among nulliparous women[5 10 -15]

Fig 3 | Correlation between rates of episiotomy and obstetric anal sphincter injury among operative vaginal deliveries in OECD countries[5 10 -15] (Pearson's correlation coefficient=0.76; P=0.01). Data on episiotomy rate among operative vaginal deliveries in Ireland were not available

Box 1: Factors contributing to Canada's high rate of obstetric anal sphincter injury

- *Relatively high rates of forceps delivery*—Rates of obstetric anal sphincter injury are higher with forceps delivery than with vacuum delivery,[16 17] and Canada uses forceps more often than many other countries[5] (5.1% v 2.5% in Norway among nulliparous women). Some European countries have abandoned forceps altogether,[12] and only Australia, Ireland, and the UK have higher rates of use (fig 2).

- *Relatively low rates of episiotomy*—Accumulating evidence supports the routine use of mediolateral episiotomy (with an incision angle of 60°) in operative vaginal delivery to reduce the risk of obstetric anal sphincter injury, particularly with forceps and among nulliparous women.[18] However, no adequately powered randomised trial has examined this, and recommendations surrounding mediolateral episiotomy in operative vaginal delivery vary.[2 14 19 -21] For example, European and Australian guidelines recommend mediolateral episiotomy for operative vaginal delivery in women having their first vaginal birth,[19 20] whereas Canadian guidelines recommend restricted use of mediolateral episiotomy.[2] Large differences in episiotomy rates between countries parallel these diverse recommendations[22 23]; in 2020, reported rates of episiotomy were 90% with forceps and 50-60% with vacuum in the UK,[14] compared with 65% and 38%, respectively, in Canada in 2018 (fig 3).[24]

- *Decline in training opportunities*—Diminishing expertise in operative vaginal delivery may be contributing to the high injury rates. Canadian studies show that maternal and neonatal trauma have increased as use of operative vaginal delivery has declined.[25] However, studies that attempt to assess practitioner skill using proxy measures, such as procedure volume or years in practice, have not shown an association with maternal or neonatal trauma.[26 -29] A detailed report[6] on the safety of operative vaginal delivery during 2013-19 showed that several hospitals offering the highest level of obstetric care in Canada had high rates of maternal and severe neonatal trauma, even after adjustment for differences in case mix and irrespective of how many forceps or vacuum deliveries were performed each year[3]; however, practitioner level information was not available.

- *Lack of efforts to reduce injury*—Unlike many other countries, Canada has had no national initiative aimed at reducing maternal injury.[30 -32] For example, in the UK the Royal College of Obstetricians and Gynaecologists and Royal College of Midwives introduced a "care bundle" to reduce injury, comprising antenatal discussion about obstetric anal sphincter injury, manual perineal protection, mediolateral episiotomy, and systematic examination of the perineum.[30] A similar campaign was launched by Women's Healthcare Australasia.[31]

Does evidence support increased use of operative vaginal deliveries?

Although no randomised trials have compared outcomes from operative vaginal deliveries and second stage caesarean deliveries,[33] population based, observational studies in Canada and the United States have shown that caesarean delivery in the second stage of labour is associated with higher rates of neonatal respiratory morbidity and maternal infection than operative vaginal delivery.[34 -37] Composite severe maternal morbidity and mortality rates (which do not include maternal trauma) vary by instrument, with lower rates among women having vacuum deliveries and similar rates among women with forceps or caesarean deliveries. Rates of severe perinatal morbidity and mortality in Canada are higher after operative vaginal delivery than caesarean delivery performed for arrest in labour but not for fetal distress.[34] Although several demographic and clinical factors were controlled for in the adjusted estimates, important clinical features were not captured (eg, fetal head flexion, asynclitism, moulding, and caput). In addition, indicators of patient preference and practitioner skill, important factors in deciding the delivery method, were not available.

