

# Fostering Excellence in Obstetrical Surgery

R Douglas Wilson

Department of Obstetrics and Gynecology, Cumming School of Medicine University of Calgary, Calgary, Alberta, Canada

Correspondence: R Douglas Wilson, Department of Obstetrics and Gynecology, Cumming School of Medicine University of Calgary, Alberta, Canada, Tel +1 403-470-7229, Email [doug.wilson@ahs.ca](mailto:doug.wilson@ahs.ca)

**Introduction:** This obstetric surgery review is directed toward the common obstetrical surgeries (caesarean delivery, VBAC/TOLAC, operative vaginal delivery, placenta accreta spectrum) with evidence for quality and safety to allow for obstetrical outcome excellence.

**Materials and Methods:** This focused scoping review has used a structured process for article identification and inclusion for each of the focused surgeries.

**Results:** The review results provide an obstetrical surgery (OS) overview for caesarean delivery, vaginal birth after caesarean delivery and/or trial of labor after caesarean delivery, operative vaginal delivery, placenta accreta spectrum; considerations for quality and safety variance due to non-clinical human factors; quality improvement (QI) tools; OS QI implementation cohorts; implementation considering certain barriers and solutions.

**Conclusion:** Administrative health care systems and obstetrical surgery care providers cannot afford, not to consider and implement, certain evidenced-based “bottom-up/top-down” processes for quality and safety, as the patients will demand the quality and the safety, but the lawyers should not have to enforce it.

**Keywords:** obstetrical safety, obstetrical quality, obstetrical morbidity, caesarean delivery, vaginal birth after caesarean delivery, trial of labor after caesarean delivery, operative vaginal delivery, placenta accreta spectrum, implementation process

## Introduction

Why is obstetrical surgery important for reproductive health morbidity care in 2023? What are the systems (primary/secondary) and clinical factors that create morbidity for pregnant people? What evidenced-based management tools and implemented processes can be considered or used to provide enhanced safety and quality for obstetrical surgery?

The rates of caesarean delivery (CD) and the associated accreta spectrum disorder have increased steadily over the past 3 decades, while the clinical use of operative vaginal delivery and vaginal birth after CD – trial of labor after caesarean (VBAC /TOLAC) have decreased. The impact of obstetrical surgery on a person’s reproductive outcomes and future options is important. The clinical management of the first pregnancy (>20 weeks of gestation) and the utilized delivery method will have a significant impact on future reproductive choices. Clinical delivery training, maternity care pathways/systems, and hospital -birthing resources will influence the complexity of counselling, informed consent, and shared decision- making.<sup>1–8</sup>

This health care leadership commentary is directed toward the common obstetrical surgeries (caesarean delivery, VBAC/TOLAC, operative vaginal delivery, placenta accreta spectrum) and the available quality and safety evidence to allow for enhanced obstetrical practice outcomes.

## Methods

This structured (scoping) prevention and quality improvement review has utilized the peer-reviewed and grey literature to evaluate clinical outcomes for caesarean delivery, operative vaginal delivery, and TOLAC/VBAC with the associated benefit and risk/morbidity including diagnosis and management for placenta accreta spectrum. Evidenced-based human resource, clinical, and system approaches were identified to be used for enhanced quality and safety with the listed obstetric surgeries. Key search terms were included using pregnancy, delivery, morbidity, adverse events, labor and

delivery complications, quality improvement, patient safety, audit, measurement, caesarean delivery, operative vaginal delivery, placenta accreta spectrum, vaginal birth after CD (VBAC), trial of labor after caesarean (TOLAC).

## Results

### Counselling Overview for the Four Obstetrical Surgery Options

**Table 1** summarizes the obstetrical surgeries with the clinical benefit and risk counselling topics.<sup>1–8</sup>

Caesarean delivery (CD) (2021–2022) was the most common inpatient hospital surgery in Canada. The CD rates have continued to increase in Canada, from 18.7% (1997) to 28.2% (2016), representing a 50.8% increase. In the United States (2021), 32.1% of live births were by CDs, the rate of primary CDs (no previous CD) was 22.3 per 100 live births to women while the rate of vaginal births after a previous caesarean (VBAC) was 14.2 per 100 live births. These increasing CD rates for North American are, in concert, with global comparisons, as the rates in many countries have increased by 40% between 2000 and 2015. Some common explanations provided for these observed CD increases are attributed to pregnant persons having their first birth at a later age, increased pregnant person obesity, increased use of fertility treatments, clinical convenience for both physicians and patients, and more pregnant people are making the choice to have a CD, with expectations of smaller family size.<sup>1,2</sup> Classification of CD clinical factors is important as it allows for an understanding and comparison of different classification rates and audit results (Table 2).<sup>9–12</sup>

Trial of labor after caesarean delivery (TOLAC) and vaginal delivery after caesarean delivery (VBAC)<sup>3,4</sup> are similar terms for the option of waiting for the onset of spontaneous labor and the opportunity for a possible vaginal delivery, following a previous CD delivery. Important counselling issues are related to the indication for the previous caesarean delivery, the patient motivation for a vaginal delivery, the limited opportunity for oxytocin use in labor and the 1% risk for uterine rupture during labor, with maternal and neonatal morbidity and possible neonatal mortality. The optimal technique for uterine closure has not been established. Table 3<sup>13–30</sup> summarizes present evidence for uterine closure techniques related to minimizing the risk of uterine rupture during labor and/or a uterine scar defect with blastocyst implantation. A reasonable surgical approach would consider a double-layered continuous unlocked - monofilament suture with a decidual exclusion for uterine closure, following the use of routine pre-operative antibiotic prophylaxis. This suggestion for uterine closure is based on the evidence for better wound healing and an outcome of increased residual myometrial thickness (RMT), thereby providing improved quality and safety for maternal outcomes, regardless of increased OR time or cost-effectiveness factors.

**Table 1** Obstetrical Surgeries Benefit and Risk Considerations<sup>1–8</sup>

Obstetrical Surgery	Benefit	Risk
Caesarean Delivery (CD) (primary; repeat) <sup>1,2</sup>	Indication dependent: maternal or fetal benefit Robson CD category classification	Uterine hysterotomy/closure Surgical complications Post-partum hemorrhage
Vaginal Birth after CD (VBAC) <sup>3,4</sup>	Successful vaginal delivery has range of 65–70% Selected maternal and/or neonatal factors impact potential successful VBAC: maternal co-morbidities previous neonatal birth weight previous fetal presentation (breech; occiput posterior) previous labor factors (maternal, placental, fetal, uterine, cervix)	Uterine rupture risk 1% with maternal and neonatal morbidity (mortality)
Operative Vaginal Delivery (OVD) <sup>5,6</sup>	Assisted vaginal delivery by forceps or vacuum techniques with appropriate indications and fetal factors (presentation, position, descent)	Maternal cervical and/or vaginal trauma Neonatal cranial trauma Post-partum hemorrhage with uterine, cervical, and vaginal sources
Placenta Accreta Spectrum (PAS) <sup>7,8</sup>	Antenatal recognition allows for counselling and planning. Optimal US/MRI imaging is necessary for optimal planning. Surgical team -based care has improved patient safety and outcomes.	Increased risk based on the number of uterine incisions Hysterotomy scar with blastocyst implantation Unrecognized PAS until delivery results in severe post-partum hemorrhage risk

