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Preface

The Agency for Healthcare Research and Quality (AHRQ), through its Evidence-Based Practice Centers (EPCs), sponsors the development of evidence reports and technology assessments to assist public- and private-sector organizations in their efforts to improve the quality of health care in the United States. This project was funded by the National Institutes of Health Office of Medical Applications of Research (NIH OMAR). The reports and assessments provide organizations with comprehensive, science-based information on common, costly medical conditions and new health care technologies. The EPCs systematically review the relevant scientific literature on topics assigned to them by AHRQ and conduct additional analyses when appropriate prior to developing their reports and assessments.

To bring the broadest range of experts into the development of evidence reports and health technology assessments, AHRQ encourages the EPCs to form partnerships and enter into collaborations with other medical and research organizations. The EPCs work with these partner organizations to ensure that the evidence reports and technology assessments they produce will become building blocks for health care quality improvement projects throughout the Nation. The reports undergo peer review prior to their release.

AHRQ expects that the EPC evidence reports and technology assessments will inform individual health plans, providers, and purchasers as well as the health care system as a whole by providing important information to help improve health care quality.

We welcome comments on this evidence report. They may be sent by mail to the Task Order Officer named below at: Agency for Healthcare Research and Quality, 540 Gaither Road, Rockville, MD 20850, or by e-mail to **epc@ahrq.gov.**

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Structured Abstract

Objectives. The RTI International—University of North Carolina at Chapel Hill Evidence-based Practice Center (RTI-UNC EPC) systematically reviewed the evidence on the trend and incidence of cesarean delivery (CD) in the United States and in other developed countries, maternal and infant outcomes of cesarean delivery on maternal request (CDMR) compared with planned vaginal delivery (PVD), factors affecting the magnitude of the benefits and harms of CDMR, and future research directions.

Data sources. We searched MEDLINE®, Cochrane Collaboration resources, and Embase and identified 1,406 articles to examine against *a priori* inclusion criteria. We included studies published from 1990 to the present, written in English. Studies had to include comparison between the key reference group (CDMR or proxies) and PVD.

Review methods. A primary reviewer abstracted detailed data on key variables from included articles; a second senior reviewer confirmed accuracy.

Results. We identified 13 articles for trends and incidence of CD, 54 for maternal and infant outcomes, and 5 on modifiers of CDMR. The incidence of CDMR appears to be increasing. However, accurately assessing either its true incidence or trends over time is difficult because currently CDMR is neither a well-recognized clinical entity nor an accurately reported indication for diagnostic coding or reimbursement.

Virtually no studies exist on CDMR, so the knowledge base rests chiefly on indirect evidence from proxies possessing unique and significant limitations. Furthermore, most studies compared outcomes by *actual* routes of delivery, resulting in great uncertainty as to their relevance to *planned* routes of delivery. Primary CDMR and planned vaginal delivery likely do differ with respect to individual outcomes for either mothers or infants. However, our comprehensive assessment, across many different outcomes, suggests that no major differences exist between primary CDMR and planned vaginal delivery, but the evidence is too weak to conclude definitively that differences are completely absent.

Given the limited data available, we cannot draw definitive conclusions about factors that might influence outcomes of planned CDMR versus PVD.

Conclusions. The evidence is significantly limited by its minimal relevance to primary CDMR. Future research requires developing consensus about terminology for both delivery routes and outcomes; creating a minimum data set of information about CDMR; improving study design and statistical analyses; attending to major outcomes and their special measurement issues; assessing both short- and long-term outcomes with better measurement strategies; dealing better with confounders; and considering the value or utility of different outcomes.

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Appendixes and Evidence Tables for this report are provided electronically at
http://www.ahrq.gov/downloads/pub/evidence/pdf/cesarean/cesarreq.pdf**.**

Executive Summary

Introduction

The RTI International–University of North Carolina at Chapel Hill Evidence-based Practice Center (RTI-UNC EPC) conducted this systematic evidence review on cesarean delivery on maternal request (CDMR) for the Agency for Healthcare Research and Quality (AHRQ). This review summarizes the available literature, frames the discussions regarding benefits and harms for an upcoming State of the Science (SOS) Conference organized by the National Institutes of Health (NIH), Office of Medical Applications of Research (OMAR), and highlights the limitations of the evidence base. We received advice and input from an independent Technical Expert Panel (TEP).

For this review, we defined CDMR as a cesarean delivery for a singleton pregnancy, on maternal request, at term, and in the absence of any maternal or fetal indication for cesarean delivery. We recognized that the available literature does not explicitly define CDMR as a specific study group to allow for comparison with other planned routes of delivery. Given this lack of evidence on CDMR *per se*, the SOS conference planning committee requested that we include proxies for CDMR such as cesarean deliveries for breech presentation.

We also recognized that the ideal comparison groups to address the potential benefits and harms of CDMR would be *planned vaginal delivery* and *planned CDMR* in a low-risk population. Planned vaginal delivery does not always result in spontaneous labor followed by spontaneous vaginal delivery. Therefore, the ideal evidence demands a comparison of intent: *planned* vaginal delivery with *planned* CDMR rather than the comparison of actual delivery routes such as spontaneous vaginal delivery with unlabored cesarean. In the absence of such high-quality evidence, we compiled a summary of the best available literature, using proxies for CDMR, frequently relying on studies that define groups by *actual* route of delivery and not *planned* route of delivery.

We systematically reviewed the evidence on three key questions (KQs): (1) trend and incidence of cesarean delivery over time, (2) effect of approach to delivery (CDMR compared with planned vaginal delivery) on maternal and neonatal outcomes, and (3) factors that affect the magnitude of the benefits and harms identified in KQ2. Additionally, we described future research directions as KQ4.

Several factors make interpretation of the available evidence challenging: (1) comparisons are generally made by actual, not planned, routes of delivery (the latter being a preferred intent-to-treat approach); (2) available proxies are of variable relevance to CDMR; (3) practice patterns vary widely over time and among providers, (4) confounders are common and rarely accounted for; (5) statistical power is frequently inadequate, particularly for rare outcomes; (6) timing of outcomes and their measurement is inappropriate; (7) investigators use unvalidated questionnaires; and (8) severity and utility ratings of various outcomes are typically lacking.

Methods

We searched MEDLINE®, Cochrane Collaboration resources, and Embase. Based on key questions and discussion with our TEP, we generated a list of article inclusion and exclusion

criteria. We excluded studies that: (1) did not report on women of reproductive age; (2) were published in languages other than English; (3) did not report information pertinent to the key clinical questions; (4) had fewer than 50 subjects for randomized controlled trials (RCTs) or 100 subjects for observational studies; and (5) were not original studies. Additionally, and in consultation with the TEP, we excluded studies that did not provide data on both planned cesarean delivery and planned vaginal delivery for KQ 1 and KQ 2. As a consequence of this search strategy, we cannot address outcomes or modifiers unique to vaginal delivery, without reference to a cesarean delivery comparison group. Our aim was to compare primary planned cesarean delivery (cesarean delivery on maternal request, or CDMR) with planned vaginal delivery. Time and resources did not permit us to review comprehensively the benefits and harms associated with repeat cesarean deliveries. However, we did summarize outcomes particularly relevant to subsequent cesarean deliveries such as subsequent uterine rupture, subsequent fertility, and placenta previa by examining recent systematic reviews or updating a recent meta-analysis.

We reviewed each abstract and article systematically against *a priori* criteria to determine inclusion in the review. Two reviewers separately evaluated the abstracts for inclusion or exclusion. If one abstractor concluded that the article should be included in the review, we retained it. We assigned each excluded article a reason for exclusion. We entered the data from abstraction forms into evidence tables and checked for consistency and accuracy. Staff reconciled all disagreements about information in evidence tables.

The vast majority of studies reported results on actual route of delivery rather than planned route of delivery (intent to treat). The comparison groups varied widely. We found it impossible to arrive at any meaningful summary of the literature without explicitly categorizing the comparison groups and the studies themselves. We developed a four-tier classification system of relevance to CDMR based on the following criteria: (1) whether studies analyzed outcomes by planned route of delivery (trials of route of delivery); (2) whether CDMR was included as a comparison group (high relevance); (3) whether comparison groups comprised planned cesareans (moderate relevance), and (4) whether studies involved undefined "elective" or a mix of planned and unplanned, unlabored cesareans (low relevance).

We rated trials of routes of delivery and studies of high and moderate relevance for quality, assigning scores of good, fair, or poor. For RCTs, our rating system evaluated (1) randomization approach and implementation; (2) post-randomization exclusion; (3) masking; (4) operational definitions and measurements; (5) loss to followup; and (6) statistical analysis. For nonrandomized observational cohorts, we evaluated (1) study design; (2) study population; (3) comparability of subjects; (4) statistical analysis; (5) measure of effect and loss to followup. We summarized the strength of evidence for each outcome, judging the evidence to be strong for results that are clinically important, consistent, and free from serious doubts about generalizability, bias, or flaws in research design. We judged evidence to be moderate for studies of strong design, with some inconsistencies or concern about generalizability, bias, research design flaws or for studies of weaker design with consistent evidence. We judged evidence to be weak for studies of weaker design with inconsistent results or studies of strong design with inconclusive results.

From our review of 1,406 abstracts, we found 69 articles comprising 65 studies that addressed one or more key questions. Of these, 13 addressed KQ1, 54 addressed KQ2, and 5 addressed KQ3.

Results

KQ1: Incidence and Trends of Cesarean Delivery on Maternal Request

KQ 1 referred to the incidence and trends in cesarean deliveries over time in developed countries; it made specific reference to primary cesarean before onset of labor, CDMR, medical indications, and malpresentation as proportions of total cesarean deliveries. The absence of data to answer this question is striking. Regarding incidence, the available literature yielded rates of cesarean deliveries as a proportion of all deliveries for a wide array of time points and countries. For 2001 in the United States, data suggest rates of more than 25 percent. Elsewhere in the developed world for 2001, rates of cesarean delivery ranged from 14 percent in The Netherlands to 35 percent in Italy. Since 2001, the rates of cesarean delivery have risen in the United States; recent figures put the rate at more than 29 percent for 2004.

The rate of cesarean deliveries is rising worldwide. Both "elective" cesarean deliveries (sometimes defined as unlabored) and "nonelective" cesarean deliveries contribute to this rise; however, the proportions vary by country, study, and time period. Four studies distinguished between prelabor primary and repeat cesareans. An Irish study reported an unlabored primary cesarean delivery rate of 18.9 percent of all cesarean deliveries during the 12-year period from 1989 to 2000. One study in Australia showed that prelabor primary cesarean delivery as a percentage of all deliveries rose from 4.1 percent in 1980 to 4.8 percent in 1987. In the United States, primary prelabor cesarean delivery rates were approximately 5 percent of all deliveries in 1996 and approximately 7 percent in 2001. In 2001, "primary elective" prelabor cesarean rate as a proportion of all cesarean deliveries was 28.3 percent in the United States.

The extent to which CDMR is contributing to the rise in cesareans remains unclear. Finally, we did not find sufficient data to comment on medical indications or malpresentation as a proportion of all cesarean deliveries.

KQ 2: Outcomes of Cesarean Delivery on Maternal Request

Overall, few moderately relevant studies were available, and the strength of evidence is weak for nearly all outcomes.

Maternal outcomes for primary cesarean deliveries. *Mortality.* Four studies suggested no evidence of difference in maternal mortality associated with planned vaginal versus planned cesarean delivery. These studies provided weak evidence overall.

Infection. The 12 studies that included maternal infection as an outcome provided weak evidence that the risk of maternal infection was lower with planned cesarean than with unplanned cesarean delivery and lower for vaginal than for cesarean delivery.

Anesthetic complications. Two studies showed a lower rate of anesthetic complications with planned vaginal than with planned cesarean delivery; the third reported no significant difference between these two routes of delivery. These studies provided weak evidence suggesting a lower rate of anesthetic complications with planned vaginal delivery.

Hemorrhage and blood transfusion. Eleven studies provided moderate strength of evidence showing a lower risk of hemorrhage and blood transfusion in planned cesareans than in vaginal delivery. These studies also yielded evidence of lower hemorrhage or blood transfusion in planned cesareans than in unplanned cesareans.

Hysterectomy. Three studies yielded weak evidence on the association between emergency hysterectomy after childbirth and either planned vaginal or planned cesarean delivery. The rarity of the outcome results in insufficient statistical power to draw firm conclusions regarding the risk associated with either delivery route.

Thromboembolism. Eight studies provided weak evidence for an association between thromboembolism and planned vaginal or planned cesarean delivery. Studies reported no consistent direction or magnitude of effect.

Surgical complications. Ten studies provided weak evidence on surgical complications associated with planned vaginal and planned cesarean delivery. Studies generally showed a lower risk of surgical complications in planned "elective" cesarean than unplanned "emergency" or "labored" cesarean deliveries.

Breastfeeding. One study provided weak evidence that although women with planned vaginal deliveries may initiate breastfeeding sooner than women with planned cesarean deliveries, they do not report any difference in the duration of breastfeeding. Other evidence suggests that women are more likely to bottlefeed following a cesarean delivery (planned or unplanned) compared with a vaginal delivery.

Postpartum pain. Four articles (from three studies) reported on postpartum pain using various pain measures at different time periods. Together, these studies provide weak evidence of no significant difference in pain between modes of delivery, but they draw from populations with breech deliveries and may, therefore, overestimate the pain in the planned vaginal delivery group.

Psychological outcomes: postpartum depression. Two studies provide weak evidence suggesting no differences in postpartum depression by delivery route. As with pain, studies with breech populations likely overestimated the rate of complications, interventions, and possible negative psychological outcomes in the planned vaginal delivery group.

Psychological outcomes: other. Seven articles (from six studies) yielded weak evidence about a range of other psychological outcomes. The data were consistent in reporting that women who had an unplanned cesarean birth or an instrumental vaginal delivery were more likely to experience adverse psychological outcomes than were women who either underwent a spontaneous vaginal or a planned cesarean birth. The variety of outcomes and measures makes a summative assessment of other outcomes challenging.

Maternal length of stay. Four studies provided moderate evidence that length of stay is higher for cesarean delivery, planned or otherwise, than for vaginal delivery.

Urinary incontinence. Nine articles (from eight studies) provided weak evidence that rates of stress urinary incontinence for planned "elective" cesarean section were either lower than or no different from those for vaginal delivery. Numerous problems limit evidence on this outcome: lack of high-quality prospective studies that compare planned routes of delivery, have adequate power, include comprehensive long-term followup, account for multiple deliveries, account for variations in practice patterns including use of epidural anesthesia and episiotomy, use validated urinary questionnaires administered at consistent time points from delivery, and define incontinence in a standardized fashion by its occurrence, severity, and impact on quality of life.

Anorectal function. Seven articles (from six studies) provided weak evidence showing a reduced risk of anal incontinence in planned cesarean deliveries compared with unplanned cesarean or instrumental vaginal deliveries. Evidence was inconsistent about differences between planned cesarean and spontaneous vaginal delivery.

Pelvic organ prolapse. We found no evidence on the association between pelvic organ prolapse and planned vaginal or planned cesarean delivery.

Sexual function. One study provided weak evidence that sexual function does not differ by planned route of delivery.

Maternal outcomes relevant to subsequent cesarean delivery. *Subsequent fertility issues.* Studies not included in this review suggests a higher risk with all cesarean deliveries (unplanned or planned), but we found no reliable evidence of difference relevant to CDMR.

Subsequent uterine rupture. A recent update of a systematic review on the outcomes of vaginal birth after cesarean (VBAC) provided moderate evidence on subsequent uterine rupture. The update found no statistically significant differences between trial of labor after cesarean and elective repeat cesarean delivery with regard to rates of *asymptomatic* uterine rupture rates. The update noted that two studies of fair or good quality found a small but higher risk of *symptomatic* uterine rupture in trial of labor after cesarean than in elective repeat cesarean delivery.

Placenta previa. Given that placenta previa is the most common placental implantation anomaly, we updated a recent meta-analysis examining the relationship between placenta previa and a history of cesarean delivery. Our update supports the earlier meta-analytic conclusion that the odds of placenta previa are associated with advancing maternal age and increasing parity. The literature provided moderate evidence that the risk of placenta previa increases with previous cesarean delivery.

Subsequent stillbirth. Studies not included in this review suggest a higher risk with all cesarean deliveries (unplanned or planned), but we found no reliable evidence of difference relevant to CDMR.

Neonatal outcomes. *Fetal mortality***.** We found no studies that addressed fetal (in utero) deaths.

Neonatal mortality. Two studies provided weak evidence on neonatal mortality. The studies suggested a higher risk for all cesareans (planned or unplanned) than for spontaneous vaginal delivery. The studies did not control for underlying maternal or neonatal indications for cesarean or were underpowered for such a rare outcome, leading to limited ability to draw conclusions on this outcome.

Unexpected (iatrogenic) prematurity. We found no study that addressed unexpected prematurity and allowed comparisons by type of cesarean with intended or actual vaginal birth.

Respiratory morbidity. Measures of respiratory morbidity range from transient tachypnea of the newborn (TTN) to severe respiratory distress syndrome (RDS) with long-term sequelae. Nine articles yielded moderate evidence that the risk of variably defined “respiratory morbidity” was higher for all cesarean births than for vaginal deliveries. This risk reduces with advancing gestational age. Studies did not assess meconium aspiration syndrome by mode of delivery.

Transition issues. One study reported on this outcome, but the significant issues of appropriate categorization in this study make interpreting the data difficult. We consider the available evidence insufficient to judge the direction of effect.

Neonatal asphyxia or encephalopathy. Two studies provided weak evidence of a higher risk of neonatal encephalopathy associated with operative vaginal deliveries and “emergency” or “labored” cesareans than with spontaneous vaginal delivery.

Intracranial hemorrhage. One study provided weak evidence on intracranial (subdural/cerebral, intraventricular, and subarachnoid) hemorrhage. The prelabor cesarean deliveries included those done for maternal or neonatal indications, so they likely involved

cesareans for placenta previa and fetal anomalies, which may independently increase the risk of intracranial hemorrhage. Despite the higher theoretical risk for prelabor cesarean deliveries, this study did not find any significant difference between spontaneous vaginal delivery and prelabor cesarean deliveries. It did show consistently higher rates of intracranial hemorrhage for assisted vaginal deliveries and cesarean deliveries in labor.

Facial nerve injury. One study provided weak evidence that the risk of facial nerve injury varies by mode of delivery; the risk is higher for forceps and the combined use of forceps and vacuum delivery than for spontaneous vaginal delivery. These findings suggested that CDMR posed no risk for facial nerve injury greater than that associated with planned vaginal delivery.

Brachial plexus injury. One study provides weak evidence that the incidence of brachial plexus injury is lower in cesarean delivery than in vaginal delivery.

Fetal laceration. Two studies provided weak evidence on fetal lacerations based on data limited to cesarean deliveries. They reported a higher rate of fetal lacerations among emergency and labored cesarean than among elective cesarean delivery.

Neonatal length of hospital stay. One study provided weak evidence that the neonatal length of hospital stay is higher for "elective" cesarean delivery than for vaginal delivery.

Long-term neonatal outcomes. We did not find any evidence on long-term neonatal outcomes.

KQ 3: Modifiers of Cesarean Delivery on Maternal Request

The evidence on effect modifiers is sparse and pertains to only a few outcomes for KQ 2. Five studies provided evidence on the modifiers of CDMR, specifically neonatal respiratory distress, infectious morbidity, and urinary incontinence.

With regard to respiratory morbidity, results showed a consistent decrease in respiratory morbidity as gestational age rises, despite differences in inclusion criteria and definitions of elective cesarean delivery. Gestational age appears to play a lesser role as a risk factor for fetal respiratory distress in planned vaginal delivery than in planned cesarean.

With regard to infectious morbidity, the single study we found suggested no effect of physician experience, incision type, maternal age, or prophylactic antibiotics on infectious morbidity; it did suggest that the risk was higher among obese or black patients than among other women. Pelvic floor exercises decreased the risk of urinary incontinence; pre-pregnancy body mass index increased it.