Evidence on trauma is clearer. Operative vaginal deliveries are associated with high rates of severe maternal and neonatal trauma, most notably obstetric anal sphincter injury in mothers, and subaponeurotic haemorrhage and brachial plexus injury in neonates.[5 36 38 -40] The rate of obstetric anal sphincter injury in Canadian women is 2.8% for spontaneous vaginal deliveries,[5] 18-25% for forceps deliveries, and 11-16% for vacuum delivery, depending on indication and pelvic station.[34] Adjusted rates of severe neonatal trauma are fourfold higher for operative vaginal deliveries than for caesarean deliveries. Although the absolute rates of severe neonatal trauma are low (0.96% with forceps and vacuum, 0.2% with second stage caesarean delivery),[5 34] rates of maternal and severe neonatal trauma with operative vaginal delivery are increasing in Canada, especially with forceps delivery.[25 40]

The long term effects of each delivery option also need to be considered. A primary caesarean delivery carries a 0.7-1.5% risk of developing placenta previa, a 0.3% risk of placenta accreta, and 0.3% risk of uterine rupture in a subsequent pregnancy, and these risks increase with increasing numbers of previous caesarean deliveries (table 1).[41] Morbidity associated with placenta accreta can be severe, with high rates of haemorrhage, hysterectomy, and intensive care unit admission.[41]

Table 1 | Incidence (%) of complications of caesarean delivery in subsequent pregnancies[41 -43]

No of previous caesarean deliveries	Placenta previa	Placenta accreta	Uterine rupture	Hysterectomy	Wound infection	Wound dehiscence	Postpartum haemorrhage	Placental abruption	Surgical injury
1	0.7-1.5	0.3	0.3	0.1-0.7	0.9-1.5	0.1	0	1.0-1.4	0.1
2	1.1-2.0	0.6	0.6	0.1-0.9	0.4-1.5	0.2-0.3	0.1	1.0-1.3	0.3
3	1.0-2.3	2.1	0.8	0.4-2.4	1.3-1.6	0.2-0.8	1.9	1.1-1.5	1.2
4	2.3-4.2	2.3	0.6	1.4-3.5	3.5	0-1.4	1.4	—	1.9
≥5	3.4	6.7	0.8	9.0	3.4	1.2	—	—	4.5

The long term consequences of operative vaginal deliveries are also considerable, albeit qualitatively different and less visible from the obstetric perspective. Obstetric anal sphincter injury is associated with an increased risk of dyspareunia, pelvic floor disorders, pelvic pain, and sexual dysfunction.[17 44 -46] Faecal and anal incontinence are direct complications of these injuries and can have devastating effects on social, psychological, and physical wellbeing.[17 45 -48] Reported rates of anal incontinence following repair of obstetric

anal sphincter injury are 15-61% (mean 39%),[17] and these increase from 31% at 3-6 months to 69% at 20 years after delivery.[46 47] A prospective cohort study of 6760 Swedish women with two vaginal deliveries found the rate of faecal incontinence 20 years after delivery was 23.7% among women with one obstetric anal sphincter injury and 36.1% among those with two.[47]

A study of women's future pregnancy and mode of delivery experience after an operative vaginal delivery or second stage caesarean delivery found women in both groups commonly avoided further pregnancy because of fear of childbirth (51% operative vaginal delivery, 42% caesarean delivery). Women with a previous operative vaginal delivery were two to three times more likely to have a vaginal delivery than women who had a caesarean delivery.[49] However, the study did not identify caesarean deliveries that resulted from a failed operative vaginal delivery attempt and combined forceps and vacuum delivery into one category, making interpretation challenging. Studies evaluating the association between second stage caesarean delivery and preterm birth in a subsequent pregnancy have the same methodological flaws.[50 -52] Reassuringly, neurodevelopmental and cognitive outcomes in children and young adults seem to be similar for operative vaginal and second stage caesarean delivery.[53 -57]

Supporting patient centred, evidence informed choice

The most recent Canadian clinical practice guideline on operative vaginal delivery[2] asserts that "Overall, in carefully selected circumstances, both vacuum and forceps are associated with relatively low rates of serious morbidity and mortality in both mother and baby."[2] The high incidence of maternal trauma associated with such deliveries is obscured by aggregating spontaneous and operative vaginal deliveries: the guideline mentions an incidence of obstetric anal sphincter injury "between 4% and 6.6% of all vaginal births, including those by [operative delivery]."[2] The failure to acknowledge the high rate of injury associated with operative vaginal deliveries (eg, 25.3% rate of maternal trauma following forceps delivery) signals a disregard for transparency and could limit the ability of patients to make evidence informed decisions about childbirth.