**Table 2** Robson Caesarean Delivery (CD) Classification: International Comparisons<sup>9-12</sup>

Robson CD Classification <sup>9</sup>	Population Description/ Group	Quebec CD % <sup>10</sup>	France CD % <sup>11</sup>	Greece CD % <sup>12</sup>
Baseline: global CD rate 21–23%		22.9	24.0	60.9
1	Nulliparous (NP) normal onset of labor	12.2	11.5	6.9
2a	NP/induction	15.6	18.0 (total)	10.7
2b	NP/preterm labor	2.1		23.9
3	Multiparous (MP) normal onset of labor	2.2	4.1	0.2
4a	MP/induction	2.2	10.8 (total)	0.4
4b	MP/preterm labor	1.4		0.6
5	Previous CD	35	28.8	30.6
6	NP/breech	10.6	6.7	5.3
7	MP/breech	6.5	3.8	2.0
8	Multiple fetal pregnancy	4.3	7.5	7.0
9	Fetal anomalies	2.2	1.1	0.8
10	Preterm labor < 37 weeks	5.7	7.7	11.7

**Table 3** Uterine Closure Detail

Study Method [Reference]	Technique	Outcome
	<b>Suture Type</b>	
Randomized Controlled Trial-2022 <sup>13</sup>	Monofilament vs multifilament for uterine closure at the time of CD	In singleton pregnancies undergoing primary or secondary CD, the use of synthetic absorbable monofilament sutures after a CD was not associated with a reduction in uterine scar defect at 6 months after delivery compared to the use of 'synthetic absorbable multifilament sutures.
Systematic Review /Meta-Analysis –2022/2021 <sup>14-16</sup>	Considering the suture type for hysterotomy closure reported that the MA did not support a specific type of suture material for uterine closure at CD because of insufficient evidence.	A barbed suture was associated with decreased operative time, the use of conventional monofilament suture was associated with an increase in uterine scar thickness, but the clinical utility of these differences is not clear. The decreased operative time for the barbed suture was supported by two additional SR-MA publications.
	<b>Uterine Closure Techniques</b>	
Systematic Review/Meta-Analysis-2014 <sup>17</sup>	Compared single vs double layers and locking and unlocking sutures	Current RCT evidence does not support a specific type of uterine closure for optimal maternal outcomes and is insufficient to conclude about the risk of uterine rupture. Single-layer closure and locked first layer are possibly coupled with thinner residual myometrium thickness.
Enhanced Recovery After Surgery-Caesarean Delivery Review –2022 <sup>18</sup>	Closure of hysterotomy in two layers maybe associated with a lower rate of uterine rupture.	
Enhanced Recovery After Surgery-Caesarean Delivery- 2018 <sup>19</sup>	Closure of hysterotomy in two layers maybe associated with a lower rate of uterine rupture.	Evidence level Low; Recommendation grade Weak

(Continued)

Table 3 (Continued).

Study Method [Reference]	Technique	Outcome
Systematic Review/Meta-Analysis –2021 <sup>20</sup>	Single and double-layer CD closure on residual thickness and isthmocele	High quality evidence shows that double-layer closure results in a higher RMT compared to single-layer closure, despite no significant difference in an isthmocele formation.
Systematic Review/Meta-Analysis –2021 <sup>21</sup>	Single and double-layer uterine closure techniques after CD in terms of ultrasound findings and rate of CD complications.	Favoured double-layered closure for RMT; dysmenorrhea while single-layer closure had a shorter OR time. Both techniques had similar results for uterine dehiscence or rupture risk (RR 1.88); healing ratio; maternal infectious morbidity; hospital stay; re-admission rate.
Systematic Review/Meta-Analysis –2018 <sup>22</sup>	Single and double-layer closure Locked and unlocked sutures Inclusion verses exclusion of decidual layer	Double-layered unlocked sutures are preferable to single locked sutures regarding RMT, healing ratio, and dysmenorrhea. Excluding decidia seemed to result in higher niche prevalence.
Systematic Review /Meta-Analysis-2017 Letter To Editor-2017 <sup>23,24</sup>	Risk of CD scar defect following single vs double-layer uterine closure SR /MA	Single and double-layer uterine closure after CD had similar incidence of scar defect, uterine dehiscence, uterine rupture in a subsequent pregnancy (Evidence GRADE quality was low) LTE: no correction for unlocked and locked sutures; method and timing of niche assessment; 4 small RCTs were excluded from the original SR /MA
Prospective cohort-2022 <sup>25</sup>	Impact of selected risk factors on the healing process after CD using single-layer continuous suture excluding decidia	Systemic disease during pregnancy and in the maternal history and colonization of the cervical canal have no impact on uterine scar healing
<b>Other Closure Techniques</b>		
Randomized Controlled Trial- 2021 Randomized Controlled Trial –2021 Letter To Editor- 2021 <sup>26–28</sup>	Babu and Magon uterine closure technique: far-far-near-near (FFNN) continuous unlocked double-layer method carried out in a single step	Kelm: providing protection from an isthmocele formation and ensuring a sufficient RMT. Tahermanesh: FFNN large niche 3% / control double-layer 24% RMT not significantly different Closure time not significantly different
Randomized Controlled Trial 3 arms –2022 <sup>29</sup>	Group I: Classical double-layer closure of uterine incision was performed as follows: a holding Vicryl 1–0 was placed in the left corner to stabilise and define the demarcation of the suture line. A continuous unlocked stitch beginning at the right corner was used, closing the whole thickness of the uterine wall, including the decidual layer. The second unlocked stitch was performed by Vicryl 1–0 in a lateral–lateral (horizontal) position, adapting the first layer. Up to three additional single sutures were added for hemostasis if required. Group II: The Turan technique may be summarised as follows: beginning in one corner, the incision is closed using Vicryl 1–0 stitch. The first layer is transversely passed through the inner myometrium decida line, and second layer is transversely passed through outer myometrium-visceral line continuously in the form of a purse-string closure. With this technique, the original string is returned to the starting point and tied with a knot. Following the double-layered purse-string closure, the aperture left in the middle of the uterine incision is closed with one separate figure of eight suture. Group III: New approach can be summarised as follows: the incision is closed using Vicryl 1–0 stitch starting from one corner. The first layer is transversely passed through the inner myometrium-decidea line, and second layer is transversely passed through outer myometrium-visceral line continuously by alternating continuous stitches through the upper (step up) and the lower (step down) uterine flaps. The original string is returned to the starting point and tied with a knot as in the Turan technique. Following the double-layered step up–step down closure, additional single sutures were added for hemostasis if required.	Compared to group II and Group III, residual myometrial thickness was significantly thinner in group I ( $p < 0.001$ ). The number of patients with uterine niche was 10 (50% of all scar defects) in group I whereas it was 4 (20%) in group II and 6 (30%) in group III. Operative time was significantly longer in group II ( $p < 0.001$ ). This led to our conclusion that Turan technique and our new approach are associated with thicker myometrial thickness and less frequency of uterine scar defect than classical double-layer uterine incision closure; however, our approach takes less operative time.