Given the lack of evidence directly comparing effect modifiers in a population with planned CDMR with those in a population with planned vaginal delivery, inferences about effect modifiers must be drawn cautiously. Furthermore, most studies did not adjust for confounders, so results must be interpreted as crude estimates.

Conclusions

The incidence of CDMR appears to be increasing. However, accurately assessing its true incidence or trends over time is difficult because currently CDMR is neither a well-recognized clinical entity nor an accurately reported indication for diagnostic coding or reimbursement. More information is available on this question from nations other than the United States, and they differ from this country in health systems, cultural attitudes, patient demographics, and other factors. Drawing inferences from non-US sources, therefore, must be done with caution.

Virtually no studies exist on CDMR *per se*, so the knowledge base rests chiefly on indirect evidence from proxies such as cesareans performed for breech presentation. These proxies each possess unique and significant limitations. Furthermore, the vast majority of studies to date compared outcomes by actual routes of delivery, not planned routes of delivery. Therefore, significant uncertainty remains regarding the "ideal" route of delivery. Primary CDMR and planned vaginal delivery likely do differ with respect to individual outcomes for either mothers or infants. However, our comprehensive assessment, across many different outcomes, suggests that no major differences exist between primary CDMR and planned vaginal delivery, but the evidence is too weak to conclude definitively that differences are completely absent. If a woman chooses to have a cesarean delivery in her first delivery, she is more likely to have subsequent deliveries by cesarean. With increasing numbers of cesarean delivery, risks occur with increasing frequency.

Given the limited data available, we cannot make definitive conclusions about factors that might influence outcomes of planned CDMR versus planned vaginal delivery. Neither is the knowledge base adequate to comment definitively on many factors that influence the outcomes of actual cesarean and vaginal deliveries.

Our review was focused on primary CDMR. We note that a comprehensive assessment of the risks and benefits of CDMR extends beyond the first cesarean. Future research needs to account for complications and risks associated with repeat cesarean deliveries such as adhesions, placenta previa and accreta, and subsequent stillbirths.

Significant resources will need to be allocated to study CDMR if the nation is to be well informed about the benefits and harms to mothers and infants in both the first and subsequent pregnancies. To realize the maximum gain from such work, research intended to answer questions about maternal and neonatal outcomes of CDMR must study them by intent-to-treat methods. This means comparing outcomes of planned CDMR with those of planned vaginal delivery, not comparing outcomes by actual routes of delivery.

Future research efforts need to focus on a substantial set of problems: developing consensus about terminology for both delivery routes and outcomes; creating a minimum data set of information about CDMR; improving study design and statistical analyses; attending to major outcomes and their special measurement issues; assessing both short- and long-term outcomes with better measurement strategies; dealing better with confounders; and considering the value or utility (in quality-of-life terms) of different outcomes. Examining the costs and cost-effectiveness of different pathways of delivery and considering the impact of CDMR on the medicolegal system also warrant attention.

Finally, if we are to gain meaningful data on short- and long-term maternal and neonatal outcomes associated with CDMR (whether or not compared with planned vaginal delivery), we should define success as a healthy mother and infant in the broadest sense of well-being possible. Studies ought to be well-designed, prospective, and with adequate sample sizes and clearly described power analyses for both common and rare outcomes. Accumulating such high-quality evidence is possible with cooperation from all stakeholders; acquiring it is imperative if women and care providers are to be able to make informed decisions about CDMR.

Evidence Report

Chapter 1. Introduction

Context for Systematic Evidence Review of Cesarean Delivery on Maternal Request

The National Institutes of Health (NIH) Office of Medical Applications of Research (OMAR) reviews and evaluates clinically relevant NIH research program information and serves to promote the effective transfer of this information to the health care community. OMAR accomplishes this objective through its Consensus Development Program, which includes major Consensus Development conferences and State-of-the-Science conferences (SOS, when there is less definitive evidence available). OMAR, given the wide recognition of the limited literature available to guide clinical practice of cesarean delivery on maternal request (CDMR), planned an SOS Conference for March 2006. As background, OMAR commissioned this systematic review through the Agency for Healthcare Research and Quality (AHRQ) as a means of summarizing the available literature, framing the discussions regarding benefits and harms, and highlighting the limitations of the entire evidence base.

For the purposes of this review, cesarean delivery on maternal request is defined as a cesarean delivery for a singleton pregnancy, on maternal request, at term, and in the absence of any maternal or fetal indication for cesarean delivery. The panel chair of the SOS Conference, and a panel of independent technical experts (TEP) recognized that the available literature does not explicitly define CDMR as a specific study group to allow for comparison with other planned routes of delivery. Given this lack of evidence on CDMR per se, the TEP and SOS conference panel chair requested that we include proxies for CDMR such as cesarean deliveries for breech presentation.

We recognize that the ideal comparison groups to address the potential benefits and harms of CDMR would be *planned vaginal delivery* vs. *planned CDMR* in a low-risk population. We also note that planned vaginal delivery does not always result in spontaneous labor followed by spontaneous vaginal delivery.

The ideal evidence, therefore, demands a comparison of intent: *planned* vaginal delivery compared with *planned* CDMR rather than the comparison of actual delivery routes such as spontaneous vaginal delivery compared with unlabored cesarean. Such a comparison, based on intent to treat, is critical to assess the purported benefits of CDMR in reducing the risk of pelvic floor disorders (urinary incontinence, pelvic organ prolapse[*] [loss of pelvic support], anal incontinence) because it is unclear whether or to what extent pelvic floor damage is caused by pregnancy itself, the first stage of labor [regular contractions to full cervical dilatation], or the second stage of labor [full dilatation to delivery—pushing phase]).

In the absence of such high-quality evidence, we compiled a summary of the best available literature, using proxies for CDMR, frequently relying on studies that define groups by *actual* route of delivery and not *planned* route of delivery. Studies comparing actual and not planned route of delivery may provide inaccurate estimates of benefits and harms by reporting only outcomes of a limited group. For instance, a comparison of spontaneous vaginal delivery with

[*] Pelvic organ prolapse describes a group of conditions when one or more of the organs in the pelvis (the bladder, uterus, small intestines or rectum) fall into the vagina or through the vagina outside the body. Different terms describing prolapse include "cystocele" or "dropped bladder"; "uterine prolapse" or "dropped uterus"; "rectocele" or "enterocele."[130]

unlabored cesarean may overestimate the risk of third-degree lacerations in the planned vaginal delivery group by not accounting for the group of women who ultimately underwent a cesarean delivery after attempting a vaginal delivery. Similarly, such a comparison would overestimate the risk of wound infection in the planned cesarean delivery group by not accounting for the higher rate of wound infection in women who ultimately underwent a cesarean delivery after attempting a vaginal delivery.

In addition, comparing actual routes of delivery rather than planned routes of delivery yields an inadequate assessment of potential confounders that, by definition, may influence both the route of delivery and the maternal or neonatal outcomes of interest. For instance, prolonged fetal bradycardia (fetal distress) can influence the need for an emergency delivery by cesarean, vacuum, or forceps and can also negatively affect neonatal outcomes. Studies that examine actual routes of delivery typically fail to account for such confounders.

To clarify the nature of these complex pathways and to highlight the potential confounders inherent in these comparisons, we present a framework of possible pathways for primiparous women with singleton pregnancies at term (see Figure 1). The pathways begin with planned routes of delivery, describe common labor events and potential confounders, and ultimately lead to various actual routes of delivery. As noted already, available studies often include comparison groups of actual routes of delivery for primiparous women with singleton pregnancies at term.

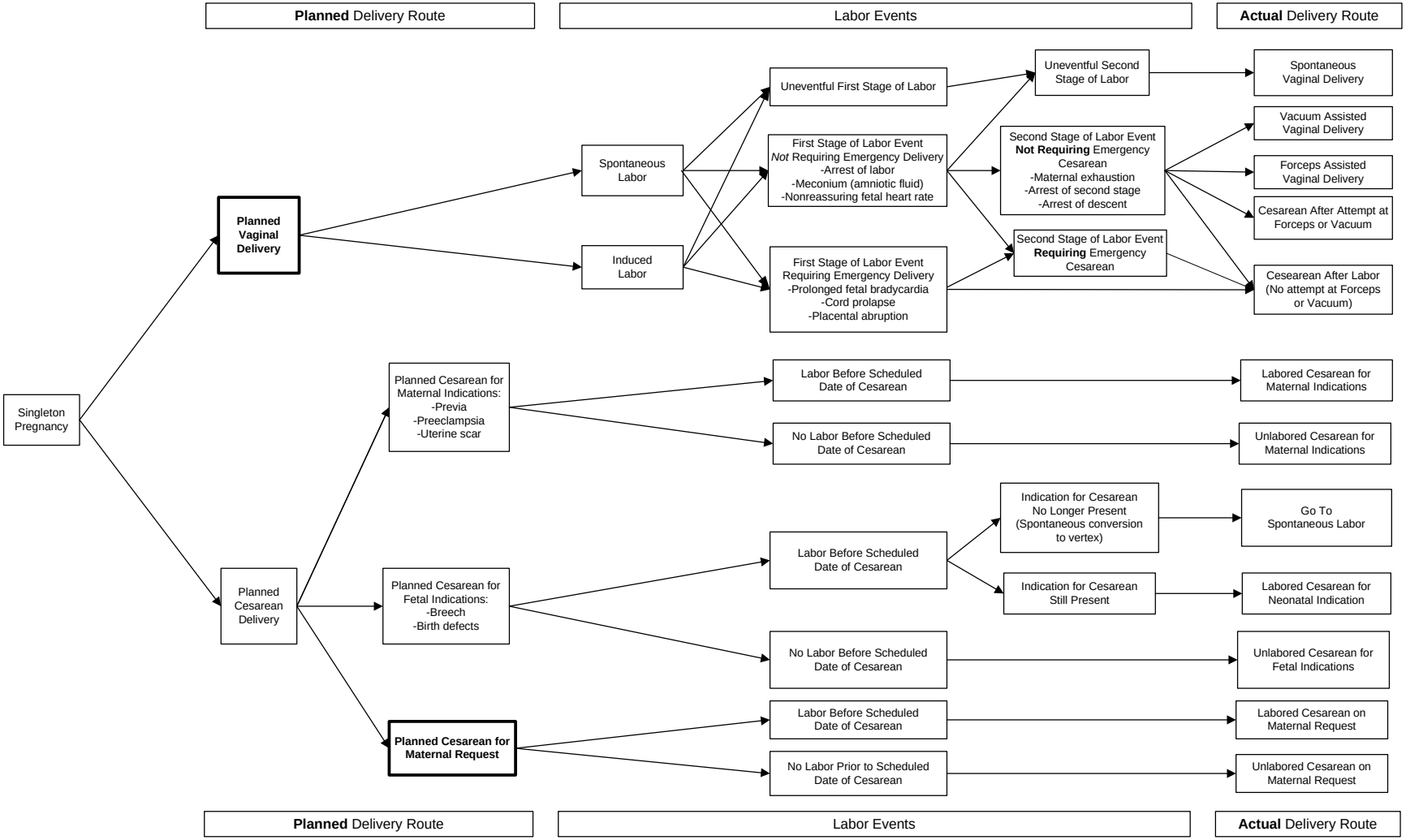
On the left of Figure 1, we list the range of planned routes of delivery before labor. These include planned vaginal delivery and planned cesarean delivery for fetal indications, maternal indications, or upon maternal request. Given the lack of evidence on CDMR, planned cesarean for maternal indications or planned cesarean for fetal indications serve as proxies for CDMR, accounting for potential confounding effects when possible. For example, we consider cesarean delivery for breech as a proxy for CDMR for maternal outcomes. However, we do not consider this group as an appropriate proxy when assessing neonatal outcomes, because underlying pathology may result in both breech presentation and poor neonatal outcomes. (A later section of this chapter presents a note on terminology and glossary dealing further with the variable language for this topic.)

The middle section of Figure 1 includes labor events in either the first or second stage of labor that could necessitate a particular route of delivery and influence outcomes. These involve circumstances such as significant and prolonged fetal bradycardia (decrease in fetal heart rate), meconium-stained amniotic fluid (amniotic fluid containing material from fetal bowel movement), arrest of labor (slow or absent progress during the active phase of labor), cord prolapse (when the umbilical cord falls into the vagina prior to delivery), and placental abruption (placental detachment from the wall of the uterus). Generally, studies do not control for these potential confounders.

On the right of Figure 1, we show actual routes of delivery. In our review, most studies compare outcomes among various actual routes of delivery. As noted above, the ideal comparison would be between various planned routes of delivery. We attempt to describe such comparisons when available.

Our pathway for describing various routes of delivery for primiparous women with singleton pregnancies at term is not meant to represent a comprehensive flowchart of the multitude of prelabor and intrapartum events that may occur and that may alter the planned course of delivery. For instance, we do not describe planned vaginal delivery for either maternal or fetal indications

Figure 1. Possible pathways for planned vaginal and planned cesarean deliveries



Note: Text in bold represents ideal comparison groups for this review.

(or both). However, we do include pathways for cesarean delivery for neonatal and maternal indications because these serve as the only available proxies for CDMR.

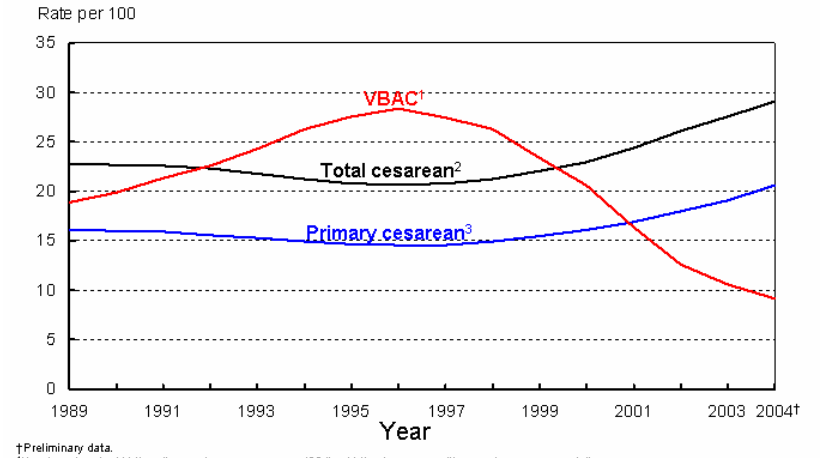
Significant advances in operative techniques, anesthesia, availability of antibiotics, and neonatal care over the past several decades have resulted in a decline in maternal and neonatal mortality.[1] For this reason and in consultation with our TEP, AHRQ, and the SOS Conference panel chair, we limited our searches to articles published in or after 1990.

The remainder of this chapter describes the clinical and epidemiological issues related to CDMR, describes the four key questions (KQs) addressed by our systematic review, and presents an analytical framework for approaching the KQs.

Clinical and Epidemiological Issues

The Centers for Disease Control and Prevention (CDC) reported that 29.1 percent of all births in the United States resulted from cesarean deliveries in 2004, an increase of 40 percent from 1996 and the highest percentage ever reported in the United States (see Figure 2).[2] After declines between 1989 and 1996, the total cesarean rate and the primary cesarean rate (i.e., percentage of cesareans among women with no previous cesarean delivery, which was 20.6 percent in 2004) have increased each year.[2]

Figure 2. Total and primary cesarean rate and vaginal birth after previous cesarean (VBAC) rate — United States, 1989-2004



†Preliminary data.
[1]Number of vaginal births after previous cesarean per 100 live births to women with a previous cesarean delivery.
[2]Percentage of all live births by cesarean delivery.
[3]Number of primary cesarean deliveries per 100 live births to women who have not had a previous cesarean.
NOTE: Due to changes in data collection from implementation of the 2003 revision of the U.S. Standard Certificate of Live Birth, there may be small discontinuities in rates of primary cesarean delivery and VBAC in 2003 and 2004; see "Technical Notes."

Among women with previous cesarean deliveries, the rate of vaginal birth after previous cesarean (VBAC) has dropped over time; the likelihood that subsequent deliveries would be cesarean was approximately 91 percent in 2004. Recent analysis from the Healthcare Cost and Utilization Project Nationwide Inpatient Sample suggests that "elective primary cesarean deliveries," defined as a procedure that occurred before labor and without a previous history of cesarean delivery, rose from 19.7 percent of all cesarean deliveries in 1994 to 28.3 percent in 2001, an increase of approximately 43.6 percent.[3] This statistic includes cesarean deliveries performed for malpresentation, antepartum bleeding, herpes, severe hypertension, uterine scar, multiple gestation, macrosomia (excessive weight or size of the infant, relative to gestational age), unengaged head (fetal head not applied to cervix), "soft tissue condition," other hypertension, preterm, fetal anomaly, and unspecified indications; the contribution of CDMR to this statistic is unknown. The higher level of comfort that obstetricians feel with the risks

associated with cesarean deliveries compared with those associated with vaginal deliveries may explain the rise in primary cesarean deliveries in part;[4] physicians also may be justifying cesarean deliveries after a brief and "gentle" trial of labor.[5]

The topic of CDMR has drawn heightened interest and publicity. This attention can be attributed to the increased awareness that what happens in the delivery room has lifelong implications for both mother and child. The concerns associated with the increased rate of cesarean deliveries include the likelihood of higher risks from surgery, such as mortality, infection, anesthetic complications, hemorrhage, need for blood transfusions, and neonatal respiratory distress.

One purported benefit of CDMR is protection against pelvic floor disorders such as urinary incontinence, pelvic organ prolapse, and anal incontinence. Substantial controversy exists regarding appropriate clinical practice and whether CDMR should be made more widely available, in part to take advantage of this possible benefit and also to allow ease of scheduling the delivery for patients and providers. A recent editorial in the American College of Obstetricians and Gynecologists (ACOG) Clinical Review strongly suggested that CDMR be made more widely available to women.[1] This recommendation was directed specifically toward nulliparous women or those who have undergone pelvic reconstructive surgery. Conversely, organizations such as the International Federation of Gynecology and Obstetrics (FIGO) support vaginal birth and believe that the practice of CDMR lacks ethical justification.[6] However, the ACOG Ethics Committee determined that the physician is ethically justified in performing a CDMR if he or she believes that it promotes the overall health and welfare of the woman and her fetus but is equally justified in refusing to perform one if the physician believes it to be detrimental to the woman and her fetus.[7]

Significant variability associated with obstetrical practice and labor management makes it difficult to quantify the risk of CDMR. Given these uncertainties, no clear evidence guides informed decisionmaking regarding CDMR. As women's life expectancy has increased to 80.1 years of age over the past several decades,[8] and as women remain active well into their postmenopausal years, attention to the antecedents of long-term maternal health outcomes is increasingly important.

Key Questions and Analytic Framework

Table 1 presents the final key questions posed by AHRQ on behalf of OMAR. Figure 3 depicts the analytic framework we used to address the four key questions, given the flowchart for the various *planned* vaginal and *planned* cesarean pathways (in Figure 1).

Given the time and resources available for this systematic review, we focused on the maternal and neonatal outcomes of high priority to the SOS conference planning committee. The maternal *short-term* outcomes include mortality, infection, anesthetic complications, hemorrhage or blood transfusion, hysterectomy, thromboembolism, surgical complications, breastfeeding, postpartum pain, psychological outcomes, and length of stay. The *long-term* maternal outcomes include urinary incontinence, anorectal function, pelvic organ prolapse, sexual function, subsequent fertility issues, subsequent placenta previa, subsequent uterine rupture, and subsequent stillbirth.

Table 1. Key Questions posed by AHRQ on behalf of OMAR

Key Questions
1. What is the trend and incidence of cesarean delivery over time in the United States and in other countries?
a. What is the contribution of primary pre-labor cesarean deliveries?
b. Of the primary pre-labor cesarean deliveries what is the contribution of cesarean delivery on maternal request, for medical indications, and for malpresentation?
2. What are the short-term (under one year) and long-term benefits and harms to mother and baby associated with cesarean by request versus attempted vaginal delivery?