Evidence from Canadian hospitals shows that informed consent practices related to operative vaginal deliveries reflect this tendency to under-report the associated risks.[58 59] A study examining consenting practices documented in medical records of women who had operative vaginal deliveries at two tertiary care centres in Ontario, Canada, in 2019, showed that neonatal and maternal risks were not mentioned for 68% of forceps deliveries and 92% of vacuum deliveries.[58] A Canadian survey of patient satisfaction with the informed consent procedure during labour also found that women with operative vaginal delivery had more than fourfold lower satisfaction rates compared with those who had had a caesarean delivery.[59]

The benefits and risks associated with all delivery alternatives need to be carefully communicated to pregnant women, ideally in the antenatal period,[60] with current, empirically derived measures that reflect the risks women encounter in routine obstetric practice. The UK Royal College of Obstetricians and Gynaecologists provides advice for clinicians on obtaining consent for operative vaginal delivery that can be easily tailored to reflect local contexts.[61] Evidence based decision aids regarding delivery options developed in consultation with patients can help to facilitate informed decisions that reflect patient values.[62]

Strategies to reduce rates of obstetric trauma

Preventing operative intervention in second stage of labour

Efforts should be directed towards safely avoiding all operative delivery (whether vaginal or caesarean) among women who choose to attempt a vaginal delivery. Strategies shown to reduce the need for operative delivery include providing continuous support for women during labour[63] and encouraging women to adopt specific positions in the second stage of labour (upright or lateral for women not using epidural[64] and recumbent in women using epidural).[65 66] Evidence is conflicting on other strategies, including delayed pushing,[67 68] higher thresholds of prolonged labour,[69 70] manual rotation of the fetal occiput for malposition,[71] and intrapartum ultrasonography.[72 -74]

National quality improvement initiatives

National quality improvement campaigns in high income settings have been shown to reduce obstetric anal sphincter injuries.[30 32] The campaigns use multiple approaches or "care bundles," including antenatal discussion about risk of obstetric anal sphincter injury and personal risk factors, manual perineal protection during childbirth (with consent), mediolateral episiotomy (when indicated and with consent), and systematic examination for perineal trauma by an experienced clinician following vaginal births.

These protective measures should be implemented for all vaginal deliveries. Although the incidence of obstetric anal sphincter injury after spontaneous vaginal deliveries is lower than after operative delivery (2.8% in Canada, 2013-19), spontaneous deliveries account for most (89%) vaginal deliveries and more than half of obstetric anal sphincter injuries in Canada.[5] Care bundles have been shown to reduce anal injury rates among women having spontaneous vaginal deliveries by 25%.[30]

Improve training in forceps and vacuum delivery

Before initiating programmes to increase training in forceps and vacuum delivery, it is necessary to identify skilled practitioners (ie, those with documented low rates of trauma with operative vaginal delivery on chart review) to act as instructors. Competency should be demonstrated before unsupervised operative vaginal deliveries can be performed, and maternity care providers should be required to audit their performance regularly.[75]

High fidelity simulation training could provide a safe method of gaining experience. A systematic review[76] investigating the effect of simulated operative vaginal delivery training concluded that it improved physician knowledge, comfort, and skill as well as patient outcomes. However, only two of the eight studies included in the review assessed patient outcomes. One of these studies found very high, albeit reduced, rates of obstetric anal sphincter injury with forceps (32% for deliveries by residents and 28% for attending physicians),[26] while the other combined outcomes from vacuum and forceps deliveries, making it difficult to interpret.[77] Further study on the effect of simulation training on patient outcomes is warranted before larger scale investment in this approach.

Doing better

The characterisation of operative vaginal deliveries as safe procedures given the consistently high rates of trauma in Canada is misleading. Efforts to reduce the rates of caesarean delivery and associated risks must be balanced against all the potential harms of alternative interventions. Lower rates of caesarean delivery are not synonymous with better care. Although maternity care services in Canada generally conform to the highest standards, there is an urgent need for recognition, transparency, and action regarding

maternal and neonatal trauma associated with operative vaginal delivery. Maternal trauma can no longer be regarded as a minor, acceptable, or unavoidable outcome of childbirth; this belief contributes to the stigma experienced by women with these injuries and disregards the patient perspective on what constitutes morbidity.

Key messages

- Maternal and neonatal trauma rates from operative vaginal delivery are substantially higher in Canada than in other high income countries

- Despite high rates, maternal trauma is not properly accounted for in data on safety of operative delivery methods

- Counselling about delivery options should take place antenatally and be informed by guidelines that use balanced, up-to-date evidence and support patient autonomy

- Efforts to reduce rates of trauma should be accompanied by the promotion of informed, respectful care to support safe and positive birth experiences

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