(Continued)

**Table 3** (Continued).

Study Method [Reference]	Technique	Outcome
Prospective cohort-2022 <sup>30</sup>	402 CD patients Group 1: classical primary continuous suturing Group 2: novel technique as Z-suture on both corners and 8 sutures in the remaining middle part incision closure	Group 2: <ul style="list-style-type: none"> <li>● less bleeding</li> <li>● less sutures were used</li> <li>● increased RMT (197 ± 50 mm/146 ± 39mm)</li> <li>● thickened RMT showed negative correlation with incision length after closure, number of needle passes, and required uterine closure time.</li> </ul> Group 1 and 2 were equal re isthmocele.

Operative vaginal delivery (OVD)<sup>5,6</sup> refers to the use of delivery forceps or vacuum devices, in the second stage of labour, to facilitate a vaginal birth when the fetal position and descent is appropriate for the delivery technique. Clinical factors, associated with the use of OVD, are a prolonged or arrested fetal descent or possible findings associated with imminent fetal risk or with pregnant person exhaustion or where a pregnant person co-morbidity contraindicates pushing to assist the vaginal delivery. The choice of forceps (and type) or a vacuum device is based on many factors such as the amount of caput or moulding on the fetal head, fetal gestational age, fetal presentation (position-station), fetal response to the pregnant person pushing efforts, pregnant person access to epidural anesthesia, operator-provider experience, and operator-patient informed consent preference based on the likelihood of OVD success.

Placenta accreta spectrum (PAS) disorders,<sup>7,8</sup> first reported in 1927, is becoming more common and is evolving into one of the most significant iatrogenic pregnancy complications requiring team-based obstetrical surgical expertise. The PAS incidence has increased from 1 in 2510 women (1994) to the present range of 1 in 272 –403 women (2016). PAS contributes to 30% of the maternal mortality rate, especially if no antenatal diagnosis has been identified.<sup>31</sup>

## Non-Clinical Human Factors (Culture and Insight for SMM, Equity, and Trauma Informed Care) Impacts Obstetrical Surgery

The domains reported for patient-centered care (PCCW) include fostering a relationship, exchanging information, addressing emotions, managing uncertainty, making decisions, and enabling self management. While the information exchange domain is more commonly identified, a theoretical rapid review found that little research has been done to establish what constitutes PCCW, or how to implement or measure PCCW despite the advocacy to improve women's health with emphasis on PCC and the worldwide recognition in women's health disparities.<sup>32</sup>

The components for quality of care have identified the clinical areas of equity, safety, patient-centered care, timeliness/accessibility, effectiveness/appropriateness, and efficiency. This obstetrical surgery review will only focus on the first three components as these reflect on the team-based culture and attitude for obstetrical surgery rather than the other components for procedural skill, although important.

The variation in safety surveillance outcomes for the obstetrical surgery suggests that there are quality and equity variations in the care, especially when the populations have been risk adjusted.<sup>33</sup> These areas could be considered as clinical targets for prevention.<sup>34–36</sup> Socio-economic disadvantage has been associated with post-partum re-admission and could be an important quality obstetrical surgery indicator for improvement or prevention, based on the severe maternal and adverse outcomes surveillance in obstetrical care.<sup>37</sup>

Eight steps have been proposed for use in narrowing disparities and inequity across the maternal care gap: enhance communications; address implicit bias; implement a disparities dashboard; perform enhanced maternal mortality and severe maternal morbidity reviews; standardize care on labor and delivery; promote a culture of equity; develop new models of care across the care continuum; and engage key stakeholders.<sup>38,39</sup>

Surveillance and audit for severe maternal morbidity (SMM) is required to achieve safety and quality. SMM is defined as an unintended outcome(s) during the process of labor and delivery that may result in significant short-term or long-term consequences to a woman's health. ACOG and SMFM have recommended two screening criteria for SMM

identification: 1) transfusion of 4 or more units of blood and 2) admission of a pregnant or postpartum woman to an ICU. Investigators have demonstrated that these two simple criteria have a high sensitivity and specificity for identifying women with severe morbidity and a high positive predictive value (0.85). Centers may choose to incorporate additional screening criteria to identify additional maternal elements for detailed review.<sup>40,41</sup> A short list of SMM causes and their potential preventability are summarized (Table 4).<sup>40,41</sup>

Patient centered care/trauma-based feelings are very likely to have an impact on obstetrical surgery and should be considered. The CDC highlights the significant prevalence of patient-related trauma. It has been reported that one in four children experiences some sort of maltreatment (physical, sexual, or emotional abuse). One in four women have experienced domestic violence, while one in five women and one in 71 men have experienced rape at some point in their lives (12% of these women and 30% of these men were younger than 10 years old when they were raped). These statistics indicate that a very large number of people have experienced serious trauma at some point in their lives.<sup>42</sup>

It is important for health care providers to understand that commonly used medical exams, by definition, can feel invasive to the pregnant person. The medical care process often involves asking sensitive questions, examines intimate body parts, and sometimes delivers uncomfortable/painful treatments. An understanding of these six principles will help to guide a trauma-informed approach by maternity or all health care providers to create an environment with safety; peer-support; trustworthiness and transparency; collaboration and mutuality; empowerment and choice; and recognition of any potential cultural, historical and gender issues.<sup>42</sup>

The informed consent process for obstetrical surgery requires that there is knowledge, with the adoption of a trauma-informed approach required by the team/provider so there is constant attention, caring awareness, sensitivity, and possibly a cultural change at an organizational level.<sup>42</sup>

## Obstetrical Surgery Services Options or Tools for Quality and Safety Considerations

The opportunity for obstetrical surgery improvement or prevention of adverse outcome requires a preventive approach as well as the identification of morbidity associated outcomes with the potential use of obstetrical surgery. Obstetrical surgery is a team-based process. Change implementation via the system, knowledge, or behavioral factors provides added complexity to an identified clinical improvement process.

Prevention requires preconception and/or antenatal knowledge transfer processes.