Maternal

Maternal outcomes—short term	Maternal outcomes—long term
1. Mortality*	1. Urinary function*
2. Infection*	2. Anorectal function*
3. Anesthesia*	3. Pelvic organ prolapse*
4. Hemorrhage/blood transfusion*	4. Sexual function*
5. Hysterectomy*	5. Endometriosis
6. Thromboembolism	6. Pelvic pain
7. Surgical complications	7. Future fertility
8. Unplanned ICU admission	8. Subsequent ectopic pregnancies
9. Wound breakdown	9. Subsequent uterine rupture*
10. Breastfeeding	10. Subsequent placental implantation issues*
11. Pain (labor and postoperative)	11. Subsequent stillbirth*
12. Psychological	12. Psychological
13. Readmission to hospital	13. Subsequent surgery
14. Maternal length of stay	14. Fistulae
15. Maternal recovery	

Fetal/Neonatal

Fetal/Neonatal outcomes—short term	Neonatal outcomes—long term
1. Fetal mortality*	1. Bonding and early behavioral issues
2. Neonatal mortality*	2. Long-term development outcome
3. Unexpected (iatrogenic) prematurity*	
4. Respiratory distress syndrome*	
5. Metabolic complications	
6. Transition issues	
7. Transient tachypnea of the newborn*	
8. Persistent pulmonary hypertension of the newborn	
9. Encephalopathy/asphyxia*	
10. Cerebral accident and stroke	
11. Unplanned NICU/special care nursery	
12. Birth Injury	
13. Brachial plexus injury*	
14. Fractures	
15. Lacerations	
16. Infections	
17. Length of stay	
18. Breastfeeding	

* Indicates outcomes considered of higher priority by the Conference Planning Committee

Table 1. Key Questions posed by AHRQ on behalf of OMAR (continued)

Key Question
3. What factors influence benefits and harms?
a. Fetal gender
b. Fetal size
c. Parity
d. Socioeconomics
e. Race/ethnicity
f. Maternal BMI
g. Maternal medical conditions
h. Pregnancy dating
i. Type of labor (e.g. augmented)
j. Physician experience/specialty
k. Delivery volume/level of perinatal care
l. Time of day of delivery
4. What future research directions need to be considered to get evidence for making appropriate decisions regarding cesarean on request or attempted vaginal delivery?

The analytic framework and this review concentrate on outcomes associated with primiparous births. Such an approach excludes two important outcomes that are particularly relevant to a comprehensive assessment of short-term and long-term risks associated with CDMR: (1) placental implantation abnormalities (previa, accreta, and percreta) and (2) uterine rupture generally associated with a trial of labor after cesarean.

Because the rate of VBAC is decreasing, women who undergo a first cesarean are likely to deliver future children through a similar route. Although we do not fully understand the mechanism by which placenta previa occurs,[9] studies indicate that the risks of placenta previa and similar placental implantation abnormalities increase with the number of cesarean deliveries.[10-12]

In consultation with the TEP and the SOS Conference panel chair, we determined that a comprehensive assessment of these two outcomes—placental implantation abnormalities and uterine rupture—was beyond the scope and resources allocated for this review. However, given the importance of these two outcomes and the likelihood that they may significantly affect short- and long-term maternal and neonatal morbidity and mortality associated with hemorrhage or prematurity, respectively, we updated recently completed and well-designed systematic evidence reviews on these topics.

Neonatal outcomes included in this systematic evidence review include fetal mortality, neonatal mortality, unexpected (iatrogenic) prematurity, respiratory morbidity including transient tachypnea, respiratory distress syndrome, and persistent pulmonary hypertension, transition, neonatal encephalopathy and asphyxia, intracranial hemorrhage, facial nerve injury, brachial plexus injury, fetal laceration, neonatal length of stay, and long-term issues.

In consultation with our TEP, AHRQ, and the SOS Conference panel chair, we determined that this systematic evidence review would not examine outcomes unique to vaginal delivery in the absence of a cesarean comparison group. The examination of outcomes and modifiers of vaginal deliveries in studies without cesarean comparison groups was outside the scope and resources allocated to this review.

The following sections describe our conceptual approach to addressing the four KQs in greater detail.

KQ 1: Trend and Incidence of Cesarean Delivery

This question includes trend and incidence of cesarean delivery over time and covers the contribution of primary prelabor cesarean deliveries. KQ 1 further seeks to determine the contribution of CDMR and other cesareans for other indications such as repeat elective cesarean deliveries, unlabored cesareans for medical indications (maternal or neonatal), unlabored cesareans for malpresentation, and labored cesareans after a planned vaginal delivery (Figure 3). These groupings will be particularly relevant to both maternal and neonatal outcomes because short- and long-term risks may be associated with the degree of effort exerted to achieve a vaginal delivery.[13]

Despite the theoretical importance of these distinctions, obtaining accurate data on the rate of cesarean delivery truly on maternal request in the absence of maternal or neonatal indications is challenging. Determining the true prevalence of CDMR in this country is difficult because such deliveries are often coded with other indications, possibly reflecting insurance coverage issues.[4] However, some evidence suggests that such deliveries do occur and possibly at an increasing rate.[5,14]

We queried other sources of data to answer this key question. These include CDC, National Vital and Health Statistics, the World Health Organization, and sources from other nations such as Statistics Canada, the Australian Department of Human Services, and the United Kingdom Department of Health.

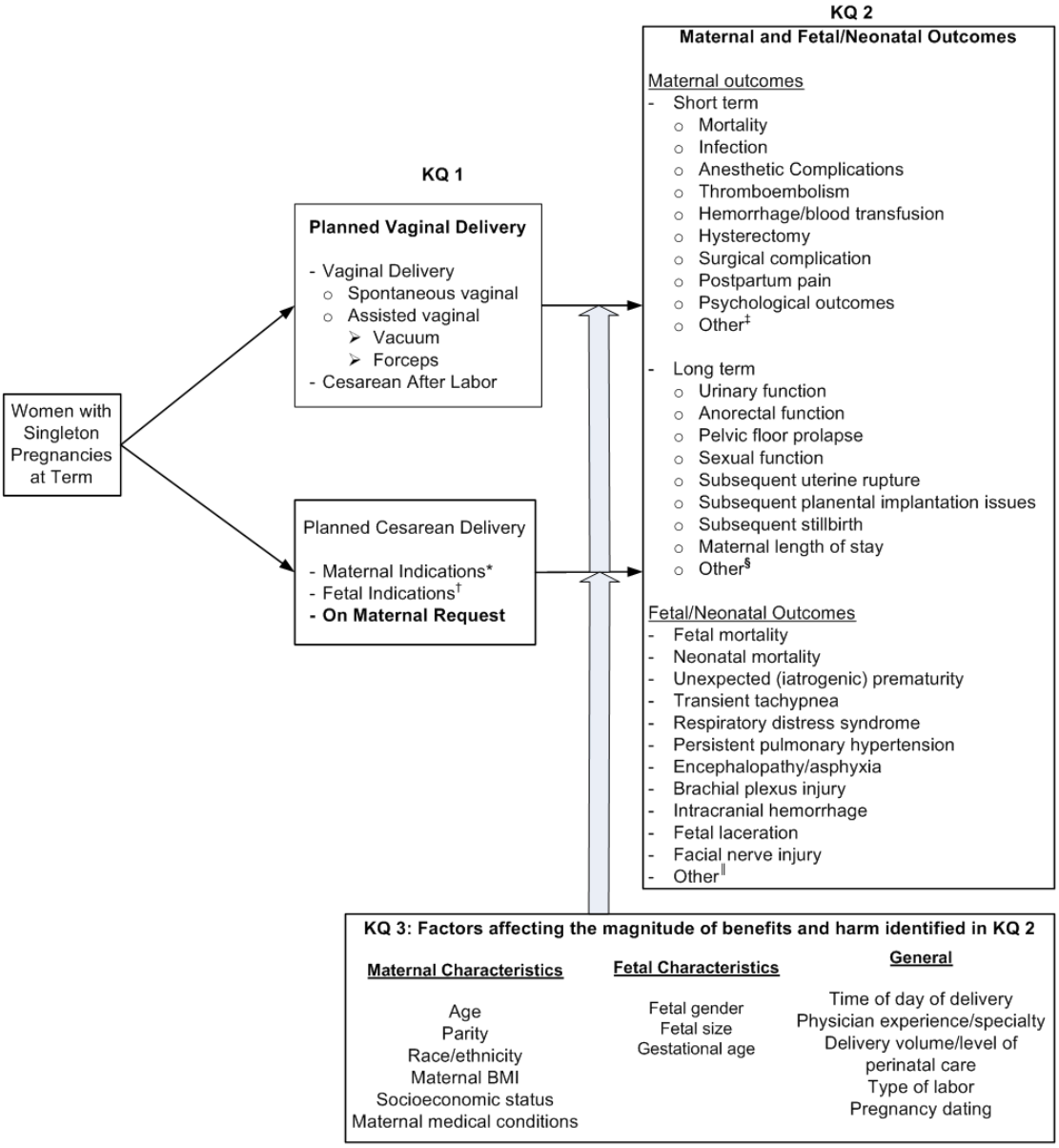
We defined "developed countries" as the United States, Canada, the United Kingdom, Western Europe, Israel, Australia, New Zealand, and Japan. We also tracked citations from other countries, such as Brazil.

KQ 2: Effect of Planned Route of Delivery on Outcomes

Several factors make interpretation of the available evidence challenging. We summarize them in the following section.

Comparison of planned routes of delivery (intent to treat). As explained above, the appropriate comparison is that of intent: *planned* vaginal delivery compared with *planned* CDMR. The majority of studies included in this systematic review report outcomes by *actual* route of delivery. A design centered on actual delivery route often allows investigators to distinguish between labored and unlabored cesarean deliveries. In studies limited to unlabored cesareans, women who present in labor before their scheduled date of delivery are, by definition, excluded. Excluding these women may overestimate potential benefits (e.g., reduction in pelvic floor disorders) and potential harms (e.g., neonatal respiratory morbidity) associated with CDMR because the studies then cannot account for any effect that labor has on outcomes of interest.[15-17]

Figure 3. Analytic framework for cesarean delivery on maternal request



Indications for Cesarean

***Maternal Indications**: Abdominal cerclage, obstructive lesions in the lower genital tract, prior pelvic reconstructive surgery and major, anal involvement from inflammatory bowel disease

†**Fetal indications:** Breech or other malpresentations, congenital anomalies, nonreassuring fetal heart rate, genital herpes infections

*†**Maternal *and* fetal indications:** abnormal placentation (previa, accreta, percreta), abnormal labor due to cephalopelvic disproportion

Maternal and Neonatal Outcomes

‡**Maternal Short Term Outcomes (Other):** Maternal recovery, breastfeeding, unplanned ICU admission, readmission to hospital, anesthesia duration and use, type of anesthesia

§**Maternal Long Term Outcomes (Other):** Endometriosis, pelvic pain, future fertility, subsequent ectopic pregnancies, subsequent surgery, psychological, fistulae

‖**Neonatal Outcomes: (Other):** Metabolic complications, transition issues, cerebral accident and stroke, birth injury, fractures, infections, breastfeeding, unplanned NICU/special care nursery, length of stay, bonding and early behavioral issues, long-term development

Studies that include both labored and unlabored planned cesareans may have a rate of labor that exceeds the rate of labor expected for a population planning CDMR and may allow for a longer period of time in labor before cesarean delivery.

Appropriate proxies for CDMR. We expected high-quality data on CDMR *per se* to be limited because CDMR is rarely listed as an indication for a cesarean delivery Available studies include a wide range of indications for cesarean that are highly variable in their relevance to CDMR. Use of cesarean for breech or other malpresentations is currently the closest proxy for CDMR. However, studies of cesarean deliveries for breech were designed with neonatal outcomes as primary endpoints; therefore, they may be limited in their ability to serve as proxies for CDMR for maternal outcomes. For instance, the International Term Breech trial (hereafter Breech Trial) allowed patients who presented in labor to be randomized to a cesarean delivery[18] without adjusting for the length of the labor before cesarean or the length of time the membranes had been ruptured. As indicated above, the ideal comparison would involve intent and compare *planned* vaginal with *planned* CDMR. Thus, any protocol for CDMR would have some women going into labor before their planned cesarean; data from such deliveries ought to be analyzed as part of the planned CDMR group. However, the extent to which cesarean for breech serves as an accurate surrogate for CDMR is unclear because of uncertainty as to whether the time period between presentation in labor and cesarean delivery for breech is similar to that of CDMR. Issues such as prolonged rupture of membranes before the decision to perform a cesarean may increase the risk of other complications, such as maternal and neonatal infections and length of hospital stay.

Another major limitation to the use of breech as a proxy for CDMR is that when comparing study groups based on intent to treat, the risk of requiring a cesarean in the planned vaginal delivery group is likely to be significantly higher than if the fetus were vertex (head first).

Changing practice patterns. Practice patterns have changed considerably for both cesarean and vaginal deliveries over the past two decades. Historically, quantifying the risks and benefits of vaginal and cesarean births has been difficult, as the data on the risks associated with cesarean were based on older studies when cesarean deliveries were routinely performed under general anesthesia, after prolonged labor, and without the benefit of prophylactic antibiotics and thromboprophylaxis. Such surgical procedures are not comparable to CDMR under current standard practices. The absolute risks associated with a planned CDMR are likely to be lower in today's environment than they were previously,[19-23] and they are dropping.[24] Similarly, clinical management of planned vaginal delivery has also been improving, as in the declining use of episiotomy.[25,26]

The TEP and the SOS Conference panel chair decided to exclude studies published before 1990 to focus the systematic review on studies with practice patterns similar to contemporary norms. However, the studies we examine in this review do not necessarily include "best practices" for either vaginal or cesarean routes of delivery and demonstrate variable practice patterns among providers. For instance, studies generally do not clarify whether prophylactic antibiotics were administered for cesarean; this step, of course, can affect rates of maternal infection. Similarly, studies of vaginal delivery may reflect overuse of episiotomy, inappropriate thresholds for performing cesarean delivery, and inadequate management of labor. Therefore, a comparison of planned vaginal and planned cesarean ought to include the best clinical practice patterns for each of these intended routes of delivery. In the absence of information on the extent

to which studies deviate from ideal practice patterns, how the balance of harms and benefits may shift in an ideal practice environment remains unclear.

Confounders. As noted earlier, ideal comparisons include *planned* vaginal delivery vs. *planned* cesarean delivery. The comparison of actual routes of delivery may result in inadequate assessment of confounders that influence both route of delivery and maternal or neonatal outcomes. For instance, confounders such as multiple gestations, placenta previa, and polyhydramnios (excess amniotic fluid) may increase the likelihood of preterm labor and delivery, may influence the recommended route of delivery, and may also result in poor maternal and neonatal outcomes.

Statistical power. The consequences of a fundamental shift to higher rates of CDMR are profound. They should be examined in well-designed studies that are adequately powered to detect clinically meaningful differences. The available literature that we discuss generally has sample sizes lower than are necessary to achieve adequate power, especially for rare outcomes.

Appropriate timing of outcome measurements. Decisions made in the delivery room have lifelong implications for the mother and infant. Ideal studies require that outcomes be assessed at time periods appropriate for that particular end result of care. Studies of the association between parturition-related variables including routes of delivery and pelvic floor disorders (urinary incontinence, pelvic organ prolapse, anal incontinence, and sexual dysfunction) are often limited to the immediate postpartum period. Assessing whether the condition results in long-term impairment is difficult in these studies.

Long-term outcome studies, although relatively uncommon, are often retrospective in design; they draw associations between current pelvic floor complaints and previous obstetrical events, sometimes decades earlier. These studies are often unable to collect specific information regarding planned routes of delivery or even sufficient detail regarding actual routes of delivery. Therefore, they frequently are unable to control for many important confounders such as interval pregnancies and deliveries and other factors that have been implicated in the development of pelvic floor disorders, such as length of labor, use of vacuum or forceps, obesity, smoking, constipation or chronic straining, or previous reconstructive pelvic surgery.

Measurement of outcomes (comprehensiveness, severity, and utility). Ideally, a systematic review of the outcomes of planned route of delivery should provide a comprehensive assessment of outcomes, accounting for the severity of symptoms and the utility of various outcomes to patients. For instance, accurate measurement of neonatal respiratory morbidity should include the risks of all forms of harm associated with planned route of delivery, including potentially higher risks of meconium aspiration in planned vaginal deliveries[27] and potentially higher risks of transient tachypnea of the newborn and respiratory distress syndrome in planned cesarean deliveries.

The issue of severity rating is particularly important for pelvic floor outcomes such as urinary incontinence, pelvic organ prolapse, or anal incontinence. An undifferentiated measure of urinary incontinence that does not account for severity would mask the considerable difference in quality of life between a small amount of leakage that occurs rarely and severe, daily urinary leakage. Similarly, neonatal outcomes such as respiratory morbidity need to be categorized and analyzed by degree of severity. For instance, transient tachypnea of the newborn (TTN) and respiratory distress syndrome (RDS) represent extremes of severity; investigators should not group them into a single measure of respiratory morbidity, because doing so may obscure meaningful differences between groups.

Factoring in both severity and utility when assessing the overall benefit and harm of CDMR is critically important. A woman considering a *planned* route of cesarean delivery needs to assess comprehensively both short- and long-term risks, to both herself and her infant, and in both the current pregnancy and future pregnancies. Currently, clinicians and others have little or no way to judge the "priority" of a range of possible outcomes. For instance, urinary incontinence needs to be described in a manner that relates both its occurrence and severity and that provides a utility weighting relative to other potential outcomes such as wound infection. Similarly, in assessing overall harms and benefits to the neonate, the potentially higher risk of neonatal respiratory morbidity (TTN and RDS) associated with a *planned* CDMR needs to be weighed against the potential reduction in the rate of other outcomes such as stillbirths after 39 weeks, intrapartum deaths, and shoulder dystocias (emergency occurring when infant's shoulder gets "stuck") associated with a *planned* vaginal delivery.

KQ 3: Magnitude of Benefits and Harms

As suggested by our analytic framework (Figure 3), the choice of CDMR or a planned vaginal delivery, as well as the rates and severity of subsequent maternal and fetal or neonatal benefits and harms, may be influenced by several maternal, fetal, provider, and health care system characteristics. Given that few studies control for or assess the effect of such factors on maternal and fetal outcomes, we acknowledge the challenges of measuring the magnitude of these factors on maternal and fetal or neonatal outcomes. As in KQ 2, we stratified the analysis into unlabored and labored cesarean deliveries as well as planned vaginal deliveries.

KQ 4: Future Research

We anticipate that even after this comprehensive systematic review has been discussed at the SOS conference and published, appreciable uncertainty will remain about the risks associated with CDMR. Suggestions to address these limitations of the literature, put forward in our discussion of KQ 4, will guide the development and direction of future research.

Understanding some of the gaps in the literature at this point may help readers interpret our analyses and findings for KQs 1, 2, and 3. Especially important are problems related to the characterization of CDMR and other modes of delivery that typically serve as proxies for CDMR. These include cesareans for breech and other ambiguous categorizations, which may be called "elective," "planned," "nonemergency," "unlabored," and "scheduled" cesareans. This variability in language is not trivial, and readers of this evidence report are cautioned against assuming that various research teams in fact mean the same thing by the same term or that use of different terms accurately depicts different situations.

In addition, we have assessed maternal and neonatal outcomes and weighted them based on the level of relevance to CDMR, the quality of individual study, and the overall strength of evidence for each particular outcome measure. In taking this approach, we have identified several outcomes that require substantial additional research. The analytic framework provides the infrastructure for designing future studies by highlighting particularly relevant comparison groups. Although a comprehensive assessment that balances outcomes based on their relative rates and utilities or disutilities is the ideal, this goal is probably still unattainable.

A Note on Terminology

The purpose of this systematic review is to address CDMR, but the paucity of literature on the topic requires the use of proxies. As noted above, studies in this review use nonstandardized terms such as "elective," "scheduled," "planned," "labored," "unlabored," "urgent," "emergent," and "emergency" cesarean deliveries. Table 2 provides a glossary of these general terms as they are commonly used. Not all studies use these exact definitions; in fact, they may use definitions that differ significantly from those employed in other studies. For instance, the term "primary elective" cesarean is widely interpreted as referring to a woman's first cesarean delivery, planned for a wide range of maternal and fetal indications and generally distinguished from emergency cesarean delivery and labored cesarean delivery after planned vaginal delivery. However, one study included 9 percent of women undergoing a repeat cesarean in their "primary elective" cesarean group. The authors of this study defined the term "primary elective" cesarean as a "planned operation in which the patient had been admitted to the hospital at least 8 hours before the cesarean without symptoms of labor,"[28 p. 2] allowing for inclusion of repeat cesareans.