Pre-conception reproductive education to understand the personal maternal pregnancy risk estimate should be encouraged, given that maternity risk issues related to maternal comorbidities are increasing in prevalence. The person, planning a pregnancy, requires a better understanding and recognition of the maternal and pregnancy-related conditions before they become pregnant. The obstetrical risk conditions can change quickly from the common mild-to-moderate morbidity outcomes to SMM outcomes with potential long-term health implications, limiting an appropriate informed consent understanding. The possibility of pregnancy triage with change in maternity care, to the most appropriate level of maternity provider and delivery location, may be required and these potential risk needs to be understood and considered by the pregnant person. The morbidity risks for pregnant people have increased, multi-disciplinary collaborative processes may be required and

**Table 4** Most Common Causes for Severe Maternal Morbidity (SMM): Opportunity to Alter Outcome Was Identified in 62% of Cases (Strong in 20% and Possible in 42%)<sup>40,41</sup>

SMM Element % of Cases	Unpreventable %	Possibly %	Preventable %
Obstetrical hemorrhage 27%	29	45	26
Placental hemorrhage 18%	57	29	14
Infection 14%	32	50	18
Cardiovascular disease 11%	61	22	17
Hypertensive disorder 10%	40	40	20
Other medical-surgical disease 10%	20	60	20

understanding and acceptance from patients, providers, and health care systems is needed. A risk evaluation tool is available for early discussion with the non-pregnant or pregnant person related to possible clinical morbidity (mortality) factors. This counselling tool allows for a patient-provider review and recognition (informed consent) of the possible leading causes of maternal morbidity risk: pre-conception risks (maternal age >45 years; pre-existing cardiac or hypertensive conditions) and pregnancy-obstetrical risks (gestational hypertension, preeclampsia, or eclampsia; caesarean delivery, whether preterm or term; operative vaginal delivery; maternal sepsis; placenta accreta spectrum; antepartum or postpartum hemorrhage).<sup>43</sup>

Fetal-based morbidity (aneuploidy, genetic inheritance, congenital anomalies (malformation, deformation, disruptive-teratogenic impact)) requires protocol-guideline-based counselling by the provider to allow patient understanding and choice.<sup>44</sup>

The antenatal surveillance and perinatal data sources are commonly available as administrative healthcare requirements for many provinces, states, and countries collect this data. The Alberta Perinatal Health Program (APHP Alberta Canada) audits key perinatal – neonatal performance indicators to promote maternal health, positive birth outcomes and healthy infancy. These indicators are provided to the healthcare provider, with a view to enhance practitioner knowledge and skills, to promote evidence informed clinical practice through quality assurance, and to facilitate the collection and analysis of perinatal data for continued surveillance. The Peri-Link data repository is used to inform and evaluate programs and provides provincial leadership through partners and stakeholders.<sup>45</sup>

The three key APHP program activities identified are: the collection and validation of provincial perinatal data, the analysis and interpretation of data for those providing perinatal services, and support for perinatal research.<sup>45</sup>

APHP facilitates perinatal health research by offering epidemiology support and providing data from the Peri-Link data repository. These quality assurance activities are undertaken with a view for continual improvement of the provided health care or services (evaluating identified patient safety concerns; reviewing reported maternity associated adverse events). An additional goal for this surveillance is to provide a method of communication for QI recommendations to appropriate and accountable individual(s). The outcomes of these quality assurance activities would include:<sup>45</sup>

- The identification of preventable factors and system issues.
- Identified gaps in knowledge and clinical service delivery.
- Recommendations for quality improvements.
- Collection, analysis, and reporting of aggregate data with perinatal and maternal mortality.
- Review, revise, and/or develop perinatal forms and audit tools to support/promote the optimal perinatal practice.

With a quality surveillance program and an identified perinatal concern, a useful quality improvement approach is to “Plan, Do, Study, Act”.<sup>46</sup> The Plan-Do-Study-Act (PDSA) method is a process to test the identified clinical care change that has been implemented to modify the identified problem /gap. The PDSA cycle evaluates a clinical care change – by planning it, trying it, observing results/outcomes, and acting on what is learned or identified. PDSA is a scientific method, used for action-oriented learning and change. The purpose is to learn as quickly as possible, whether and how an intervention or clinical care change works in a particular setting, allowing adjustments to be made to increase the chances of delivering and sustaining the desired improvement, or to stop the unsuccessful intervention and try something else. Planning is the foundation, as this step ensures that the whole clinical team is aligned, knows their responsibilities, and is clear in the purpose of the PDSA from the start.<sup>46</sup>

The four PDSA cycle approaches are:

- Plan: identifying a goal or purpose, formulating an intervention or clinical care change, defining success with a measurable outcome, and implementing the chosen plan/process appropriate plan into action.
- Do: identified components or the clinical care elements of the process or pathway are implemented.
- Study: monitoring/measuring outcomes to test the validity of the change for signs of progress and success, or problems and areas for improvement. Short-cycles changes, coupled with analysis of test results, are helpful so the team can learn from these clinical changes, before the PDSA activities are used more broadly.
- Act: closing the cycle, integrating the knowledge generated by the entire process, which can be used to adjust the goal, change methods, or even reformulate an intervention or improvement initiative altogether.

An implemented checklist QI approach has advantages of simplicity and repetition as any clinical care team may forget important care elements leading to clinical care mistakes.<sup>47</sup> The team can serially follow a defined checklist, complete the identified elements, and adapt the list to your own circumstances and psychology. The checklist helps the team to be specific and allows the team to delegate tasks and responsibility.

The WHO Surgical Safety Checklist (SSC) considers nineteen items focused into three “time-based phases” of a surgical procedure: sign-in (before induction of anesthesia, while the patient is still conscious); time-out (with the surgeon present, before skin incision); and sign-out, based on the Joint Commission’s Universal Protocol. The SSC has been shown to reduce complications and mortality by >30%. The WHO Checklist is simple, can be completed in under 2 minutes, improves patient safety and inter-discipline communication, and prevents ‘avoidable complications by emphasising current safety procedures.’<sup>47</sup>

Enhanced recovery after surgery (ERAS) is a protocol program that uses measurable clinical care elements in an operative pathway to provide surgical and patient quality and safety, audit, and comparison. ERAS is a patient-centered system that uses evidence-based pathways that have been developed and implemented by a multidisciplinary team to improve the surgical and facility culture and to reduce the patient’s surgical stress response, optimize their physiologic function, and facilitate recovery. There are three main ERAS pillars: evidence-based perioperative care process elements, multi-modal and multi-professional teamwork, and continuous clinical element audit using the pre-, intra-, and post-operative clinical elements/tasks to minimize the variance in care (benefit; risk).<sup>18,19,48–51</sup>

The Enhanced Recovery after Surgery – Caesarean Delivery (ERAS-CD) elements and recommendations (Parts 1–3) separate the surgical delivery process into a “focused” pathway with the pre-operative section (Part 1) starting at 30–60 minutes before skin incision, for both scheduled and unscheduled caesarean deliveries, but including a potential longer “optimized” pathway that manages the antenatal education and maternal comorbidities. The intraoperative section (Part 2) focuses on the time immediately prior to beginning the surgery including prophylactic antibiotics, through the caesarean surgery, to the immediate newborn care. The postoperative section (Part 3) focuses on the time from the completion of caesarean delivery until maternal discharge.<sup>18,19,48,49</sup>

The clinical maternity care has complex pathways, with increasing risk management factors that are related to obstetric comorbid medical, genetic, surgical, and lifestyle factors. Consideration for the prospective and quality assessment/improvement research, evaluation, audit, and collaboration is required for enhancement of the maternal and fetal health outcomes, quality, and safety.<sup>18,19,48,49</sup>