In discussing studies, we clearly specify each study's definition with respect to medical indications for cesarean and laboring status. In recognition of the variation across definitions, we elected to use the term that the authors used, denoting such terms by using quotation marks, rather than try to impose a single, overarching term such as elective cesarean delivery or CDMR.

Organization of This Evidence Report

Chapter 2 describes our methods, including our search strategies and inclusion/exclusion criteria; we also document our approach to rating the relevance of each study to CDMR, grading the quality of articles, and rating the strength of evidence. In Chapter 3, we present the results of our literature search and synthesis of retained articles for three issues (KQs 1, 2, and 3). Chapter 4 further discusses the findings, presents our conclusions, and offers recommendations for future research (KQ 4). References follow Chapter 4. Appendixes* include a detailed description of our search strings (Appendix A), abstraction and quality-rating forms (Appendix B), detailed evidence tables (Appendix C), list of excluded studies (D), and acknowledgments (Appendix E).

Technical Expert Panel (TEP)

We identified seven technical experts in the field of obstetrics to provide assistance throughout the project; they included specialists in maternal fetal medicine, general obstetrics and gynecology, urogynecology, family medicine, pediatrics, and nurse-midwifery. The TEP (Appendix D) was expected to contribute to AHRQ's broader goals of (1) creating and maintaining science partnerships as well as public-private partnerships and (2) meeting the needs of an array of potential customers and users of its products. Thus, the TEP was both an additional resource and a sounding board during the project.

To ensure robust, scientifically relevant work, we called on the TEP to provide reactions to work in progress and advice on substantive issues or possibly overlooked areas of research. TEP members participated in conference calls and discussions through e-mail to

* Appendixes and Evidence Tables for this report are provided electronically at http://www.ahrq.gov/downloads/pub/evidence/pdf/cesarean/cesarreq.pdf

Table 2. Glossary of terms

Cesarean Delivery
Cesarean delivery on maternal request (CDMR): A cesarean delivery for a singleton pregnancy, on maternal request, at term, and in the absence of any maternal or fetal indication for cesarean delivery.
Elective cesarean delivery: Generally includes a planned cesarean for a wide range of maternal and fetal indications, generally distinguished from emergency cesarean delivery and labored cesarean delivery after planned vaginal delivery. This category includes CDMR. This category may also include patients that go into labor prior to their scheduled delivery date.
Emergency cesarean delivery: A cesarean delivery that is performed expeditiously, in which delay may result in significant maternal or neonatal harm, sometimes referred to as emergent.
Labored cesarean delivery: A cesarean delivery that is performed after the onset of labor. This category could include planned and unplanned cesarean deliveries.
Planned cesarean delivery: A subset of elective cesarean delivery where the intent to deliver by cesarean is determined prior to labor. Of note, this category includes all deliveries resulting from a decision to pursue an intended cesarean delivery, including patients that present in active labor before their scheduled delivery date and are allowed to deliver vaginally either spontaneously or with vacuum or forceps assistance. Use of this category facilitates comparison based on intended routes of delivery.
Primary cesarean delivery: A cesarean delivery in a woman without a prior history of cesarean.
Repeat cesarean delivery: A cesarean delivery in a woman with a prior history of cesarean delivery.
Scheduled cesarean delivery: A term used synonymously with planned cesarean delivery.
Unlabored cesarean delivery: A cesarean delivery performed before the onset of labor. This category may include planned and unplanned cesarean deliveries as well as emergency cesarean deliveries in the absence of labor.
Unplanned cesarean delivery: A cesarean delivery that occurs in a woman who planned a vaginal delivery but who required a cesarean delivery for either a maternal or neonatal indication that arose prior to or during labor. This category includes emergency cesareans whose indications became evident prior to or during labor.
Urgent cesarean delivery: A cesarean delivery in which surgery needed to be performed in a timely manner but not as an immediate emergency delivery.
Vaginal Delivery
Assisted vaginal delivery: A vaginal delivery that requires the use of forceps, vacuum, or both.
Planned vaginal delivery: A delivery resulting from a decision to pursue an intended vaginal delivery. This category includes spontaneous vaginal delivery, vacuum-assisted vaginal delivery, forceps-assisted vaginal delivery, and unplanned cesarean deliveries. Use of this category facilitates comparison based on intended routes of delivery.
Spontaneous vaginal delivery**:** A vaginal delivery that occurs without the assistance of forceps or vacuum. This category may include both spontaneous onset of labor and induced labor.

- refine the analytic framework and key questions at the beginning of the project;
- discuss the preliminary assessment of the literature, including inclusion/exclusion criteria; and
- provide input on the information and categories included in evidence tables.

Because of their extensive knowledge of the literature, which includes numerous articles authored by TEP members themselves, and their active involvement in professional societies and as practitioners in the field, we also asked TEP members to participate in the external peer review of the draft report. TEP proceedings included the panel chair of OMAR's SOS Conference.

Chapter 2. Methods

In this chapter, we document the procedures that the RTI International–University of North Carolina Evidence-based Practice Center (RTI–UNC EPC) used to develop this comprehensive evidence report on cesarean delivery on maternal request (CDMR). It will be used as the core background document for an upcoming State of the Science (SOS) conference sponsored by the Office of Medical Applications Research (OMAR) of the National Institutes of Health (NIH).

We first describe our strategy for identifying articles relevant to our four key questions, our inclusion/exclusion criteria, and the process we used to abstract relevant information from the eligible articles and generate our evidence tables. We also discuss our criteria for grading the quality of individual articles and the strength of the evidence as a whole. Finally, we explain the peer-review process.

Literature Review Methods

Inclusion and Exclusion Criteria

Our inclusion and exclusion criteria are documented in Table 3. As noted in Chapter 1, we limited our searches to articles published in or after 1990 because of the significant advances in operative techniques, anesthesia, availability of antibiotics, and neonatal care over the past several decades that have resulted in a decline in maternal and neonatal mortality.[1] We also restricted our searches to developed countries so that we could have comparable data on the standard of care. Based on recommendations from the Technical Expert Panel (TEP), we tracked citations from Brazil, which has long been documented to have high rates of cesarean deliveries;[29,30] however, no study from Brazil met our inclusion criteria.

Because our searches focused on the comparison of planned cesarean delivery to planned vaginal delivery, we recognized that we were unlikely to capture relevant studies on placental implantation abnormalities. On the advice of our TEP, our summary of this topic consists of an update of a recent systematic review on placenta previa.[31] Because of time and resource limitations, however, we could not address other placental implantation abnormalities such as accreta (abnormally firm attachment of the placenta to the uterine wall) and percreta (extension of the placenta through the entire wall of the uterus) that may also be associated with a history of cesarean deliveries.

Similarly, our search strategy focused on primary cesarean deliveries, excluding studies limited to repeat cesarean deliveries. For that reason, we could not capture studies that examined outcomes such as uterine rupture related to subsequent deliveries in women with prior cesarean deliveries. Again on the advice of our TEP, we address this important topic using information from an update of a recent review on vaginal birth after cesarean (VBAC).[32]

We excluded studies that (1) did not report on women of reproductive age; (2) were published in languages other than English (given the available time and resources); (3) did not report information pertinent to the key clinical questions; (4) had fewer than 50 subjects for randomized controlled trials (RCTs) or 100 subjects for observational studies; and (5) were not original studies. Additionally, and in consultation with the TEP, we excluded studies that did not

Table 3. Inclusion/exclusion criteria for cesarean delivery upon maternal request

Category	Criteria
Study population	Humans, females, all races, ethnicities, and cultural groups
Study settings and geography	Developed nations: United States, Canada, United Kingdom, Western Europe, Japan, Australia, New Zealand, Israel
Time period	1990-2005
Publication languages	English only
Sample size	Sample sizes must be appropriate for the study question addressed in the paper. RCTs: 50 or more participants Observational studies: 100 or more participants
Admissible evidence (study design and other criteria)	Original research studies that provide sufficient detail regarding methods and results to enable use and adjustment of the data and results Eligible study designs include RCTs: double-blinded and single-blinded; observational studies: prospective and retrospective cohort studies, case control studies, and cross-sectional; and meta-analyses. Ineligible study designs include single case reports or small case series. Patient populations must be of reproductive age or older. KQ 1 and KQ 2 All studies must include a comparison of planned cesarean deliveries with planned vaginal deliveries.

include data on both planned cesarean delivery and planned vaginal delivery for KQ 1 and KQ 2. As a consequence of this search strategy, we cannot address outcomes from vaginal delivery alone, without reference to a cesarean delivery comparison group. A review of the outcomes from vaginal delivery alone was beyond the scope and resources available. As a consequence of this limitation, we are not able to address modifiers of vaginal deliveries alone in KQ 3.

We also excluded studies that reported on an undefined group of cesarean deliveries; many of the maternal and neonatal indications that would have been included were so highly associated with significant morbidity as to preclude any meaningful extrapolation to CDMR.

Literature Search and Retrieval Process

Databases. We used multifaceted search strategies to include current and valid research on the key questions. We used standard electronic databases: MEDLINE®, Cochrane Collaboration resources, and Embase. We also hand-searched the reference lists of relevant articles to make sure that we did not missing any relevant studies. We consulted with the TEP about any studies or trials that are currently under way or that may not be published yet.

Search terms. Based on the inclusion/exclusion criteria above, we generated a list of Medical Subject Heading (MeSH) search terms (Appendix A).* Our TEP also reviewed these terms to ensure that we were not missing any critical areas, and this list represents our collective decisions as to the MeSH terms used for all searches. We needed to conduct several focused searches to capture a wide pool of relevant studies because the term "cesarean delivery on

* Appendixes and Evidence Tables for this report are provided electronically at http://www.ahrq.gov/downloads/pub/evidence/pdf/cesarean/cesarreq.pdf

maternal request" is not a standard indexing term (Table 4). The SOS Conference panel had set priorities for outcomes of interest, and those guided our selection of the specific outcomes for this review. Our initial searches did not capture key citations dealing with neonatal outcomes; based on the advice of the TEP, we conducted additional searches to capture relevant citations.

Table 4. Focused searches and unduplicated results

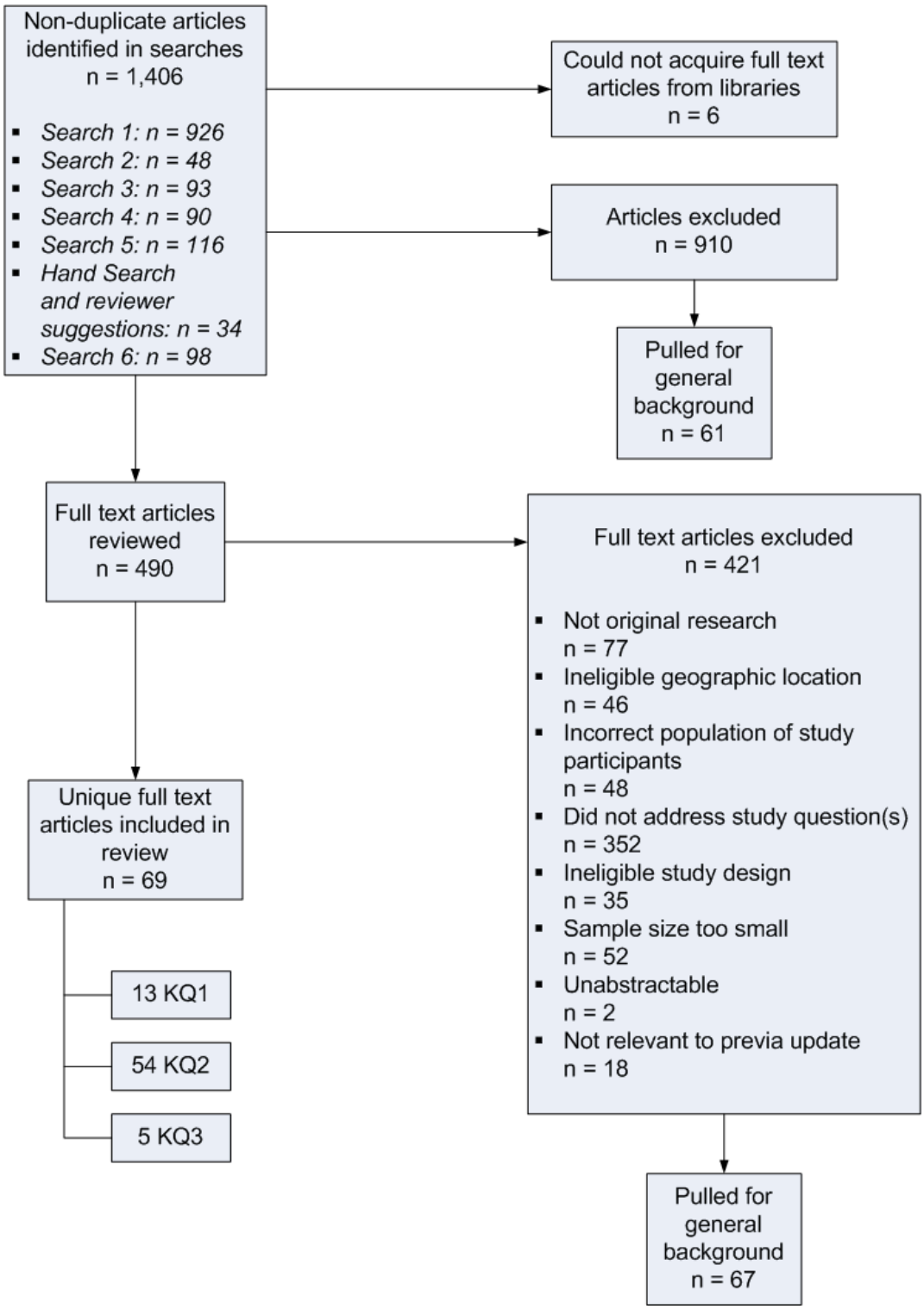
Focused Searches	Unduplicated Results
Initial search on elective cesarean delivery and similar terms in MEDLINE®, Cochrane Collaboration resources, and Embase	926
Additional search on neonatal outcomes limited to RCTs	48
Additional search on neonatal outcomes limited to observational studies	93
Additional search on adverse events in neonates	90
Additional searches on placenta previa	116
Additional search on update of Faiz and Ananth's review of placenta previa[31]	98
Handsearch	34
Total	1,406

Figure 3 presents the yield and results from our search, which we conducted from April through June 2005. Beginning with a yield of 1,402 articles, we retained 65 articles comprising 62 studies that we determined were relevant to address our key questions and met our inclusion/exclusion criteria (Figure 4). Peer reviewers suggested several additional citations, of which 4 articles comprised 3 new studies that did not duplicate ones we had already identified and excluded. We reviewed titles and abstracts of the remaining suggestions against the basic inclusion criteria above; we retained relevant articles, all published after our search cutoff date, and used them as appropriate in the discussion in Chapter 4.

Article selection process. Once we had identified articles through the electronic database searches, review articles, and bibliographies, we examined abstracts of articles to determine whether studies met our criteria. Two reviewers separately evaluated the abstracts for inclusion or exclusion, using an Abstract Review Form (see Appendix B). If one abstractor concluded that the article should be included in the review, we retained it. The group included four physicians—Anthony Visco, MD (Scientific Director); Katherine Hartmann, MD, PhD (Senior Advisor); Jennifer Wu, MD; and Gerald Gartlehner, MD, MPH (Study Coordinator). It also included one health services researcher—Meera Viswanathan, PhD (Study Director) and three epidemiologists—Michele Jonsson Funk, PhD, Rachel Palmieri, BS, and Shauna Hay, BS.

Four hundred and ninety articles required full review because of missing or uninformative abstracts. For the full article review, one reviewer read each article and decided whether it met our inclusion criteria, using a Full Text Inclusion/Exclusion Form (Appendix B). Articles excluded at the full-article review stage and reasons for their exclusion are listed in Appendix D.

Figure 4. Disposition of articles for cesarean on maternal request article disposition



Literature Synthesis

Development of Evidence Tables and Data Abstraction Process

The staff members who conducted this systematic review jointly developed the data abstraction tables (Appendix B[†]) and evidence tables (Appendix C). We designed the tables to provide sufficient information to enable readers to understand the studies and to determine their quality; we gave particular emphasis to essential information related to our key questions. The format of the evidence tables was based on successful designs used for prior systematic reviews.

We trained abstractors in entering data into the tables by having them abstract several articles and then reconvening as a group to discuss the utility of the table design. The abstractors repeated this process through several iterations until they decided that the tables included the appropriate categories for gathering the information contained in the articles.

All team members shared the task of initially entering information into the data abstraction forms. Another member of the team also reviewed the articles and edited all initial table entries for accuracy, completeness, and consistency. The two abstractors reconciled all disagreements concerning the information reported in the abstraction forms. The full research team met regularly during the article abstraction period and discussed global issues related to the data abstraction process.

We then entered the data from the abstraction forms into evidence tables and once again checked for consistency and accuracy.

The final evidence tables are presented in their entirety in Appendix C. Studies are presented in the evidence tables alphabetically with the last name of the first author. A list of abbreviations and acronyms used in the tables appears at the beginning of that appendix.

Quality and Strength of Evidence Evaluation

Rating the relevance of individual articles. The vast majority of studies reported results on actual route of delivery rather than planned route of delivery (intent to treat), which led to the limitations introduced in Chapter 1. Initial review of the literature demonstrated several ambiguous definitions that presented the authors of this review with several challenges. The use of the phrase "elective cesarean delivery" was particularly problematic because of its wide range of definitions. Some investigators used the term "elective" to refer to situations in which a vaginal delivery was contraindicated, such as with placenta previa. Others used it to describe situations in which vaginal delivery could have been attempted, such as with breech presentation, active herpes simplex virus, or repeat cesarean delivery. Still others used it but failed to define it further, precluding reviewers from understanding either the labor status or the indications for the cesarean.

We found it impossible to arrive at any meaningful summary of the literature without explicitly addressing the issues of how to characterize the groups in these studies and, thus, how to categorize the studies themselves. To address this ambiguity, we developed a four-tier classification system of relevance to CDMR based on the following criteria: (1) whether studies

[†] Appendixes cited in this report are provided electronically at http://www.ahrq.gov/downloads/pub/evidence/pdf/cesarean/cesarreq.pdf.

analyzed outcomes by planned route of delivery (trials of route of delivery); (2) whether CDMR was included as a comparison group (high relevance); (3) whether comparison groups comprised planned cesareans (moderate relevance), and (4) whether studies involved undefined "elective" or a mix of planned and unplanned, unlabored cesareans (low relevance).

Table 5 presents relevance ratings for all studies included in this review. The first three categories of relevance—high (H), moderate (M), and low (L)—are explained below.

Because we view the first criterion above as the ideal comparison, we assigned trials of routes of delivery,[‡] comparing prospectively assigned planned routes of delivery for breech presentation, a relevance rating of "T" to distinguish them from other studies that dealt with actual delivery routes. However, we note that trials of route of delivery for *breech* presentation are limited in their relevance to CDMR for primarily *vertex* (head first) presentation for four main reasons: (1) they cannot be included in a summary of neonatal outcomes because the confounding effect of breech presentation in the sample of women could negatively influence neonatal outcomes; (2) the extent to which cesarean for breech serves as an accurate surrogate for CDMR is unclear because of uncertainty as to whether the time period between presentation in labor and cesarean delivery for breech is similar to that for CDMR; (3) the risk that a cesarean would be performed in the planned vaginal breech delivery group is likely to be significantly higher than if the fetus were vertex; and (4) the inclusion of multiparous patients, including some with previous cesarean deliveries, results in significantly different risks and benefits than for the central focus of this review, namely, primary CDMR.

Table 5. Summary relevance rating

	Degree of Relevance to CDMR and Rating	Definition of Category	Number of Studies Included for		
			KQ 1	KQ 2*	KQ 3
H	High (H)	Cesarean delivery on maternal request	1[33]	0	0
M	Moderate (M)	Cesarean delivery planned for maternal and/or neonatal indications and can include both labored and unlabored	3[34-36]	16†[28,37-53]	4[48,53-55]
L	Low (L)	Unspecified "elective" cesarean delivery, can be a mix of planned and unplanned deliveries that are either unlabored or do not give clear indication of labor status	9[3,56-63]	19[64-82]	1[82]
	Trials of delivery for neonatal indications (T)	Intended mode of delivery (planned cesarean versus planned vaginal)	0	2†[18,20,83,84]	0

* Excludes studies from the placenta previa update † Includes multiple articles from a single study

Many studies included a combination of planned and unplanned, labored and unlabored cesarean births for maternal or neonatal indications in an "elective" cesarean group. Using our relevance classification scheme, we sorted this range of studies into groups of literature with high, moderate, and low relevance to CDMR. Studies with a cesarean delivery group performed solely on maternal request, without any maternal or neonatal indications, were considered the most highly relevant to the central question of this systematic review; we assigned them a

[‡] These studies of trial of routes of delivery assigned women to either planned vaginal delivery or planned cesarean delivery (often called "trials of labor"), but did not require a randomized design.

relevance rating of A. As expected, however, we found no such published studies for KQ 2 and KQ 3 and only one such study for KQ 1.

Studies in the moderately relevant category were all planned cesareans, but they included labored, unlabored, or a mix of labored and unlabored cesarean deliveries. Some studies included cesareans planned and performed, before labor, for maternal or neonatal indications (or both). Such studies may understate the risk of CDMR, because an accurate assessment of outcomes should include both labored and unlabored cesareans when comparison groups are separated by intent; that is, planned CDMR versus planned vaginal delivery. The group also included studies involving planned and performed cesareans for maternal and/or neonatal indications but with a mix of labored and unlabored deliveries. These may overestimate the risk of planned CDMR if the rate of labored cesareans in the study exceeds the rate of labor before scheduled delivery in a population considering CDMR.

Studies of low relevance did not define the "elective" cesarean delivery group, or they included a mix of planned and unplanned unlabored cesarean deliveries. The chief uncertainty concerns the degree to which the "elective" cesarean delivery group included emergency or labored cesareans. Emergency indications that would potentially be included in such a category include abruption, maternal trauma, and fetal distress; each could increase maternal or neonatal morbidity considerably.

Rating the quality of individual articles. We developed our approach to assessing the quality of individual articles (see Appendix B for Quality Rating Forms) based on the domains and elements for RCTs and nonrandomized observational studies recommended in the evidence report by West and colleagues, *Systems to Rate the Strength of Scientific Evidence.*[85]

We also elected to limit our quality ratings to studies with at least moderate relevance because low-relevance studies were generally designed for purposes other than addressing planned cesarean delivery.

The only study eligible to be rated with an RCT form was the International Term Breech Trial (hereafter Breech Trial).[18,20,83] Two of the criteria listed below (randomization approach, post-randomization exclusions) apply to the entire study; all others (masking, operational definitions and measures, loss to followup, and statistical analysis) apply to each article individually. We elected to rate each article in the Breech Trial individually because of significant variations in the article-specific criteria.

1. *Randomization approach and implementation*: This item judged whether the approach described a valid method of randomization, whether allocation concealment was achieved, and whether balance was documented across study groups.

Approach: If the study assigned the groups in a manner inconsistent with true randomization methods, it had the potential to automatically receive a poor rating for this category and overall. If the study had merely stated that if "randomly assigned" the groups and either had no balance or did not report on balance, it would have received a poor rating. A study with no documentation of concealment or with inadequate concealment methods would have been rated poor if the study had poor balance of allocation or if balance was not documented. A study with potentially poor concealment would have been rated fair if they documented good balance.

2. *Post-randomization exclusions*: This item captured how many post-randomization exclusions were explicitly stated.

Approach: In typical randomized trials, intention-to-treat analysis is expected. Any exclusions after randomization would have been considered inappropriate and would have led to a rating of poor.

3. *Masking*: This item was relevant only to outcome assessors.

Approach: If the outcome assessors were adequately masked within the possibilities of the study design, we rated the category as good. If there was a mix of masking among the outcomes, we rated the category as fair. If masking was not done at all and not attempted, we rated the category as poor.

4. *Operational definitions and measurements:* This item judged the quality of the operational definitions of the outcomes (i.e., were they adequately described) and whether they were adequately collected (i.e., was the method sufficient and appropriate).

Approach: We rated this category on the basis of an average across all outcomes for each timepoint and the ability to define and measure them. Good definitions and measurement include the following: validated questionnaires, detailed time points in question, details about what was asked of the patient, medical chart abstractions, and clinical examination or assessment. Failure to use such methods resulted in a rating in the fair-to-poor range, depending on how the article collected the information.

5. *Loss to followup*: This item collected percentages of followup at every time point in the study at which data were collected; we used it to determine if followup was adequate.

Approach: In general, we considered followup greater than or equal to 90 percent in the short term and 80 percent in the long term to be good.

6. *Statistical analysis*: This factor included whether the investigators conducted the study in an appropriate manner and took the effect of multiple comparisons into account. This item also reviewed the study's use of multivariate statistical techniques and/or participant restriction or stratification to control for confounding.

Approach: We rated this category on the basis of an average across all outcomes for each time point. Articles that reported appropriate statistical tests, point estimates, tests for homogeneity, stratification, and confidence intervals were rated as good. Articles that reported *P*-values alone were rated as fair, and articles that did not report statistical analysis were rated as poor.

Two article abstractors independently rated each article on each of the categories as indicated by the quality assessment form. We reconciled differences by consensus, giving each item equal weight. Specifically, articles that received good ratings on all categories would have been

eligible to be rated as good studies overall. None of the three articles received a good rating. If an article received one or two fair or poor ratings, or the equivalent of a deficiency, it was rated as an overall fair-quality article. The original article from the Term Breech Trial, published in 2000, received a quality rating of fair.[20] Articles with three or more fair ratings or a poor randomization design or implementation with a fatal flaw were rated as a poor-quality article. The two follow-up articles from the Breech Trial, published in 2002[18] and 2004[83] respectively, received a quality rating of poor.

We used the following criteria to rate the quality of nonrandomized observational studies:

1. *Study design:* Given the difficulties of identifying planned cesarean delivery retrospectively, we assigned prospective studies a higher score.

   Approach: To receive a rating of fair for this component of study design, we required a study to be prospective.

2. *Study population:* We sought documentation in the publication of the degree to which the study population was representative of women with uncomplicated spontaneous vaginal births in the study facilities or the broader population sampled.

   Approach: To receive a rating of good for this component of study design and conduct, we required a study to describe clearly (1) the base population from which cohort participants were sought, (2) the number of women in that base population (a denominator), and (3) the proportion of eligible women who were ultimately enrolled in the cohort.

   Studies with all three items were rated as good; studies lacking one item were classified as fair; and studies lacking more than one item were rated as poor.

3. *Comparability of subjects.* For cohort studies, we sought five tiers of documentation showing that the study had (1) specific inclusion/exclusion criteria for all groups, (2) applied criteria equally to all groups, (3) comparable study groups at baseline with reference to variables not unique to mode of delivery, (4) study groups comparable to nonparticipants with regard to confounding factors, and (5) study groups comparable with regard to followup.

   In addition, for case-control studies, we sought documentation on whether the study had (1) explicit case definition, (2) case ascertainment not influenced by exposure status, and (3) controls similar to cases except that they did not have the condition of interest and did have an equal opportunity for exposure.

   Approach: We rated a cohort study as having good comparability of subjects if at least four of five elements were present. We rated studies as having fair comparability if two or three elements were present. Studies with fewer than two elements were rated as poor. We required case-control studies to have all three elements of the case-control rating to rate a good for the overall category. We rated case-control studies that were missing one

element for the case-control rating as fair and those missing two or more elements rated as poor.

4. *Statistical analysis:* We sought documentation on whether the study reported on the following aspects of statistical analysis: (1) appropriate statistical tests; (2) modeling and multivariate techniques or multiple comparisons; (3) power calculations and achieved sample size; (4) assessment of confounding by bivariate analysis, stratified analysis, or multivariable modeling; (5) reporting of adjusted estimates for main effects that took into account identified confounding or modifying factors (stratified or separate analyses were acceptable for simple constructs); and (6) presentation of adjusted results with a measure of statistical precision such as a confidence interval or *P*-value.

   Approach: We assigned a rating of good for the category of statistical analysis if studies provided at least five of the six elements above. We assigned a rating of fair if studies reported on three or four elements and a rating of poor if studies reported on fewer than three elements.

5. *Result and loss to followup:* For all studies, we sought documentation on whether the study reported a measure of effect for outcomes and provided an appropriate measure of precision. In addition, for panel studies, we sought documentation of two follow-up measures: (1) analysis of how respondents differed from nonrespondents if loss exceeded 20 percent, and (2) if absolute loss to followup exceeded 25 percent.

   Approach: For studies with cross-sectional measures, we assigned a rating of fair if the study reported a measure of effect with an appropriate measure of precision. Studies without a measure of effect were rated poor. Panel studies needed to have an absolute loss to followup at or below 25 percent. If the differential loss to followup from panel studies exceeded 20 percent, the investigators needed to report on bias from followup to receive a good rating. We rated a study as poor for this component if it had more than 25 percent loss to followup or more than 20 percent loss without comparison for response bias.

For categories 1 and 5 above, studies could receive a maximum rating of fair. For categories 2, 3, and 4, studies could receive a maximum rating of good. We summarized the ratings across all five categories to assign an overall rating as follows:

- good, if the study received a fair on both categories with a maximum of fair rating and good on all three categories with a maximum rating of good;
- fair, if the study received three to five fair scores with fewer than two good scores; or
- poor, if the study received two or fewer fair or good scores.

Grading the strength of available evidence. Our scheme follows the criteria applied by West et al.[85] That system included three domains: quality of the research, quantity of studies (including number of studies and adequacy of the sample size), and consistency of findings. Two senior staff members assigned grades by consensus.

We graded the body of literature and present our findings in Chapter 4. The possible grades in our scheme are as follows:

I. Strong: The evidence is from studies of strong design; results are both clinically important and consistent with minor exceptions at most; results are free from serious doubts about generalizability, bias, or flaws in research design. Studies with negative results have sufficiently large samples to have adequate statistical power.
II. Moderate: The evidence is from studies of strong design, but some uncertainty remains because of inconsistencies or concern about generalizability, bias, research design flaws, or adequate sample size. Alternatively, the evidence is consistent but derives from studies of weaker design.
III. Weak: The evidence is from a limited number of studies of weaker design. Studies with strong design either have not been done or are inconclusive.
IV. No evidence: No published literature.

External Peer Review

As is customary for all evidence reports and systematic reviews done for the Agency for Healthcare Research and Quality (AHRQ), the RTI-UNC EPC requested review of this report from a wide array of individual outside experts in the field, including our TEP, and from relevant professional societies and public organizations. AHRQ also requested review from its own staff and appropriate federal agencies. We initially asked 33 individuals or organizations about their interest and availability for peer review. Ultimately, we sent 18 invitations for peer review: to 5 TEP members, 6 relevant organizations, and 7 individual experts. Reviewers included clinicians (e.g., obstetrics, urogynecology, family practice, pediatrics), representatives of professional societies and advocacy groups, and potential users of the report.

We charged peer reviewers with commenting on the content, structure, and format of the evidence report, providing additional relevant citations, and pointing out issues related to how we had conceptualized and defined the topic and key questions. We also asked them to complete a peer review checklist. We received 15 responses in addition to comments from AHRQ staff. The individuals listed in Appendix E gave us permission to acknowledge their review of the draft. We compiled all comments and addressed each one individually, revising the text as appropriate.

Chapter 3. Results

This chapter presents the results of our evidence review for the first three key questions (KQs): (KQ 1) trend and incidence data; (KQ 2) outcomes of cesarean delivery on maternal request (CDMR), proxies for CDMR, and various comparison routes of delivery; and (KQ 3) modifiers of outcomes. These KQs are the principal focus of a March 2006 State of the Science (SOS) conference being convened by the Office of Medical Applications of Research (OMAR) at the National Institutes of Health (NIH). KQ 4, on future research, is covered in Chapter 4 of this report. Appendix C* provides the detailed evidence tables for KQ 2.

As explained in Chapters 1 and 2, we rated studies for their relevance to the comparisons of interest for the SOS conference, using four categories. Three categories related mainly to observational studies: high (H), moderate (M), and low (L) relevance; none of these compared outcomes prospectively by planned route of delivery for both cesarean and vaginal delivery. The fourth category comprised two studies comparing outcomes from prospectively assigned planned routes of delivery: a nonrandomized study of a "trial of labor" (assigned by department) and the other a randomized trial, known as the International Term Breech Trial (Breech Trial); they are both denoted by T; both studies used intent-to-treat analyses.

With one exception for KQ 1, no included studies were rated highly relevant. Of the remainder, most are of only low relevance because they were designed to address hypotheses or clinical issues other than the ones of interest for this systematic review.

We have already noted the extreme profusion of terms in this field and the fact that clinicians, investigators, and others do not apply them consistently across this evidence base. Moreover, the terms and phrases do not map consistently (or necessarily accurately) to the conceptual framework and definitions that we articulated for this systematic review. For that reason, in reporting on studies in this chapter we have put quotation marks around certain terms or phrases to indicate that they represent the usage of the authors of those studies, not necessarily our usage.

Key Question 1: Trends and Incidence of Cesarean Delivery

The SOS planning group specified that the first issue we should address involved the following points concerning the epidemiology of cesarean delivery in general and CDMR (or possible proxies) in particular. They posed the questions as follows:

First, what is the trend and incidence of cesarean delivery over time in the United States and in other developed countries?

Secondarily:

a. What is the contribution of primary prelabor cesarean deliveries?
b. Of the primary prelabor cesarean deliveries, what is the contribution of cesarean delivery on maternal request (i.e., CDMR), for medical indications, and for malpresentation?

We answer these questions on the basis of both published articles and web-based sources (a form of gray literature). However, we report incidence data before trend data, because the former

* Appendixes and Evidence Tables for this report are provided electronically at http://www.ahrq.gov/downloads/pub/evidence/pdf/cesarean/cesarreq.pdf

are a part of the latter. Because of the focus on the United States and then other developed countries, our main approach in this section is by country.

Literature Relevant to the Epidemiologic Questions

Overall, we identified 13 published studies reporting the incidence and trends of modes of cesarean section. Of the 13 articles, we gave 1 study a relevance rating of high,[33] 3 studies a rating of moderate,[34-36] and 9 studies a rating of low.[3,56-63] We also found web-based sources for four regions: United Kingdom[86] and three states in Australia (Victoria,[87-89] South Australia,[90] and New South Wales[91]). All of the Web-based sources were moderately relevant to CDMR. Two published studies were conducted in the United States,[3,56] 3 in the United Kingdom,[33,60,61] 3 in Australia,[34,57,58] 2 in the Republic of Ireland,[35,59] and 1 each in Norway,[36] Finland,[62] and Denmark.[63] We also found web-based sources reporting rates of "elective" cesarean delivery for the United Kingdom[86] and three states in Australia (Victoria,[87-89,92] South Australia,[90] and New South Wales[91]).

Four articles supplied trend data from the United States[3] and Australia.[34,57,58] Three of the four web-based sources provided trend data.[86,87,91] With the exception of two published studies that obtained data from surveys usually sent to medical directors,[59,61] all other studies gathered data from administrative databases or materials (e.g., birth certificates). Except for one study,[33] all were conducted retrospectively.

Overall Estimates of Incidence and Trends

Rates of incidence and trends of cesarean delivery vary by country. In general, countries report rising trends of cesarean delivery, with recent incidence rates at 29 percent for the United States[2] and 23 percent for the United Kingdom.[86] In the following section, we present data on incidence and trends of cesarean delivery by country. We also present rates of primary prelabor cesarean, CDMR, cesarean for medical indications, and for malpresentation, when available; studies rarely provided sufficient information to answer this key question. Four studies report on primary prelabor cesarean,[3,34,35,56] and one study reports on CDMR.[33] Other studies use variable definitions of "elective" or "planned" cesarean delivery, denoted in quotes in the text. We present summary tables for each country, with each study listed in alphabetical order by last name of first author.

Country-Specific Incidence and Trend Data

United States. *Incidence.* In 2001, the rate of cesarean delivery was more than 25 percent.[3] Studies from two sources suggest similar primary prelabor "elective" cesarean rates: 4.25 percent[56] and approximately 5 percent[3] of all deliveries in 1995. The definition of elective primary cesarean delivery in both studies includes malpresentation, antepartum bleeding, herpes, severe hypertension, uterine scar, multiple gestation, macrosomia, unengaged head, soft tissue condition, other hypertension, preterm, fetal anomaly, and unspecified, resulting in a definition of "elective" cesarean delivery that has low relevance to CDMR (Table 6).

Table 6. United States, incidence and trend data

Source Groups Relevance Rating	Study Objective Source Time period	Definitions and Inclusion-Exclusion Criteria	Incidence and Trend Data
Gregory et al., 2001[56] Groups G1: total cesareans G1a: primary prelabor elective Low	Objective: to describe variation in elective primary cesarean rates by nonclinical factors Retrospective Discharge data and American Hospital Association data 1/1/1995–12/31/1995	Primary prelabor elective: first cesarean delivery, patient did not labor and underwent cesarean delivery with respect to the following 13 categories: malpresentation, antepartum bleeding, herpes, severe hypertension, uterine scar, multiple gestation, macrosomia, unengaged head, soft tissue condition, other hypertension, preterm, fetal anomaly, and unspecified. Emergency: decision made after labor Excluded: Hospitals with < 200 deliveries, women with history of cesarean	Incidence: G1: 463,196 G1a: 19,664 (4.25% of total deliveries) Trend: NR
Meikle et al., 2005[3] Groups G1: primary prelabor elective Low	Objective: to describe national trends for elective primary cesarean delivery from 1994 to 2001, with attention to changes in indications Retrospective NIS database 1994–2001	Primary prelabor elective: first cesarean delivery: a procedure that occurred before labor and without a previous history of cesarean delivery. Used 13 indications for elective cesarean previously reported in Gregory et al. above [56] Excluded: women who labored and previous cesarean deliveries	Incidence: See below for 2001 Trend: G1: Primary prelabor elective cesarean deliveries (% of all deliveries) 1994: 16,036 (19.7%) 2001: 281,698 (28.3%)

Trends. Meikle et al. reported a rise in the primary elective cesarean deliveries as a proportion of all deliveries from approximately 5 percent in 1994 to approximately 7 percent in 2001.[3] The authors also reported a rise in elective primary cesarean deliveries as a proportion of all cesarean deliveries from 19.7 percent in 1994 to 28.3 percent in 2001.