Understanding the caesarean delivery (CD) rate is complex as there are many factors that contribute to the overall CD rate.<sup>50,51</sup> The Robson’s system is a classification system for caesarean deliveries, using 10 clinical groups, based on five parameters: obstetric history (parity and previous caesarean delivery), onset of labour (spontaneous, induced, or caesarean delivery before the onset of labour), fetal presentation or lie (cephalic, breech, or transverse), number of neonates, and gestational age (preterm or term). The ten Robson categories (Table 2) are mutually exclusive, totally inclusive, and can be applied prospectively, with each pregnant person that is admitted for delivery can be classified immediately, using a few variables that are generally routinely recorded.<sup>9–12,50,51</sup> The Robson classification system helps with institution-specific monitoring and auditing but offers a standardised comparison method that can be used between institutions, countries, and timepoints.<sup>50</sup>

The Robson classification system (Table 2) has had some modifications to the original Robson groups.<sup>9–12,51</sup> The modification has added a subclassification to categories 5–10 for pregnant people that have had a caesarean delivery but defines when, after spontaneous onset of labour, after induction of labour, or before the onset of labour:

5. Previous caesarean section, singleton, cephalic,  $\geq 37$  weeks’ gestation (5a; 5b; 5c).
6. All nulliparous with a single breech (6a; 6b; 6c).
7. All multiparous with a single breech (including previous caesarean section) (7a; 7b; 7c).
8. All multiple pregnancies (including previous caesarean section) (8a, 8b, 8c).
9. All women with a single pregnancy in transverse or oblique lie (including those with previous caesarean section) (9a; 9b; 9c).
10. All singleton, cephalic, <37 weeks’ gestation pregnancies (including previous caesarean section) (10a; 10b; 10c).

There are limitations when using the Modified Robson Criteria:<sup>51</sup>

- The classification does not allow the analysis of caesarean delivery by demand and indicated caesarean delivery for specific conditions (placenta previa).
- The classification does not account for: pre-existing medical, surgical, or fetal disease; indications for and methods used for induction of labour; and degrees of prematurity, all of which may influence the rate of caesarean delivery.
- Group 5 includes 2 clinically different groups: (1) those who planned or needed a repeat caesarean delivery, and (2) those who attempted VBAC and required caesarean delivery.
- Additional clinical factors that are not available for comparison are: maternal age; maternal BMI; specific gestational age at delivery; fetal vertex position (anterior; posterior); and birth weight.<sup>51</sup>

The American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) is a nationally validated, risk-adjusted, outcomes-based approach to measure and improve the quality of surgical care. It employs a prospective, peer-controlled, validated database to quantify 30-day, risk-adjusted surgical outcomes, which provide a valid comparison of outcomes among all providers and hospitals in the program. ACS NSQIP utilizes the data that is:<sup>52,53</sup>

- From the patient's medical record/chart (not from insurance claims)
- Risk-adjusted outcomes
- Case mix-adjusted outcomes (increased bench-making accuracy)
- Based on 30-day patient outcomes following the surgical exposure

ACS NSQIP has the appropriate tools, reports, analysis, and support to collect data and implement quality improvement initiatives:<sup>52,53</sup>

- Benchmarking (hospital-specific reports; comparative local and national data).
- Periodic reports and collaborative meetings are used to review and interpret data (performance information to guide surgical decision-making, identify areas for improvement that with the greatest return and highest impact).
- Access to and the use of validated practices tools (evidence-based guidelines, case studies).
- NSQIP software.
- Delivery site audits.

American College of Surgeons' National Surgical Quality Improvement Program (NSQIP) has not been used directly for obstetrical surgery to date, but the successful implementation, in pregnant people with non-obstetrical surgical treatment, would support the obstetrical use. Annually, about 1 in 500 US individuals have a non-obstetric surgery while pregnant, most commonly appendectomy and cholecystectomy. Accurate risk assessment of non-obstetric surgery during pregnancy requires data but non-obstetric surgery during pregnancy and related complications are rare events. A study evaluated whether reproductive-aged pregnant people have a higher risk of major 30-day postoperative complications after non-obstetric surgery compared with their non-pregnant counterparts. The conclusion was that pregnant people are generally not at higher risk of major postoperative complications after non-obstetric surgery compared to their non-pregnant peers of reproductive age. It was reported that there was an increased need for blood transfusion in pregnancy and pregnancy complications were found to be increased for the less common surgical procedures such as colorectal and hernia surgeries. This study focused on maternal complications by pregnancy status, and not on pregnancy outcomes, as pregnancy outcomes are not available in NSQIP. The lack of pregnancy outcome data highlights the need for new NSQIP data additions and clinical vigilance related to any surgery during pregnancy. Continued prospective collection of surgical outcomes among pregnant women is required.<sup>52</sup>

Primary umbilical hernia repair account for 175,000 general surgery cases annually in the United States. An increased intra-abdominal pressure is a known risk factor for the development of primary umbilical hernias. Unlike groin hernias, primary umbilical hernias are far more common in women and this observation may be, at least partially related, to

pregnant periods with increased intra-abdominal pressure. Review of the ACS-NSQIP database found that the incidence of umbilical hernia repair during pregnancy is very low, but for pregnant people who required an unscheduled repair, the majority had a bowel incarceration with strangulation. When the acute symptoms develop, umbilical hernias can be repaired with minimal 30-day morbidity to the mother. Additional studies are needed to determine the long-term recurrence rate of umbilical hernia repairs performed in pregnant patients and to better understand the effects of surgical intervention on the fetus.<sup>53</sup>

## Perinatal Outcomes Following a Quality and Safety Implementation In Caesarean Delivery/Obstetrical Surgery

The REDUCED Trial was based on the clinical assumption that reducing CD in nulliparous women would reduce the overall CD rate. The study aim was to assess whether adoption of a new guideline for diagnosing non-progressing labor would reduce the CD rate. This was a cluster randomized trial with the primary outcome being the rate of CD in nulliparous women with vertex presentation in labor at term. The secondary outcomes included spontaneous vaginal birth and maternal and neonatal safety. Data source was the APHP database. The outcome was that the CD rates in nulliparous women were not reduced following new guidelines for the diagnosis of nonprogressive labor. Spontaneous vaginal delivery was increased in the intervention group. The intervention was found to be safe.<sup>54,55</sup>

A retrospective study based in a tertiary obstetrical care hospital in India assessed the frequency and indications of CD using the Robson classification. From a cohort of 10,282 births, the overall CD rate was 35.2%. The study identified that group 5 with 11% (multiparous women with previous lower segment CD), group 2 with 8.6% (nulliparous women with labor induced or pre-labor CD), and group 4 with 5.5% (multiparous women without previous CD were induced or taken for pre-labor CD). The process to reduce CD identified that increasing use of VBAC is required, performing effective pelvic exams, and encourage the use of external fetal versions (breech to vertex).<sup>56</sup>

Country comparison of CD rates within the Robson classification allows insight into the areas of difference to identify innovation and/or educational correction. While the Robson classification has become a global standard for comparing and monitoring caesarean delivery (CD) rates across populations and over time; however, it does not account important maternal, fetal, and obstetric factors known to impact CD rates. The CD rate in Sweden was stable at 17.0% from 2004 to 2016 ( $p$  for trend = 0.10), while the CD rate increased in BC from 29.4% to 33.9% ( $p$  for trend <0.001). Differences in CD rates between Sweden and BC varied by Robson group.<sup>57</sup>

- Group 1 (nullipara with a term, single, cephalic fetus with spontaneous labor), the CD rate was 8.1% in Sweden and 20.4% in BC (rate ratio [RR] for BC versus Sweden = 2.52, 95% confidence interval [CI] 2.49 to 2.56,  $p < 0.001$ ).
- Group 2 (nullipara, single, cephalic fetus, term gestation with induction of labor or pre-labor CD), the rate of CD was 37.3% in Sweden and 45.9% in BC (RR = 1.23, 95% CI 1.22 to 1.25,  $p < 0.001$ ).