United Kingdom. *Incidence.* One study from Scotland offers the only evidence of high relevance to CDMR that we identified.[33] From a prospective administrative dataset for 1994, the authors reported total cesarean deliveries (including multiple and unknown gestation) of 16 percent. The authors also reported a CDMR rate of 7.7 percent and an "elective" cesarean delivery rate for breech presentation of 19.1 percent of all singleton cesarean deliveries (Table 7). Two other studies from the United Kingdom did not define "elective" section, resulting in

Table 7. United Kingdom, incidence and trend data

Source Groups State Relevance Rating	Study Objective Source Time period	Definitions and Inclusion-Exclusion Criteria	Incidence and Trend Data
Barley et al., 2004[60] Groups G1: total cesarean deliveries G1a: elective cesarean Low	Objective: To examine cesarean rates and socioeconomic status Retrospective National Health Service (NHS) episode statistics database 1/1/2001-12/31/2002	Elective: not defined	Incidence: Total NHS births: 336,324 G1: N not reported (20.1%) G1a: N not reported (8.9%) Trend: NR
Government Statistical Service[86] Groups G1: total cesarean deliveries G1a: emergency cesareans G1b: elective cesareans England Moderate	Objective: NA Surveillance data from the Hospital Episode Statistics system, accessed via the web	Elective: planned procedure before, or at the onset of, labor (carried out immediately following the onset of labor, when the decision was made before labor) Emergency: Not defined	Incidence: See below for 2003–4 Trend: Total Deliveries / % of all deliveries: G1 / G1a / G1b 1990-1: 652,100 / 12.4 / 7.1 / 5.3 1991-2: 643,800 / 12.9 / 7.4 / 5.5 1992-3: 624,600 / 13.8 / 8.1 / 5.6 1993-4: 620,200 / 15.0 / 8.9 / 6.1 1994-5: 604,300 / 15.5 / 9.0 / 6.5 1995-6: 592,600 / 16.3 / 9.5 / 6.9 1996-7: 594,500 / 17.0 / 9.7 / 7.3 1997-8: 585,000 / 18.2 / 10.4 / 7.9 1998-9: 577,500 / 19.1 / 11.1 / 8.0 1999-0: 565,300 / 20.6 / 12.0 / 8.6 2000-1: 549,600 / 21.5 / 12.7 / 8.8 2001-2: 541,700 / 22.0 / 12.7 / 9.3 2002-3: 548,000 / 22.0 / 12.7 / 9.3 2003-4: 575,900 / 22.7 / 13.1 / 9.6
Khor et al., 2000[61] Groups G1: total cesarean deliveries G1a: elective cesareans G1b: emergency cesareans Low	Objective: To assess the national obstetric anaesthetic practices in relation to cesarean sections. Retrospective Royal College of Obstetrics and Gynecology annual surveys 1/1/1997-3/31/1998	Elective: not defined Emergency: not defined	Incidence: Total deliveries: 608,853 G1: 111,919 G1a: 39,308 (40.5% of G1) G1b: 57,797 (59.5% of G1) Note: G1a+G1b do not sum to G1 due to incomplete returns Trend: NR

Para, parity.

Table 7. United Kingdom, incidence and trend data (continued)

Source Groups State Relevance Rating	Study Objective Source Time period	Definitions and Inclusion-Exclusion Criteria	Incidence and Trend Data
Wilkinson et al., 1998[33] Groups G1: total deliveries G1a: para 0 G1b: para 1, no prior cesarean delivery G1c: para 1, with prior cesarean delivery Scotland High	Objective: to determine the indications for singleton cesarean sections in Scotland in 1994 Prospective Administrative database 1/1/1994-12/31/1994	Elective: decision made before labor and primarily for breech presentation Emergency before labor: performed for suspected growth retardation and/or fetal distress Emergency during labor: performed for failure to progress and/or fetal distress Included: singleton pregnancy	Incidence: All cesarean deliveries 8,098 Elective cesareans G1: 3,150 G1a: 884 G1b: 571 G1c: 1,695 Maternal request (subset of elective): 623 (7.7%) of all 8,098 singleton cesarean deliveries 623 (19.1%) of all 3,150 elective singleton cesarean deliveries Emergency pre-labor: G1: 1,127 G1a: 592 G1b: 293 G1c: 242 Emergency in labor: G1: 3,821 G1a: 2,616 G1b: 617 G1c: 588 Overall total (data available, singleton): G1: 8,098 G1a: 4,092 G1b: 1,481 G1c: 2,525 Trend: NR

low relevance to CDMR. These studies used different sources. One study, using data from the Royal College of Obstetrics and Gynecology annual surveys, reported a total cesarean rate of 18.5 percent and an "elective" cesarean rate of 9.5 percent of all births from January 1997 to March 1998.[61] The other study, using data from the National Health Service (NHS) episode statistics database, reported a total cesarean rate of 20.1 percent and an "elective" cesarean rate of 8.9 percent of all births for 2001–2002.[60]

Trend. Web-based National Health Service data provide evidence that is moderately relevant to CDMR. They report trends for "emergency" and "elective" (defined as planned procedure before, or at the onset of labor) cesarean deliveries as a proportion of all births from 1990 to 2003–4.[86] During this period, the rate of all cesareans rose from 12 percent to 23 percent. Both elective and emergency cesareans contributed to this rise. Relative to all births, the rate of elective cesarean deliveries rose from 5.3 percent in 1990 to 9.6 percent in 2003, and the rate of emergency cesarean deliveries rose from 7.1 percent in 1990 to 13.1 percent in 2003.

Ireland. *Incidence.* Two studies using different sources reported data on Ireland for elective cesarean deliveries. One study, rated moderately relevant, provided incidence data from the National Maternity Hospital database annual report on the rate of all cesarean deliveries and "nonemergency prelabor" cesarean deliveries in 2000 as 15.1 percent. Over a 12-year period from 1989–2000, the authors reported a nonemergency prelabor cesarean delivery rate of 3 percent of all deliveries and 30 percent of all cesarean deliveries (Table 8).[35] Of these nonemergency prelabor cesarean deliveries, 24 percent were among primaparous women, 39 percent were primary cesarean deliveries among primiparous women, and 37 percent were among repeat cesarean deliveries. We calculated the total primary prelabor nonemergency cesarean rate to be 18.9 percent of cesarean deliveries during the 12-year period from 1989-2000. Farah et al. reported elective and emergency cesarean rates of 7.5 percent and 10.3 percent of all births, respectively, based on a retrospective survey of maternity unit directors.[59] The authors did not define "elective"; as a result, their study has low relevance to CDMR.

Australia. *Incidence.* The majority of studies, from both published and web-based sources, defined "elective" cesarean deliveries as a procedure planned before the onset of labor (Table 9).[34,87-92] Two other articles either did not define "elective" cesarean or defined it as cesarean before and during labor, and hence did not exclude cesareans for fetal distress or other emergencies.[57,58]

The most recent figures from these studies indicate rates of all cesarean and elective cesarean delivery of 23.5 percent and 13 percent, respectively, in New South Wales in 2001;[91] 27.4 percent and 14.1 percent, respectively, in Victoria in 2002;[87]and 30 percent and 13.3 percent, respectively, in South Australia in 2003.[90]

Trend. Trend data was reported on New South Wales,[57,58,91] Victoria,[87-89,92] and Western Australia.[34] Studies from the New South Wales database reported nearly constant rates of "elective" cesarean delivery or "cesarean before labor" over a period from 1990 to 1996[57]–1997.[58] Web-based data for New South Wales from 1996 to 2001 showed a rise in the rate of all cesareans from 17.6 percent to 23.5.[91] During this period, the rate of "elective" cesareans rose from 9.4 percent to 13.0 percent and the rate of "emergency" cesareans rose from 8.2 percent to 10.5 percent.[91]

Table 8. Ireland, incidence and trend data

Source Groups Relevance Rating	Study Objective Source Time period	Definitions and Inclusion-Exclusion Criteria	Incidence and Trend Data
Farah et al., 2003[59] Groups: G1: total cesarean deliveries G1a: elective G1b: emergency Low	Objective: To ascertain the national cesarean delivery rate for the year 1998 Retrospective Survey (maternity unit directors) 1/1/1998–12/31/1998	Labored status and indication not reported	Incidence Total deliveries: 51,133 N (% of total deliveries) G1: 9,077 (17.8%) G1a: N not reported (7.5%) G1b: N not reported (10.3%) Trend: NR
Foley et al., 2005[35] Groups: G1: total deliveries G1a: nulliparous deliveries G1b: multiparous deliveries Moderate	Objective: to study the relationship between an increasing cesarean delivery rate and term neonatal seizures and peripartum deaths Retrospective National Maternity Hospital database annual report 1/1/1989–12/31/2000	Nonemergency prelabor cesarean delivery	Incidence of cesarean deliveries in 2000: 15.1% (N not reported) Incidence over 12 years (1989-2000): G1: 77,350 G1a: 31,660 G1b: 45,690 All nonemergency prelabor cesarean deliveries: 2547 (3% of all deliveries, 30% of all cesareans) Primary prelabor cesarean deliveries G1a: 611 (24% of all nonemergency prelabor cesarean deliveries) Primary prelabor cesarean deiveries G1b: 1,002 (39% of all nonemergency prelabor cesarean deliveries) Repeat nonemergency prelabor cesarean delivery G1b: 934 (37% of all nonemergency prelabor cesarean deliveries)

Table 9. Australia, incidence and trend data

Source Groups State Relevance Rating	Study Objective Source Time period	Definitions and Inclusion-Exclusion Criteria	Incidence and Trend Data
Chan et al., 2005[90] Groups G1: elective cesareans G2: emergency cesareans South Australia Moderate	Objective: NA Data from the South Australian perinatal data collection of births, accessed via the web	Elective: planned procedure before the spontaneous onset of labor Emergency: undertaken for a complication: (a) before the onset of labor or (b) during labor, whether that labor is of spontaneous onset or following induction of labor	Incidence Total deliveries in 2003: 17,517 N (% of total deliveries): G1: 2,334 (13.3%) G2: 2,929 (16.7%)
Centre for Epidemiology Research, 2002[91] Groups G1: emergency cesareans G2: elective cesareans New South Wales Moderate	Objective: NA Data from the New South Wales Mothers and Babies 2001 report, accessed via the web	Elective: planned or unplanned cesarean delivery performed before the onset of labor Emergency: performed after the onset of labor whether or not the onset of labor was spontaneous	Incidence: See below for 2001 Trend: Total Deliveries / % of all deliveries G1 / G2 1996: 85,302 — 8.2 — 9.4 1997: 86,920 — 8.3 — 9.9 1998: 85,072 — 8.7 — 10.3 1999: 85,967 — 9.0 — 10.6 2000: 86,460 — 9.9 — 11.5 2001: 84,379 — 10.5 — 13.0

Table 9. Australia, incidence and trend data (continued)

Source Groups State Relevance Rating	Study Objective Source Time period	Definitions and Inclusion-Exclusion Criteria	Incidence and Trend Data
Read et al., 1990[34] Groups G1: total cesarean deliveries G1a: emergency cesarean deliveries G1b: elective cesarean deliveries Australia Moderate	Objective: to describe trends and patterns in the incidence of cesarean deliveries in Western Australia Retrospective Administrative database 1980-1987	Elective: a planned procedure done before the onset of labor and before spontaneous rupture of the membranes and without any procedure to produce labor Emergency: undertaken at short notice for a complication before the onset of labor or during labor whether of spontaneous origin or induced Excluded: infants < 500g	Incidence See below for 1987 Trend:

	Prelabor primary elective*	Total deliveries (parity known, singleton)*	Percent prelabor primary*
1980	766	18,501	4.1%
1981	834	21,719	3.8%
1982	836	21,876	3.8%
1983	853	22,551	3.8%
1984	828	22,418	3.7%
1985	999	22,749	4.4%
1986	1,058	23,290	4.5%
1987	1,139	23,538	4.8%

*: calculated by authors of this report

Year	Total Deliveries (all parity, multiple gestations)	% of all deliveries G1	G1a	G1b
1980	20,520	11.23	5.89	5.35
1981	21,954	11.79	6.09	5.70
1982	22,110	12.54	6.18	6.35
1983	22,785	13.28	6.75	6.53
1984	22,663	13.86	6.98	6.88
1985	23,015	15.17	7.33	7.84
1986	23,561	16.64	7.79	7.86
1987	23,836	16.90	8.25	8.65

Table 9. Australia, incidence and trend data (continued)

Source Groups State Relevance Rating	Study Objective Source Time period	Definitions and Inclusion-Exclusion Criteria	Incidence and Trend Data
Riley and King, 2003;[87] Riley and Halliday, 2001;[92] Riley and Halliday, 1999;[88] and Riley and Halliday, 1998[89] Groups G1: cesarean deliveries G1a: emergency cesareans G1b: elective cesareans Victoria Moderate	Objective: NA Data from the Victorian Perinatal Data Collection Unit, accessed via the web	Elective: planned procedure that takes place before or after the spontaneous onset of labor Emergency: undertaken for a complication before or after the onset of labor	Incidence: See below for 2000 Trend: Total Deliveries / % of all deliveries (G1, G1a, G1b) 1992: 63,795 — 17.7, 8.0, 9.7 1993: 63,795 — 18.1, 7.9, 10.2 1994: 63,983 — 18.7, 8.3, 10.4 1995: 62,372 — 19.1, 8.1, 11.0 1996: 62,028 — 19.7, 8.4, 11.3 1997: 61,311 — 20.2, 8.5, 11.7 1998: 61,072 — 21.0, 8.9, 12.1 1999: 61,587 — 22.8, 11.3, 11.5 2000: 61,569 — 23.4, 11.5, 11.9 2001: 61,064 — 25.3, 12.3, 13.0 2002: 61,959 — 27.4, 13.3, 14.1
Roberts, et al., 1999[57] Groups G1: elective cesarean deliveries New South Wales Low	Objective: to examine trends in the distribution of births at and beyond term in New South Wales and in particular, to determine whether any changes are associated with changes in the obstetric practices of induction and elective cesarean deliveries Retrospective New South Wales Midwives database 1/1/1990–12/31/1996	Elective: no labor	Incidence: See below for 1996 Trend: Year / N (G1) / % 1990: 5,006 — 6.5 1996: 5,031 — 6.6

Table 9. Australia, incidence and trend data (continued)

Source Groups State Relevance Rating	Study Objective Source Time period	Definitions and Inclusion-Exclusion Criteria	Incidence and Trend Data
Roberts et al., 2002[58] Groups G1: total cesarean deliveries G1a: cesarean deliveries during labor G1b: cesarean deliveries before labor New South Wales Low	Objective: to examine recent trends in obstetric intervention rates among women at low-risk of poor pregnancy outcome Retrospective New South Wales Midwives database 1/1/1990–12/31/1997	Cesarean before labor Cesarean after labor Included: women with low risk pregnancy during antenatal care (20 to 34 years of age with no medical or obstetric complications and a singleton cephalic-presenting infant of normal size; 10th-90th birthweight percentile, born at term; 37 to 41 weeks gestation)	Incidence Primiparous: G1: 15,974 G1a: N not reported (9.8% of all births) G1b: N not reported (2.5% of all births) Multiparous: G1: 25,652 G1a: N not reported (3.1% of all births) G1b: N not reported (8.4% of all births)

Trend: Before Labor

	Primiparous		Multiparous	
Year	N	%	N	%
1990	15,274	2.2	25,043	8.1
1991	15,617	2.1	26,698	8.2
1992	16,193	1.9	27,493	7.5
1993	15,886	2.1	26,515	7.9
1994	15,959	2.3	26,745	8.0
1995	15,825	2.1	26,202	8.0
1996	15,726	2.0	25,387	8.2
1997	15,974	2.5	25,652	8.4

Data from Victoria showed a rise in the rate of cesarean deliveries in a 10-year period from 1992 to 2002 from 17.7 percent to 27.4 percent in 2002.[87-89,92] During this period, the rate of "elective" cesarean delivery rose from 9.7 percent of all deliveries to 14.1 percent and the rate of "emergency" cesarean deliveries rose from 8 percent to 13.3 percent.

One study from Western Australia reported on an earlier time period from 1980 to 1987. The study reported a cesarean delivery rate in 1980 of 11.2 percent; by 1987 it had risen to 16.9 percent.[34] The rate of "emergency" cesareans rose during this period from 5.8 percent to 8.3 percent; the elective cesarean rate increased from 5.4 percent to 8.7 percent.

The only study reporting rates of primary prelabor cesarean delivery used data from an administrative database from 1980 to 1987 in Western Australia. Using data provided in the publication, we calculated that primary prelabor cesarean deliveries rose from 4.1 percent of all deliveries in 1980 to 4.8 percent in 1987.[34] More recent data from another study indicate a rate of cesarean before labor of 2.5 percent for primiparous women in 1997 in New South Wales. The authors do not report primary prelabor cesarean rates for multiparous women.

Norway. *Incidence.* One study of moderate relevance to CDMR reported the rate of "elective" cesarean performed for feto-pelvic disproportion, breech, diabetes, hypertension, pre-eclampsia, twins, and low birthweight as 4.5 percent over a 10-year period (January 1986 to December 1995).[36] The rate of all cesarean deliveries during this period was 12.5 percent (Table 10).

Table 10. Norway, incidence and trend data

Source Groups Relevance Rating	Study Objective Source Time period	Definitions and Inclusion-Exclusion Criteria	Incidence and Trend Data
Vangen et. al., 2000[36] Groups G1: total cesarean delivery G1a: elective cesarean delivery Moderate	Objective: to study the prevalences and risk factors for cesarean section among different groups of immigrants in comparison to ethnic Norwegians Retrospective medical birth registry and statistics 1/1/1986–12/31/1995	Elective: performed for the following reasons: feto-pelvic disproportion, breech, diabetes, hypertension, preeclampsia, twins and low birthweight, and unknown Emergent: performed for the following reasons: feto-pelvic disproportion, prolonged labor, fetal distress, breech, diabetes, hypertension, pre-eclampsia, twins and low birthweight. and unknown	Incidence Total births: 553,491 N (% of total deliveries) G1: 69,249 (12.5%) G1a: N not reported (4.5%) Trend NR

Denmark. *Incidence.* The single Danish study reported a total cesarean rate of 11.9 percent and an "unplanned" cesarean rate of 7.7 percent of all deliveries in 1989 (Table 11).[63] The authors did not comment on planned cesareans, resulting in low relevance to CDMR; we infer that the remainder, that is, 4.2 percent, were planned cesareans.

Table 11. Denmark, incidence and trend data

Source Groups Relevance Rating	Study Objective Source Time period	Definitions and Inclusion-Exclusion Criteria	Incidence and Trend Data
Lidegaard, et al, 1994[63] Groups G1: all cesarean deliveries G1a: unplanned cesarean deliveries Low	Objective: to correlate the use of birth-related technologies, the perinatal mortality, and the cesarean delivery rates in Denmark Retrospective survey of maternity ward directors 1/1/1989–12/31/1989	Labored status and indication not reported Publication uses term "unplanned" cesareans Included: births and cesareans after 35 completed weeks of gestation	Incidence Total births: 179,572 G1: 11.9% of all deliveries G1a: 7.7% of all deliveries Trend NR

Finland. *Incidence.* One Finnish study reported a total cesarean rate of 13.9 percent and "elective" cesarean rates of 7.1 percent, as a proportion of all births from July 1985 through June 1986 (Table 12).[62] The authors did not define elective cesarean delivery resulting in low relevance to CDMR.

Table 12. Finland, incidence and trend data

Source Groups Relevance Rating	Study Objective Source Time Pperiod	Definitions and Inclusion-Exclusion Criteria	Incidence and Trend Data
Jarvelin et al., 1993[62] Groups G1: all cesarean deliveries G1a: elective cesarean delivery Low	Objective: to examine indications for the induction of labor and variations in the current policy of induction at different levels of obstetric specialization and to compare the outcome of induced and spontaneous labor Prospective administrative database 7/1/1985–6/30/1986	Elective: not defined	Total deliveries: 9,362 G1: 13.9% of all deliveries G1a: 7.1% of all deliveries

Key Question 2:
Outcomes of Cesarean Delivery on Maternal Request

As noted in Chapter 1, planned cesarean or planned vaginal delivery each have a range of numerous possible endpoints. Table 13 lists such endpoints for planned cesarean deliveries and for planned vaginal deliveries, noting the relevance to CDMR (ratings of high, moderate, or low, and, by definition, not applicable [NA] for vaginal deliveries).

We present three tables to summarize the literature with reference to their particular study populations, relevance, and outcomes. Table 14 presents actual comparison groups for each study and the associated relevance rating. Table 15 catalogs the maternal and neonatal outcomes pertinent to this review that appeared in each study. Table 16 lists confounders, specifically preterm deliveries, placental previa, multiple gestations, and multiparity, for each study.

The underlying concerns for the SOS conference relate to maternal and neonatal outcomes, as depicted in the analytic framework of Chapter 1 (Figure 3). This section presents results for maternal outcomes for primary cesarean deliveries as directed by the SOS Conference panel chair and in consultation with the Technical Expert Panel (TEP). Our systematic search strategies focused on primary cesarean delivery, however, we provide a summary of outcomes particularly relevant to subsequent cesarean deliveries such as subsequent uterine rupture, placenta previa, and subsequent stillbirth. We conclude this section with a summary of results for neonatal outcomes.