The effect of adjustment between countries varied by Robson group from having no effect in some groups to explaining up to 61% of the variation in CDs in others. Adjustment for maternal, fetal, and obstetric practice factors explained a substantial fraction of the temporal change in CD rates among some Robson groups in Canada but had little impact on temporal changes in CD rates among Robson groups in Sweden. Comprehensive and accurate perinatal data collection beyond the Robson criteria is necessary to ensure policies regarding CD rates are suitably evidence informed and prioritized.<sup>57</sup>

### In VBAC/TOLAC

Factors and barriers to TOLAC/ VBAC choice indicated that the majority were systematic and interpersonal. These barriers varied across levels of influence and included restrictive clinical guidelines, provider reluctance, geographic disparities, and midwifery scopes of practice.<sup>58</sup>

A multi-faceted intervention including audits, feedback to health professionals, and implementation of best practice did not affect VBAC rates or maternal and neonatal morbidity. Recommendations indicated the need for decision-making processes and risk management tools specifically for TOLAC /VBAC.<sup>59</sup>

Hospital factors associated with maternal and neonatal outcomes of deliveries to patients with a previous CD (ecological study) identified that adverse maternal and neonatal outcomes showed no clear pattern of decreasing SMMM and SNMM with increasing tiers of service and hospital volume. Continued review and surveillance is recommended to monitor the rates of maternal and neonatal outcomes.<sup>60</sup>

Decision aid and educational/ motivational guideline implementations have shown a significant reduction in practice variation without an increase in CD or complications and increased VBAC rates and neonatal well-being, respectively.<sup>61,62</sup>

### In Operative Vaginal Delivery

In Canada, rates of trauma following OVD are higher than previously reported, irrespective of region, levels of obstetric care and volume of OVD among hospitals. From a cohort of greater than 1.3 million deliveries, forceps were used in 2.9% and vacuums were used in 8.4%. For forceps, maternal trauma was 25.3% (24.8–25.7) and neonatal trauma was 9.6% (8.6–10.6) per 1000 LB. For vacuum, maternal trauma rate was 13.2% (13.0–13.4) and neonatal trauma was 9.6% (9.0–10.2) per 1000 LB. Adjusted analysis maintained the higher trauma rate for regions but not hospital levels.<sup>63</sup>

The use of intrapartum ultrasound versus routine assessment prior to instrumental vaginal delivery found that ultrasound was associated with a lower rate incorrect evaluation of fetal head position and station but with no improvement in maternal and neonatal outcomes.<sup>64</sup>

The rates of obstetric anal sphincter injury (OASI), associated with OVD and vaginal delivery, initiated the development of OASI – Care Bundles (4 practices: antenatal discussion, manual perineal protection, mediolateral episiotomy, systematic examination after vaginal birth). Post implementation outcomes found reduced OASI rates but identified barriers and enablers to implementation with four themes impacting OASI-CB adoption (method of implementation; opportunities for use; responsiveness to change; perceptions of “what women want”).<sup>65</sup>

### In Placenta Accreta Spectrum

A primary management process requires an antenatal diagnosis of PAS as identification of PAS is needed to optimize maternal outcomes and arrange the delivery at level III or IV maternal care facility. Imaging by ultrasound and magnetic resonance imaging (MRI) development enable the antenatal diagnosis of PAS. Although ultrasonographic features of PAS may be seen as early as the first trimester; most women are not diagnosed during their 2nd or 3rd trimesters.<sup>7,66–68</sup>

Ultrasound is the primary imaging tool for the assessment of PAS. MRI serves as a complementary imaging technique to assist with the depth and extent of the myo-invasion into the uterus. This source provides a consensus statement and a pictorial review of the seven major MRI features for use in diagnosis and management.<sup>69</sup>

A panel of FIGO experts has consensually proposed a new classification and guidelines criteria for the pathologic diagnosis of PAS diseases:<sup>70–75</sup>

Placenta Accreta Spectrum (PAS) Grades (1–3).

- PAS Grade 1: Non-invasive morbidly adherent placenta (placenta accreta): Myometrial sections display a clear and complete placental–myometrial boundary and uniform myometrial thickness without thinning.

- PAS Grade 2: Superficial invasion of the placenta (placenta increta): Myometrial sections display an irregular placental–myometrial interface without the outer myometrium (with conservation of at least 25% of the wall thickness relative to the detached myometrium).

- PAS Grade 3A: Deep invasion of the placenta: Myometrial sections display an irregular placenta–myometrial interface with involvement of the outer myometrium (with conservation of less than 25% of the wall thickness relative to the detached myometrium). The serosa is completely safe (A = Abnormal invasion).

Grade 3D: Deep invasion of the placenta with disturbance of the serosa (placenta percreta): grossly invasive placenta with disruption of the uterine serosa surface (D = Deep invasion).

Grade 3E: Deep invasion of the placenta with adherent extra uterine tissues and organs: placental invasion into nearby organs (commonly the bladder) or extra-uterine fibro adipose tissues, confirmed by microscopy (E = Extra uterine invasion).

A patient -safety bundle for PAS management includes betamethasone, gynecologic oncology intra-operative consult, pre-operative balloon catheters, cell salvage technology in the OR, vertical skin incision, fundal or high transverse hysterotomy. This study indicated greater compliance to the use of all components after the introduction of the protocol (0 vs 41%;  $p < 0.0001$ ) but the maternal and post-operative outcomes were not significantly different between groups. Factors were considered such as limited number of cases, retrospective design, and single center. The authors indicated while the safety bundles are important, they may not be formulaic, nor should they be proposed as a mandatory approach.<sup>76–78</sup>

Another center's multidisciplinary collaboration focus has been on providing best/better available practices across a range of aspects of surgical care, resulting in the Toronto PAS care bundles.<sup>79</sup> Among the 105 consecutive patients identified, there were 26 in the initial period and 32 in the current period. With the implementation of all QI care bundles, median estimated surgical blood loss halved from 2000 mL in the initial period to 1000 mL in the current period, and fewer patients required allogenic blood transfusion (61.5% vs 25%). Patients in the current period demonstrated improved postoperative levels of hemoglobin compared to those in the initial period (101 g/L vs 89 g/L) and had a shorter median postoperative hospital stay (3 days vs 5 days).<sup>79</sup>

1. Standardized care bundle: building a robust core diagnostic and management team, routinely using both specialist ultrasound (by experienced perinatal sonologists) and magnetic resonance imaging (MRI) (by experienced perinatal radiologists) to aid in diagnostic accuracy and surgical planning, use of programmatic clinical care pathways (including electronic medical record order sets to force function), all-inclusive surgical briefings, following a uniform surgical approach to caesarean hysterectomy, with a focus on minimizing blood loss and complications, together with adherence to contemporary guidelines on enhanced recovery after surgery.

2. Patient blood management bundle: optimization of preoperative iron and hemoglobin, routine perioperative use of the antifibrinolytic tranexamic acid, routine use of intraoperative cell salvage to reduce the need for allogenic (donor) blood transfusion, active communication between the surgical and anesthesia teams before blood transfusion and occlusion of the internal iliac artery (IIA) with balloon tamponade or surgical ligation.

3. Comprehensive self-audit bundle: achieved through longitudinal postoperative follow-up, data collection, and monthly multidisciplinary team meetings to discuss past and future cases of PAS, identification of what is working well and actively seeking areas for improvement.

4. Research and knowledge translation bundle: through the implementation of a comprehensive database of PAS disorders facilitating all current and future studies in the study institution, leading the national development of guidelines for PAS disorders, along with an overarching aim to proactively collaborate nationally and internationally to improve care and outcomes for patients and their infants with this disorder.

Additional uterine scar/placental morbidity results from blastocyst implantation in the previous hysterotomy scar with a reported incidence of 1 per 1800–2226 of overall pregnancies. Anterior myometrial thickness at the implantation site and the gestational sac diameter were identified as independent risk factors for intraoperative hemorrhage during the treatment of the caesarean scar ectopic pregnancy. A new classification type I–III uses the myometrial thickness and sac/mass diameter to define the risk with a surgical recommendation.<sup>80</sup>

## Discussion

The obstetric surgery results have focused on the evidence from four obstetrical surgery areas thereby providing support for the value of diagnosis, measurement, audit, and information sharing to enhance quality and safety for the pregnant person and neonatal obstetrical care. Health care knowledge transfer via guidelines or protocols and then the subsequent clinical implementation into the clinical care pathway is difficult. Clinical funding, multi-disciplinary human resource needs, clinical acceptance are required, at many administrative and clinical levels, for the change, and the subsequent proof of value or return on investment (ROI) are to be identified. Surveillance processes, implementation processes and the recognized implementation barriers are summarized (Tables 5<sup>81,82</sup> and 6).<sup>83</sup> These opportunities and barriers require continued oversight and support throughout the perinatal care period. The implementation process choices that have been used and the priorities to increase success are summarized (Table 5). The three implementation themes/barriers are the personal factors, the level of change required evidence (increases the likelihood of success), and the external factors are

**Table 5** Potential Implementation Strategy Considerations

Implementation Process Choices	Process Studies	Positive Impact	Mixed or No Impact
<b>Processes Used and Evaluated<sup>81</sup></b>			
Multi-faceted intervention	88	Moderate	Moderate
Pre-identified barriers	59	Moderate	Moderate
Stakeholder engagement	42	Low	Low
Single intervention	30	Low	Low
Intervention tailored to pre-identified barriers	38	Low	Low
Theory or framework used	25	Very Low	Low
<b>Five priorities for research on implementation strategies<sup>82</sup></b>			
1. Enhance methods for designing and tailoring implementation strategies 2. Specify and test mechanisms of change 3. Conduct more effectiveness research on discrete, multi-faceted, and tailored implementation strategies 4. Increase economic evaluations of implementation strategies 5. Improve tracking and reporting of implementation strategies			

**Table 6** Barriers, Interventions, and Strategies in Guideline Implementation<sup>83</sup>

Level of Interaction	Barriers	Interventions	Strategies
Personal	Physician knowledge attitudes	Traditional: Opinion leaders CME Review Audit and feedback Interactive discussion Academic society MD participation re guideline creation	Dissemination techniques Educational access Educational meetings/CME Opinion leaders Standing orders
Guideline	Lack of evidence Plausibility of recommendations Complexity Poor layout Access to guidelines Lack of applicability Information focused on a single disease Exclusion of complex disease Lack of clear intervention goals Triability	Evidenced-based Medicine. Short and user-friendly versions Easy access Decision support systems Checklists Clear interventions goals Pilot projects	Use of methods of evidence-based medicine guideline development Communication strategies Marketing outreach visits (Computerized) decision support systems Reminders Pilot projects
External	Organizational Lack of resources Lack of collaboration Social and clinical norms	Standardization Protocols linked to QI Financial incentives Facilitation Collaboration Local consensus	Improvements in organisation of care Standing orders Local consensus Local adaption Incorporation into established structures

important to understand for the PSDA cycle (Table 6).<sup>83</sup> There are many additional obstetrical surgery factors which require support for ongoing obstetrical surgery excellence (Table 7).<sup>4,6,7,60,63,69,79,84–86</sup>

Guidelines have shown to be an effective strategy for improving health outcomes and processes of care in medicine.<sup>87</sup> In addition, the guidelines are useful in decreasing the clinical care gap between research and current practice with the goal to reduce inappropriate variability in practice [Fischer 85]. Development of practice guidelines does not necessarily guarantee health care provider adoption and adherence in practice.

Despite all the guidelines and knowledge translation efforts of the past 30 years, the healthcare delivery system continues to provide measures of underperformance.<sup>88</sup> Care in-line with guidelines is at 60% as shown by large national