We organized maternal outcomes by proximity to the delivery and then, generally, by severity of the outcome. Maternal outcomes related to pelvic floor disorder, urinary incontinence, pelvic organ prolapse, and fecal incontinence appear last. Neonatal outcomes are similarly listed by proximity to delivery and severity of outcome.

Table 13. Possible endpoints from planned route of delivery and relevance as proxies to CDMR

Possible Endpoints from Planned Cesarean Delivery	Relevance as Proxies to CDMR
Planned cesarean delivery on maternal request (no maternal or neonatal indications)	High
Trial of cesarean for specific indications such as breech	Moderate
Planned cesarean performed for neonatal indications (unlabored)	Moderate
Cesarean planned and performed for maternal indications, unlabored	Moderate
Cesarean planned and performed for neonatal or maternal indications, unlabored	Moderate
Cesarean planned and performed but presented in labor for neonatal indications	Moderate
Cesarean planned and performed but presented in labor for maternal indications	Moderate
Cesarean planned and performed but presented in labor for neonatal or maternal indications	Moderate
Cesarean planned and performed but mix of labor and unlabored for neonatal indications	Moderate
Cesarean planned and performed but mix of labor and unlabored for maternal indications	Moderate
Cesarean planned and performed but mix of labor and unlabored for neonatal or maternal indications	Moderate
Mix of planned and unplanned cesarean, unlabored, for maternal or neonatal indications	Low
Planned cesarean unspecified as to indications or labor /"elective" unspecified as to indications or labor	Low
Possible Endpoints from Planned Vaginal Delivery	
Trial of vaginal delivery for specific indications such as breech	NA*
Spontaneous vaginal delivery	NA
Vacuum	NA
Forceps	NA
Vacuum and/or forceps	NA
Mix of spontaneous and assisted vaginal deliveries	NA
Vaginal unspecified	NA
Unplanned unlabored cesarean for neonatal indications	NA
Unplanned unlabored cesarean for maternal indications	NA
Unplanned unlabored cesarean for neonatal or maternal indications	NA
Unplanned labored cesarean for neonatal indications	NA
Unplanned labored cesarean for maternal indications	NA
Unplanned labored cesarean for neonatal or maternal indications	NA
Unplanned mix of labored and unlabored cesarean for neonatal indications	NA
Unplanned mix of labored and unlabored cesarean for maternal indications	NA
Unplanned mix of labored and unlabored cesarean for neonatal or maternal indications	NA
Unplanned cesarean unspecified or "emergency"	NA

* NA, not applicable

Table 14. Comparison groups

Source	Relevance Rating*	Study and Population Characteristics						
		Planned Route of Delivery	Planned Cesarean Delivery (CD)				Mix of Planned and Unplanned CD	"Elective" Unspecified
		Analyzed by planned (P) or actual (A) delivery	P	A	A	A	A	A	A
		Labored (L) or unlabored (UL)	Both	UL	L	Both	Both	UL	NR
		Indications for cesarean delivery (mat, fet, both)	Both	Both	Both	Mat	Both	Both	NR
		Actual route of delivery (CD, VD)	CD and VD	CD	CD	CD	CD	CD	CD
Hannah et al., 2002[18]	T		●						
Hannah et al., 2004[83]	T		●						
Hannah et al., 2000[20]	T		●						
Leiberman et al., 1995[84]	T		●						
Badawi et al., 1998[37]	M						●		
Burrows et al., 2004[39]	M			●					
Bergholt et al., 2003[38]	M						●		
Dessole et al., 2004[40]	M			●	●				
Farrell et al., 2001[41]	M			●					
Farrell et al., 2001[42]	M			●					
Fawcett et al., 1992[43]	M						●		
Groutz et al., 2004[44]	M					●			
Hillan, 1995[45]	M			●					
Lal et al., 2003[46]	M			●					
Levine et al., 2001[47]	M			●					
Morrison et al., 1995[48]	M						●		
Nice et al., 1996[49]	M						●		
Sanchez-Ramos et al., 2001[50]	M						●		
Schindl et al., 2003[51]	M						●		
van Ham et al., 1997[28]	M			●					
Zanardo et al., 2004[52]	M						●		
Zanardo et al., 2004[53]	M						●		
Allen et al., 2003[64]	L							●	
Dani et al., 1999[65]	L								●
Durik et al., 2000[66]	L								●
Golfier et al., 2001[67]	L								●
Irion et al., 1998[68]	L								●
Koroukian, 2004[69]	L								●

AVD, assisted vaginal delivery; CD, cesarean delivery; FAVD, forceps-assisted vaginal delivery; Mat, maternal; Fet, Fetal; NR, not reported; SVD, Spontaneous vaginal delivery; VAVD, vacuum-assisted vaginal delivery; VD, vaginal delivery.
*Relevance ratings: T, trial of planned route of delivery; M, moderate; L, low.
†Study reported on planned route (intent to treat) for adverse outcomes and by actual route for primary outcomes.

Table 14. Comparison groups (continued)

Study and population characteristics												
Planned Vaginal Delivery (VD)	**Unspecified, Planned VD Assumed**						**Planned VD**				**Mix of planned and unplanned vaginal delivery**	
P	A	A	A	A	A	A	A	A	A	A	A	A
Both	L	L	L	L	L	L	UL	L	Both	NR or "Emer-gency"	L	Both
Both	NA	NA	NA	NA	NA	NA	Both	Both	Both	Both	Both	Both
CD and VD	SVD	VAVD	FAVD	VAVD and/or FAVD	SVD and AVD	Unspeci-fied VD	CD	CD	CD	CD	CD	CD
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Table 14. Comparison groups (continued)

Source	Relevance Rating*	Study and Population Characteristics						
		Planned Route of Delivery	**Planned Cesarean Delivery (CD)**				**Mix of Planned and Unplanned CD**	**"Elective" Unspecified**
		Analyzed by planned (P) or actual (A) delivery	P	A	A	A	A	A
		Labored (L) or unlabored (UL)	Both	UL	L	Both	Both	UL	NR
		Indications for cesarean delivery (mat, fet, both)	Both	Both	Both	Mat	Both	Both	NR
		Actual route of delivery (CD, VD)	CD and VD	CD	CD	CD	CD	CD	CD
Krebs and Langhoff-Roos, 2003[70]	L							●	
MacArthur et al., 2001[72]	L								●
MacArthur et al., 1997[71]	L								●
Mason et al., 1999[73]	L								●
Persson et al., 2000[74]	L								●
Phipps et al., 2005[75]	L								●
Reichert et al., 1993[76]	L								●
Rubaltelli et al., 1998[77]	L								●
Ryding et al., 1998[78]	L								●
Schytt et al., 2004[79]	L								●
Sutton et al., 2001[80]	L							●	
Towner et al., 1999[81]	L							●	
Wilson et al., 1996[82]	L								●

Table 14. Comparison groups (continued)

Study and population characteristics												
Planned Vaginal Delivery (VD)	**Unspecified, Planned VD Assumed**						**Planned VD**				**Mix of Planned and Unplanned Vaginal Delivery**	
P	A	A	A	A	A	A	A	A	A	A	A	A
Both	L	L	L	L	L	L	UL	L	Both	NR or "Emer-gency"	L	Both
Both	NA	NA	NA	NA	NA	NA	Both	Both	Both	Both	Both	Both
CD and VD	SVD	VAVD	FAVD	VAVD and/or FAVD	SVD and AVD	Unspeci-fied VD	CD	CD	CD	CD	CD	CD
											●	
	●	●	●							●		
	●	●	●		●					●		
	●	●	●							●		
	●											●
										●		
										●		
										●		
	●			●	●					●		
	●			●						●		
			●			●					●	
	●	●	●	●							●	
	●		●							●		

Table 15. Maternal and neonatal outcomes reported

Outcomes	Maternal Outcomes Relevant to Primary CDMR																Maternal Outcomes Relevant to Subsequent Cesarean Delivery			Neonatal Outcomes								
	Relevance rating	Mortality	Infection	Anesthetic complications	Hemorrhage/blood transfusion	Hysterectomy	Thromboembolism	Surgical complications	Breastfeeding	Postpartum pain	Psychological outcomes (postpartum depression)	Psychological outcomes (other)	Maternal length of stay	Urinary incontinence	Anorectal function	Pelvic organ prolapse	Sexual function	Subsequent fertility issues	Subsequent uterine rupture	Subsequent stillbirth	Fetal mortality	Neonatal mortality	Unexpected (iatrogenic) prematurity	Respiratory morbidity	Transition	Neonatal asphyxia/encephalopathy	Intracranial hemorrhage	Facial nerve injury	Brachial plexus injury	Fetal laceration	Neonatal length of stay	Longterm outcomes
Hannah et al., 2002[18]	T								●	●	●	●		●	●		●														
Hannah et al., 2004[83]	T								●	●	●	●		●	●		●														
Hannah et al., 2000[20]	T	●	●		●	●	●				●	●	●																		
Leiberman et al., 1995[84]	T		●				●																								
Badawi et al., 1998[37]	M																									●					
Bergholt et al., 2003[38]	M				●	●		●											●												
Burrows et al., 2004[39]	M		●		●		●																								
Dessole et al., 2004[40]	M																												●		
Farrell et al., 2001[41]	M													●																	
Farrell et al., 2001[42]	M														●																
Fawcett et al., 1992[43]	M									●		●	●																		

T, trial of planned route of delivery; M, moderate; L, low

Table 15. Maternal and neonatal outcomes reported (continued)

Outcomes	Maternal Outcomes Relevant to Primary CDMR															Maternal Outcomes Relevant to Subsequent Cesarean Delivery						Neonatal Outcomes										
	Relevance rating	Mortality	Infection	Anesthetic complications	Hemorrhage/blood transfusion	Hysterectomy	Thromboembolism	Surgical complications	Breastfeeding	Postpartum pain	Psychological outcomes (postpartum depression)	Psychological outcomes (other)	Maternal length of stay	Urinary incontinence	Anorectal function	Pelvic organ prolapse	Sexual function	Subsequent fertility issues	Subsequent uterine rupture	Subsequent stillbirth	Fetal mortality	Neonatal mortality	Unexpected (iatrogenic) prematurity	Respiratory morbidity	Transition	Neonatal asphyxia/encephalopathy	Intracranial hemorrhage	Facial nerve injury	Brachial plexus injury	Fetal laceration	Neonatal length of stay	Longterm outcomes
Groutz et al., 2004[44]	M													●																	
Hillan et al., 1995[45]	M		●		●																										
Lal et al., 2003[46]	M														●																
Levine et al., 2001[47]	M																							●							
Morrison et al., 1995[48]	M																							●							
Nice et al., 1996[49]	M		●																												
Sanchez-Ramos et al., 2001[50]	M			●	●								●																		
Schindl et al., 2003[51]	M		●	●	●			●		●		●												●							
van Ham et al., 1997[28]	M	●	●		●		●	●					●																●		
Zanardo et al., 2004[52]	M																							●						●	
Zanardo et al., 2004[53]	M																					●		●						●	
Allen et al., 2003[64]	L	●	●		●			●																							
Dani et al., 1999[65]	L																							●							
Durik et al., 2000[66]	L										●	●																			

Table 15. Maternal and neonatal outcomes reported (continued)

Outcomes	Maternal Outcomes Relevant to Primary CDMR																Maternal Outcomes Relevant to Subsequent Cesarean Delivery				Neonatal Outcomes										
	Relevance rating	Mortality	Infection	Anesthetic complications	Hemorrhage/blood transfusion	Hysterectomy	Thromboembolism	Surgical complications	Breastfeeding	Postpartum pain	Psychological outcomes (postpartum depression)	Psychological outcomes (other)	Maternal length of stay	Urinary incontinence	Anorectal function	Pelvic organ prolapse	Sexual function	Subsequent fertility issues	Subsequent uterine rupture	Subsequent stillbirth	Fetal mortality	Neonatal mortality	Unexpected (iatrogenic) prematurity	Respiratory morbidity	Transition	Neonatal asphyxia/encephalopathy	Intracranial hemorrhage	Facial nerve injury	Brachial plexus injury	Fetal laceration	Neonatal length of stay	Longterm outcomes
Golfier et al., 2001[67]	L		●		●		●	●																							
Irion et al., 1998[68]	**L**		●		●	●	●	●																							
Koroukian, 2004[69]	**L**		●	●	●		●	●																							
Krebs and Langhoff-Roos, 2003[70]	**L**	●	●				●	●						●	●	●		●		●											
MacArthur et al., 2001[72]	**L**														●																
MacArthur et al., 1997[71]	**L**														●																
Mason et al., 1999[73]	**L**													●																	
Persson et al., 2000[74]	**L**													●																	
Phipps et al., 2005[75]	**L**							●																							
Reichert et al., 1993[76]	**L**											●																			
Rubaltelli et al., 1998[77]	**L**																							●							
Ryding et al., 1998[78]	**L**											●																			
Schytt et al., 2004[79]	**L**													●																	

Table 15. Maternal and neonatal outcomes reported (continued)

| Outcomes | Maternal Outcomes Relevant to Primary CDMR | | | | | | | | | | | | | | | | | | | | | Maternal Outcomes Relevant to Subsequent Cesarean Delivery | | | | | | | | | | | | | | | | | | |

We present results for each outcome by relevance to CDMR. With respect to the quality of individual studies, we then examine studies rated "T" and the studies judged to be moderately relevant for quality (categorized as good, fair, or poor). We had no highly relevant studies for this question, and we did not grade low relevance studies for quality because we believed such grading would be unfair to studies that were obviously designed and conducted for other purposes. Thus, we focus mainly on studies of moderate relevance graded either good or fair quality; we only summarize information from poor studies (regardless of relevance) or those of low relevance (regardless of quality).

Below we present a general discussion of the direction of evidence in the following text for outcomes with more than three studies; summary tables document specific results. Because of the extreme range and diversity of outcome measures, reference groups used for comparisons, methods for reporting data, and statistical tests used, these tables are necessarily complex. We focus on percentages of women with the outcome in question in the various cesarean and vaginal delivery groups, significance of any results, and (when provided) odds ratios (OR) or relative risks (RR) provided by study authors. We do not present summary tables for outcomes with three or fewer studies; those results are noted only in text.

Finally, we do not have summary tables on psychological outcomes for two reasons. First, these outcomes had not been specified as being of high priority for the SOS conference, and time and resource constraints led us to focus on SOS-priority outcomes. Second, psychological outcomes were so numerous and varied that presenting them in summary tables seemed impractical. Where appropriate, we have reported or commented on these outcomes in the text below.

Maternal Outcomes for Primary Cesarean Deliveries

The following outcomes are relevant to both primary and subsequent cesarean deliveries. However, we draw upon evidence from studies focusing on primary cesarean deliveries to address the maternal outcomes listed below. As noted in Table 16, some of these studies include repeat cesarean deliveries. However, no study included in this review is limited to repeat cesareans. Outcomes particularly relevant to subsequent cesarean deliveries are addressed in the next section.

Table 16. Inclusion of possible confounders

	Relevance Rating	Nulliparous Only	Includes Preterm	Includes Previa	Includes Repeat Cesarean Delivery	Includes Multiple Gestations
Hannah et al., 2000[20]	T	No	No	No	Yes	No
Hannah et al., 2002[18]	T	No	No	No	Yes	No
Hannah et al., 2004[83]	T	No	No	No	Yes	No
Leiberman et al., 1995[84]	T	Yes	No	Yes	No	No
Badawi et al., 1998[37]	M	No	No	Yes	Yes	Unspecified
Bergholt et al., 2003[38]	M	No	Yes	Yes	Yes	Yes
Burrows et al., 2004[39]	M	No	No	Unspecified	Yes	No
Dessole et al., 2004[40]	M	No	Yes	Yes	Yes	Yes
Farrell et al., 2001[41]	M	Yes	Probably	Unspecified	No	Unspecified
Farrell et al., 2001[42]	M	Yes	Probably	Unspecified	No	Unspecified
Fawcett et al., 1992[43]	M	No	No	Probably	Yes	Unspecified
Groutz et al., 2004[44]	M	Yes	No	No	No	Unspecified
Hillan, 1995[45]	M	No	Probably	Probably	Probably	Probably
Lal et al., 2003[46]	M	Yes	Yes	Unspecified	No	No
Levine et al., 2001[47]	M	No	Yes (≥35 wks)	Yes	Yes	Yes
Morrison et al., 1995[48]	M	No	No	Probably	Probably	Unspecified
Nice et al., 1996[49]	M	No	Probably	Probably	Probably	Probably
Sanchez-Ramos et al., 2001[50]	M	No	Yes (≥35 wks)	Unspecified	Yes	No
Schindl et al., 2003[51]	M	No	No	Probably	Yes	Yes
van Ham et al., 1997[28]	M	No	Yes	Yes	Yes	Probably
Zanardo et al., 2004[52]	M	No	No	Yes	Yes	Yes
Zanardo et al., 2004[53]	M	No	No	Yes	Yes	Yes
Allen et al., 2003[64]	L	Yes	No	Unspecified	No	No
Dani et al., 1999[65]	L	No	Yes	Yes	Probably	Yes
Durik et al., 2000[66]	L	No	Probably	Probably	Probably	Probably
Golfier et al., 2001[67]	L	No	No	Unspecified	Probably	No
Irion et al., 1998[68]	L	No	Yes (≥36 wks)	No	Probably	No
Koroukian, 2004[69]	L	No	No	No	Probably	No

T, trial of planned route of delivery; M, moderate; L, low.

Table 16. Inclusion of possible confounders (continued)

	Relevance Rating	Nulliparous Only	Includes Preterm	Includes Previa	Includes Repeat Cesarean Delivery	Includes Multiple Gestations
Krebs and Langhoff-Roos, 2003[70]	L	Yes	Yes	Unspecified	No	No
MacArthur et al., 2001[72]	L	No	Probably	Unspecified	Probably	Unspecified
MacArthur et al., 1997[71]	L	No	Probably	Probably	Probably	Unspecified
Mason et al., 1999[73]	L	No	Probably	Probably	Probably	Probably
Persson et al., 2000[74]	L	No	Probably	Probably	Probably	Yes
Phipps et al., 2005[75]	L	No	Yes	Probably	Yes	Probably
Reichert et al., 1993[76]	L	No	No	Yes	Yes	Unspecified
Rubaltelli et al., 1998[77]	L	No	Yes	Yes	Probably	Yes
Ryding et al., 1998[78]	L	No	Probably	Probably	Probably	Unspecified
Schytt et al., 2004[79]	L	No	Probably	Probably	Yes	No
Sutton et al., 2001[80]	L	No	No	Probably	Probably	No
Towner et al., 1999[81]	L	Yes	Probably	Probably	No	No
Wilson et al., 1996[82]	L	No	No	Probably	Yes	Yes

Mortality. Four studies reported on maternal mortality associated with mode of delivery (Table 17).[20,28,64,70] One is the randomized Breech Trial (relevance rating of T); we gave the initial report a quality rating of fair. This trial compared planned vaginal with planned cesarean for breech and analyzed results using intent-to-treat.[20] We rated another study as moderately relevant but of poor quality.[28] We rated the two remaining studies as having low relevance and did not rate quality.[64,70]

Table 17. Mortality

Author, Year Relevance/Quality	Measure	Outcomes for Comparison Groups				Statistical Test Results
Hannah et al., 2000[20] T/Fair		**Planned CD**	**Planned VD**			
	Mortality	0	0.1%			NR
van Ham et al., 1997[28] Moderate/Poor		**Primary Elective CD**	**Primary Acute CD**	**Secondary Acute CD**		
	Mortality	3 cases of mortality due to underlying pathology, NR by category				NR
Allen et al., 2003[64] Low/Not rated		**Elective CD**	**SVD**	**AVD**	**CD in labor**	
	Mortality	0	0	0	0	NR
Krebs et al., 2003[70] Low/Not rated		**Elective CD**	**VD**	**Emergency CD**		
	Mortality	None of the 83 deaths reported in the sample of 15,441 women were associated with mode of delivery				NR

CD, cesarean delivery; VD, vaginal delivery; SVD, spontaneous vaginal delivery; AVD, assisted vaginal delivery; NR, not reported.