**Table 7** Additional Evidenced-Based Quality Impact Areas

<b>Obstetrical Surgery Procedure [Reference]</b>	<b>Summary for Fostering Excellence</b>
VBAC/TOLAC <sup>84</sup>	<p><b>Increasing TOLAC in Finland/</b>Despite the rapidly increasing CD incidence globally, the rates of CD have remained low in Finland. According to the Finnish institute for health and welfare (THL), the overall proportion of CD during the last decades in Finland was approximately 16%. The incidence rates for elective CD, after the first CD, had a decreasing trend, decreasing from 45% in 1999, to 28% in 2018. The rates for VBAC remained relatively constant, ranging between 38 and 52%, but a slightly increasing trend at the end of the study period was seen.</p> <p>The <b>main finding</b> of the study was that despite the increasing annual total number of deliveries with CD in the first pregnancy, the absolute numbers for VBACs have increased towards the end of the study period in Finland. The epidemiology of TOLACs and VBACs should be better studied around the world, as with the rapidly increasing rate of CDs, these events are becoming a more common challenges in health care.</p>
[4]	<p><b>USA effective but low participatory numbers for VBAC/</b>A repeated cross-sectional analysis was performed for singleton, cephalic, term deliveries in individuals with a history of one or two caesarean deliveries using the National Vital Statistics System from 2010 to 2020. Temporal trends in attempted and successful TOLAC, as well as VBAC, were characterized using join point regression. Overall, 4,277,800 deliveries were included. Attempted TOLAC increased from 15.3% in 2010 to 21.7% in 2020, with an annual percent increase (relative) of 4.25% (95% CI 2.9–5.6%). Successful TOLAC increased from 69.8% to 74.7%, with an annual percent change (relative) of 0.91% (95% CI 0.7–1.2%). The VBAC rate similarly increased such that, by 2020, it was 16.2%. This study provides US population-level trends on attempted and successful TOLAC.</p>
[85]	<p><b>Ecologic studies may be the better process/</b>Individual-level observational studies of intended treatment effects have the potential for confounding by indication (disease severity) and may result in a treatment designed to prevent an adverse event, that may appear to cause it. Therefore, the advantage of an ecologic over individual-level observational study in the assessment of intended treatment effect will hold, even if variations in disease severity, socioeconomic status, and other unmeasured factors, are taken into account as the treatment utilization is influenced by practice style in the local medical community independently of disease severity. Ecologic studies can suggest the need for changes in practice, help resolve ethical issues, and indicate priorities for randomized trials.</p>
CD Risk <sup>60</sup>	<p><b>Canada and birth location impact/</b>Hospital tier and adverse maternal and neonatal outcomes among patients with a previous caesarean delivery showed no clear pattern of decreasing SMMM and SNMM with increasing tiers of service and hospital volume. All hospitals, irrespective of tier or size, should continually review their rates of adverse maternal and neonatal outcomes.</p>
OVD <sup>63</sup>	<p>The <b>conclusion</b> reported that the rates of maternal and neonatal trauma following OVD are high in Canada compared with other countries with similar rates of OVD and are especially high in some provinces. These high rates call for a reassessment of the safety of OVD, not just in Canada, but in all settings where the rates of OVD and the opportunities for OVD training are changing.</p>
[86]	<p><b>A 'trial' of instrumental delivery,</b> which accounts for between 2–5% of OVDs, is a concept that has developed whereby certain steps are taken if an attempt at OVD is deemed to have a higher likelihood of failure. These steps include the OVD being attempted in an operating theatre, allowing an expedited recourse to CD if required, as well as being performed by a more experienced operator.</p>

(Continued)

Table 7 (Continued).

Obstetrical Surgery Procedure [Reference]	Summary for Fostering Excellence
[6]	<b>Factors that were identified in a failed OVD</b> were an older patient age, higher body mass index, obstructed labor, and neonatal birth weight more than 4000 g. During this period (2016–2020), physicians who attempted more operative vaginal deliveries were less likely to fail.
PAS <sup>7</sup>	The <b>accuracy of ultrasound in this diagnosis of PAS</b> , among women with low lying or placenta previa with previous caesarean section scars, is high and recommended for all suspected cases.
[69]	FIGO has consensually proposed a <b>new classification and guidelines criteria for the pathologic diagnosis of PAS diseases</b> , with seven major MRI features identified for use in diagnosis and management of PAS [Patel-Lippmann 2023].
[79]	<p><b>Toronto PAS service pathway:</b></p> <p><u>Multidisciplinary team/formation</u> of the core multidisciplinary team of MFM and surgical gynecology specialists. Regionalized referral of patients for assessment, management, and follow-up. Coordination of care by clinical nurse specialist. Programmatic creation of care plan, checklist, and standardized surgical and anesthetic approach. Preoperative optimization of hemoglobin. Creation of deidentified PAS database.</p> <p><u>Routine MRI/instituted</u> for all patients with US suspected PAS disorder.</p> <p><u>IIA balloons vs IIA surgical ligation/the balloon procedure-specific complication rate</u> was audited at 11% during the 2009–2016 period. As a result of these results alongside a literature review highlighting potential complications, balloon use was ceased and IIA surgical ligation was introduced in 2017.</p> <p><u>Team meetings/formal</u> monthly PAS multidisciplinary team meetings of all clinical stakeholders who participate in pre- and postoperative case/imaging/pathology review, quality improvement discussion, research, and audit.</p> <p><u>Optimization of hemoglobin/routine antenatal measurement</u> of levels of hemoglobin and ferritin, hemoglobinopathy screening, followed by oral and/or parenteral iron supplementation where indicated.</p> <p><u>Tranexamic acid/routine use</u> of the antifibrinolytic tranexamic acid 1 g IV at commencement of caesarean hysterectomy.</p> <p><u>Cell salvage/implementation</u> of cell salvage as a mainstay of PBM.</p> <p><u>Surgical briefing/formalized</u> introduction of comprehensive surgical briefing immediately before caesarean hysterectomy to discuss individual clinical characteristics and considerations. In addition, formalized intraoperative discussion between surgical and anesthesia teams before allogenic blood transfusion. A team approach to PBM was adopted here focusing on reduction in nonessential allogenic pRBC transfusions.</p> <p><u>Fellows/trainees from formalized 2-year fellowship programs</u> in surgical gynecology and MFM were streamlined as routine members of the surgical team present at all elective and emergent cases.</p>

**Abbreviations:** IIA, internal iliac arteries; MRI, magnetic resonance imaging; PBM, patient blood management; pRBC, packed red blood cells.

empirical studies of multiple conditions in adults and children. Some care is found to have waste, duplication, or of low value in 30%, according to several authoritative sources, with considerable expenditure. Many studies have documented iatrogenic harm or adverse events in at least 10% of patients globally.<sup>89–91</sup>

Despite these benefits, the implementation of guidelines is both complex, varied, and needs health system support in human resources and fiscal areas.<sup>92–95</sup> While the learning model is appealing, there is no guarantee. In healthcare, some processes are quickly accepted and embedded (laparoscopic techniques, day only surgery) while other processes have

been slow in adoption (patient involvement in decision-making, various level 1 evidence). Where innovation will create options, the learning health systems will need to spread, principally through diffusion of innovation models and local adaptations. Presently, the learning health system model represents the best option for changing the “60/30/10” outcomes but new decisions are needed. Health care is investing in biomedical and technological advances that promise safer, affordable, more effective healthcare. Big C change is required but until that time the process needs to have provider accountability using fit-for-purpose, responsive, and evidence-based delivery models that are built to learn and to correspond, in size or degree, with the local complex health system view of healthcare.<sup>89</sup>

## Conclusions

The four obstetrical surgery areas, caesarean delivery, vaginal birth after caesarean delivery/trial of labor after caesarean, operative vaginal delivery, and placenta accrete spectrum, have significant impact on quality, safety, and informed choice for maternal-fetal-neonatal outcomes. The understanding and recognition of the non-clinical patient factors of equity and trauma informed care and the clinical system culture is required at the beginning of the process. Use of surveillance, audit, and feedback systems for providers is required for the understanding, measurement, and implementation of clinical care improvement.

The original questions of “why, what, how” for excellence in obstetrical surgery are answered in this focused review but the recognition, process, and cost of clinical change are difficult. Surgeons are capable of change as shown with the implementation of checklists, protocol-based care, and measurement-audit-feedback processes. Implementation and understanding of the barriers to quality improvement and safety change requires provider engagement and health care system coordination.

Health care systems and obstetrical surgery care cannot afford, not to implement “bottom-up/top-down” processes for quality and safety, as patients will demand quality and safety but the lawyers should not have to enforce it.

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