The Breech Trial initially reported one death in the planned vaginal group (n = 1,042, or 0.1%), and none in the planned cesarean group (n = 1,041).[20] The patient who died was described as "jaundiced before labor, developed disseminated intravascular coagulation after delivery, and died of hepatorenal failure at 44 hours postpartum" (p. 1380).[20]

The moderately relevant (poor) study identified three maternal deaths that had been caused by underlying pathology.[28] The authors did not characterize these cases as either labored or unlabored cesarean deliveries, nor did they comment on indication for cesarean; thus, this study provides little information relevant to CDMR.

Of the two low relevance studies, one study reported some deaths but none associated with mode of delivery,[70] and the other reported no maternal deaths at all.[64]

Infection. Twelve studies[20,28,39,45,49,51,64,67-70,84] included maternal infection as an outcome (Table 18).

The Breech Trial found no significant differences in the rates of wound infection or maternal systemic infection.[20] An earlier nonrandomized study (rated fair) compared a trial of planned vaginal with planned cesarean for breech and analyzed results using intent-to-treat. The investigators used a composite measure of maternal morbidity (febrile morbidity, endometritis, wound infection, urinary tract infection [UTI], and thrombophlebitis) and determined that it was significantly higher in the planned cesarean group.[84]

Of five moderately relevant studies, two were of fair quality,[39,51] and three were of poor quality.[28,45,49] Only one of these compared planned "intended" vaginal delivery with planned "elective" cesarean delivery.[51] It did not give a detailed assessment of maternal infection beyond reporting a single case of sepsis among the 903 intended vaginal births and none among the 147 "elective" cesarean births.

Three studies compared outcomes only between various types of cesarean delivery; this restriction limited their utility for addressing the maternal infection issue in terms of planned CDMR vs. planned vaginal delivery. Of these, one study found no difference in UTI between planned "elective" and unplanned "emergency" cesarean deliveries but did find significantly

Table 18. Infection

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups						Statistical Test Results
Hannah et al., 2000[20] T/Fair		**Planned CD**	**Planned VD**					
	Wound infection	1.5%	1.0%					*P* = 0.32
	Maternal systemic infection	1.5%	1.3%					*P* = 0.71
Burrows et al., 2004[39] Moderate/Fair		**Primary Prelabor CD**	**Repeat Prelabor CD**	**Primary Labored CD**	**Repeat Labored CD**	**SVD (ref grp)**	**Operative VD**	
	Endometritis	3.0%	2.7%	9.4%	4.6%	0.4%	0.7%	Significantly different for all other than operative VD
	Adj OR (95% CI)	10.3 (5.9; 17.9)	9.9 (5.8; 16.9)	21.2 (15.4; 29.1)	14.6 (9.2; 23.1)	1.0	0.9 (0.6; 1.5)	
	Pneumonia	0.3%	0.5%	0.1%	0.7%	0.1%	0.2%	Significantly different for all other than operative VD and primary labored CD
	Adj OR (95% CI)	4.7 (1.1; 20.4)	5.2 (1.5; 18.1)	1.7 (0.6; 5.2)	9.3 (3.4; 25.6)	1.0	2.3 (1.0; 5.4)	
Leiberman et al., 1995[84] T/Fair		**Planned CD**	**Planned Trial of Labor (ref grp)**					
	Combined measure of maternal morbidity (includes febrile morbidity, endometritis, wound infection, UTI and thrombophlebitis)	31.0%	17.8%					*P* = 0.01
	OR (95% CI)	0.48 (0.25; 0.89)	1.0					

UTI, urinary tract infection; CD, cesarean delivery; SVD, spontaneous vaginal delivery; AVD, assisted vaginal delivery; ref grp, reference group; NS, not significant; NR, not reported; Adj, adjusted; OR, odds ratio; RR, risk ratio; CI, confidence interval.

Table 18. Infection (continued)

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups					Statistical Test Results
Hillan, 1995[45] Moderate/Poor		**Elective CD**	**Emergency CD**				
	UTI	10.9%	10.3%				*P* NS
	Wound infection	4.1%	8.3%				*P* < 0.05
	Pelvic infection (intrauterine)	1.4%	6.0%				*P* < 0.01
Nice et al., 1996[49] Moderate/Nice		**Elective CD**	**Emergency CD**				
	Wound infection	6.4%	7.6%				NS, statistics NR
Schindl et al., 2003[51] Moderate/Fair		**Elective CD**	**Emergency CD**				
	Sepsis	0	0.1%				
van Ham et al., 1997[28] Moderate/Poor		**Primary Elective CD**	**Primary Acute CD**	**Secondary Acute CD**			
	UTI	2.5%	3.4%	3.1%			NS, statistics NR
	Wound infection	1.0%	1.7%	2.8%			NS, statistics NR
	Endometritis	1.3%	0.5%	1.6%			NS, statistics NR
	Pelvic infection (intrauterine)	0.6%	0.1%	1.0%			NS, statistics NR
	Sepsis	0	0.6%	0.2%			NS, statistics NR
	Pneumonia	0	0.6%	0.4%			NS, statistics NR
Allen et al., 2003[64] Low/Not rated		**Elective CD**	**SVD (ref grp)**	**AVD (ref grp)**	**CD in Labor (ref grp)**		
	Wound infection	1.5%	0.4%	2.0%	2.2%		*P* < 0.001
		RR vs SVD: 3.5 (1.8, 6.7); RR vs AVD: 0.8 (0.4, 1.5); RR vs CD in labor: 0.7 (0.4, 1.4)					

Table 18. Infection (continued)

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups						Statistical Test Results
Golfier et al., 2001[67] Low/Not rated		**Elective CD**	**Planned VD (ref grp)**					
	Moderate and severe complications	6.0%	5.8%					NS
	RR (95% CI)	0.97 (0.59; 1.57)	1.0					
	Mild complications	6.7%	2.4%					Significantly different
	RR (95% CI)	0.46 (0.24; 0.9)	1.0					
Irion et al., 1998[68] Low/Not rated		**Elective CD (ref grp)**	**Attempted VD**					
	UTI	12.5%	5.2%					*P* < 0.001
	RR (95% CI)	1.0	0.42 (0.25; 0.70)					
	Endometritis	4.1%	1.8%					*P* = 0.07
	RR (95% CI)	1.0	0.45 (0.18; 1.11)					
	Pneumonia	0.3%	0.8%					*P* = 0.63
	RR (95% CI)	1.0	2.49 (0.26; 23.86)					
Koroukian, 2004[69] Low/Not rated		**Elective CD**	**SVD**	**AVD**	**Non-elective CD**			
	Major puerperal infection in entire sample	2.9%	0.9%	1.1%	4.3%			Significantly different
		Elective CD	**Uncompli-cated SVD (ref grp)**					
	Major puerperal infection in subset of uncomplicated deliveries	2.9%	0.8%					Significantly different
	RR (95% CI)	3.75 (3.12; 4.51)	1.0					

Table 18. Infection (continued)

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups			Statistical Test Results
Krebs and Langhoff-Roos, 2003[70] Low/Not rated		**Elective CD**	**VD (ref grp)**	**Emergency CD (ref grp)**	
	Puerperal fever/pelvic infection	1.5%	0.5%	2.3%	Significantly different
		RR vs VD: 1.2 (1.11; 1.25); RR vs Emergency CD: 0.81 (0.7; 0.92)			
	Wound infection	0.9%	0.7%	1.8%	Significantly different
		RR vs VD: NR; Emergency CD: 0.69 (0.57; 0.83)			

lower rates of wound, intrauterine, and chest infections in the planned "elective" cesarean group.[45] The second reported no significant difference in the rate of UTI, wound infection, and endometritis between planned "elective" cesarean and unplanned "acute" and "secondary acute" cesarean deliveries.[28] The third set of investigators limited their analysis to wound infection and distinguished between major and minor infections. However, they did not provide a statistical comparison of wound infection rates between planned "elective" and unplanned "emergency" cesarean deliveries.[49]

The most recent moderately relevant study compared various actual modes of delivery.[39] The risk of endometritis was significantly higher for both planned "without trial of labor" and unplanned "with trial of labor" primary cesarean deliveries than for spontaneous vaginal delivery. The risk of pneumonia was higher for both types of cesareans but significantly higher only for the planned "without trial of labor" primary cesarean group.

The remaining five studies were of low relevance because the authors either combined planned and unplanned cesareans in their cesarean comparison groups[64,70] or did not define "elective" cesarean delivery.[67-69] Generally, these studies found that the risk of maternal infection was lower for planned "elective" cesarean than for unplanned or labored or "emergency" cesarean but lower for vaginal delivery than for planned "elective" cesarean.

Anesthetic complications. Of three studies reporting on anesthetic complications associated with mode of delivery, two were moderately relevant to CDMR[50,51] and one was of low relevance.[69]

One moderately relevant study (fair quality) reported a 4 percent rate of problems with "peridural" anesthesia/postspinal headache in the "elective" cesarean group (6 of 147 women) and a 2 percent rate (18 of 903 women) with an intended vaginal birth;[51] the authors did not provide statistical testing for this outcome. The other study (poor quality) reported no difference in anesthetic complications between planned cesarean and planned vaginal delivery.[50]

The low relevance study obtained data from an administrative database using International Classification of Diseases, ninth edition (ICD-9) codes and reported rates of anesthetic complications in ascending order per 1,000 women: spontaneous vaginal deliveries, 90; assisted vaginal deliveries, 160; unplanned "nonelective" cesarean deliveries, 360; and planned "elective" cesarean deliveries, 390.[69]

Hemorrhage/blood transfusion. Of the 11 articles (Table 19) that evaluated blood loss associated with route of delivery, 1 was from the Breech Trial,[20] 6 were moderately relevant,[28,38,39,45,50,51] and four were of low relevance.[64,67-69]

As with other outcomes, definitions were not standardized. We encountered various measures of hemorrhage: blood loss >1,000 ml, blood loss >1,500 ml, blood transfusion, need for dilatation and curettage, and undefined postpartum hemorrhage. We chose to report these clinically relevant outcomes rather than anemia (change in hemoglobin or hematocrit level).

The Breech Trial (fair quality) included a heterogeneous group of women: women who were multiparous, had a history of a previous cesarean, and presented in labor.[20] The planned cesarean group had lower rates of postpartum bleeding (1.0%)—defined as estimated blood loss (EBL) >1,000ml, EBL >1,500ml, blood transfusion or need for dilatation and curettage—than the planned vaginal delivery group (1.3%); the difference was not statistically significant.

Five of the six moderately relevant studies limited comparisons to only planned "elective" vs. unplanned "emergency" cesarean delivery; they defined significant blood loss as blood loss >1000 ml,[28] transfusion,[45,50,51] or both.[38] Of these five, two were of fair quality[51 38]and three were of poor quality.[28,45,50] The sixth study (fair quality) identified postpartum hemorrhage and

Table 19. Hemorrhage

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups						Statistical Test Results
Hannah et al., 2000[20] T/Fair		**Planned CD**	**Planned VD**					
	Postpartum bleeding	1.0%	1.3%					*P* = 0.68
	Hemorrhage > 1,000 ml	0.4%	0.8%					NR
	Hemorrhage> 1,500 ml	0.2%	0.4%					NR
	Hemorrhage requiring transfusion	0.4%	0.8%					NR
	Hemorrhage requiring D&C	0.3%	0.4%					NR
	Other hemorrhage	0.2%	0.1%					NR
Burrows et al., 2004[39] Moderate/Fair		**Primary Prelabor CD**	**Repeat Prelabor CD**	**Primary Labored CD**	**Repeat Labored CD**	**SVD (ref grp)**	**Operative VD**	
	Postpartum hemorrhage	2.7%	3.2%	3.9%	2.6%	5.0%	4.7%	Labored CD and operative VD significantly different from SVD
	Adj OR (95% CI)	0.7 (0.4; 1.1)	0.8 (0.6; 1.2)	0.8 (0.6; 0.9)	0.6 (0.4; 0.96)	1.0	0.8 (0.7; 0.97)	
	Transfusion	0.3%	0.5%	1.1	0.8%	0.2%	0.4%	All modes of delivery other than primary prelabor CD are significantly different from SVD
	Adj OR (95% CI)	2.6 (0.8; 8.5)	3.0 (1.1; 8.3)	4.4 (2.7; 7.1)	4.2 (1.8; 10.1)	1.0	2.2 (1.3; 3.7)	

Adj, Adjusted; AVD, assisted vaginal delivery; CD, cesarean delivery; CI, confidence interval; SVD, spontaneous vaginal delivery; ref grp, reference group; NS, not significant; NR, not reported; NA, not applicable; OR, odds ratio; RR, relative risk; VD, vaginal delivery.

Table 19. Hemorrhage (continued)

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups							Statistical Test Results
Bergholt et al., 2003[38] Moderate/Fair		**Elective CD**	**Emergency CD**						
	Blood transfusion	0.7%	1.1%						NS
	Estimated blood loss ≥ 1,000 ml	6.8%	9.0%						NS
	Risk of intraoperative blood loss ≥ 1,000 ml during the cesarean delivery from emergency c/s	NA	Crude OR: 1.3 Adjusted OR: 1.6 (0.7; 3.4)						
Hillan, 1995[45] Moderate/Poor		**Elective CD**	**Emergency CD**						
	Blood transfusion	1.4%	4.5%						*P* < 0.05
Sanchez-Ramos et al., 2001[50] Moderate/Poor		**Elective CD**	**Attempted Vaginal Breech**						
	Hemorrhage	1.0%	1.1%						*P* = 1.00
Schindl et al., 2003[51] Moderate/Fair		**Elective CD**	**Intended VD**						
	Blood transfusion	0	0.6%						NR
	Sepsis	0	0.1%						NR
van Ham et al., 1997[28] Moderate/Poor		**Primary Elective CD**	**Primary Acute CD**	**Secondary Acute CD**					
	Blood loss (intraoperative)	4.7%	7.8%	8.7%					*P* < 0.001
	Blood loss (post-operational) ≥ 1,500 ml	1.5%	2.9%	2.6%					NR
	Blood loss (post-operational) 1,000 to 1,500 ml	2.8%	3.7%	4.9%					NR

Table 19. Hemorrhage (continued)

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups				Statistical Test Results
Allen et al., 2003[64] Low/Not rated		**Elective CD (ref grp)**	**SVD**	**AVD**	**CD in Labor**	
	Blood transfusion	0.3%	0.3%	0.8%	0.5%	
	RR (95% CI)	1.0	0.9 (0.2; 3.8)	0.4 (0.1; 1.6)	0.5 (0.1; 2.4)	SVD significantly different than elective CD
	Early postpartum hemorrhage	3.8%	5.1%	9.6%	7.5%	*P* < 0.001
	RR (95% CI)	1.0	0.8 (0.5; 1.1)	0.4 (0.3; 0.6)	0.5 (0.4; 0.8)	AVD and CD in labor significantly different than elective CD
Golfier et al., 2001[67] Low/Not rated		**Elective CD**	**Planned VD**			
	Blood transfusion	0.3%	1.0%			NR
Irion et al., 1998[68] Low/Not rated		**Elective CD**	**Attempted VD**			
	Hysterectomy for hemorrhage	0.3%	0			*P* = 0.45

Table 19. Hemorrhage (continued)

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups				Statistical Test Results
Koroukian, 2004[69] Low/Not rated		**Elective CD**	**SVD**	**AVD**	**Nonelective CD**	
	Postpartum hemorrhage in entire sample	1.74%	3.0%	3.13%	2.22%	
		Elective CD	**Uncomplicated SVD (ref grp)**			
	Postpartum hemorrhage in subset of uncomplicated deliveries	1.74%	2.42%	3.0%		Significantly different
	RR (95% CI)	0.60 (0.48; 0.76)	1.0			
	Blood transfusion in entire sample	**Elective CD**	**SVD**	**AVD**	**Nonelective CD**	
		0.07%	0.11%	0.12%	0.37%	
		Elective CD	**Uncomplicated SVD (ref grp)**			
	Blood transfusion in subset of uncomplicated deliveries	0.07%	0.06%			Not signficantly different
	RR (95% CI)	1.16 (0.41; 3.25)	1.0			

transfusion through ICD-9 codes and reported these outcomes separately.[39]

Of all six studies, five showed a lower risk of major blood loss with planned "elective" than with unplanned "emergency" cesarean delivery.[28,38,39,45,51] The differences were statistically significant in two studies (both poor).[28,45]

The three moderately relevant studies that compared risk of blood transfusion differed in their comparison groups. One showed a nonsignificant higher absolute risk with planned cesarean (1.1 percent) than with unplanned cesarean (0.7 percent).[38] A second reported cases of blood transfusions in only the planned vaginal delivery group but provided no statistical testing.[51] The third study found a higher risk of blood transfusion with both unplanned "with trial of labor" and planned "without trial of labor" primary cesareans than with spontaneous vaginal deliveries. The higher risk was statistically significant only in the unplanned "with trial of labor" group.[39]

In the only study that did not report a lower rate of blood loss associated with elective cesarean birth,[50] the rates of blood transfusion were similar between elective cesarean and planned vaginal delivery: 1.2 percent vs. 1.1 percent, respectively.

Of the four studies of low relevance, three defined significant blood loss as requiring a blood transfusion;[64,67,69] planned "elective" cesarean was associated with a lower rate of blood transfusion than that for planned vaginal delivery. Of these three studies, two compared planned "elective" cesarean with spontaneous vaginal, assisted vaginal, and unplanned "nonelective" cesarean or cesarean in labor.[64,69] In both studies, assisted vaginal delivery and nonelective or labored cesarean had the highest rates of blood transfusions. These results were statistically significant in only one study, which reported an absolute risk reduction for blood transfusion per 1,000 deliveries of 3.7 for nonelective cesarean, 1.2 for assisted vaginal, 1.1 for spontaneous vaginal, and 0.7 for elective cesarean delivery.[69] Other analyses comparing elective cesarean sections with uncomplicated vaginal deliveries suggested a significantly lower rate of postpartum hemorrhage among elective cesarean deliveries but no statistical difference in the rate of blood transfusion.[69]

Hysterectomy. Three studies reported data on hysterectomy for postpartum hemorrhage.[20,38,68] One was the Breech Trial article published in 2000 and rated of fair quality.[20] Another study that compared planned "elective" with unplanned "emergency" was moderately relevant and of fair quality;[38] the other was of low relevance.[68]

The Breech Trial did not report any hysterectomies.[20] The moderately relevant study reported no significant differences in the rate of hysterectomy between elective cesarean (0.3%, 1 of 293 deliveries) and emergency cesarean (0.2%, 1 of 635 deliveries).[38] The low relevance study reported a single case of hysterectomy for hemorrhage in the elective cesarean delivery group.[68]

Thromboembolism. Eight studies compared thromboembolism by route of delivery (Table 20). Of these studies, two were in the T relevance category (fair quality).[20,84] Two were moderately relevant studies, one of fair quality[39] and one of poor quality.[28] The remaining four studies were of low relevance.[67-70]

The studies universally lacked consistency in how they defined thromboembolism. Definitions varied from a composite outcome of maternal morbidity that included "thrombophlebitis" with other measures such as UTI, endometritis, and wound infection[84] to a single thromboembolic event measure that included obstetrical air embolism, amniotic fluid embolism, obstetrical blood clot embolism, other pulmonary embolism, cerebrovascular disorders, deep phlebothrombosis, and postpartum or unspecified venous thrombosis.[69] Two

Table 20. Thromboembolism

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups						Statistical Test Results
Hannah et al., 2000[20] T/Fair		**Planned CD**	**Planned VD**					
	Deep vein thrombophlebitis or pulmonary embolism	0	0					NR
Leiberman et al., 1995[84] T/Fair		**Planned CD (ref grp)**	**Planned VD**					
	Combined measure of maternal morbidity (includes febrile morbidity, endometritis, wound infection, UTI and thrombophlebitis)	31.0%	17.8%					*P* = 0.01
	OR (95% CI)	1.0	0.48 (0.25; 0.89)					
Burrows et al., 2004[39] Moderate/Fair		**Primary Prelabor CD**	**Repeat Prelabor CD**	**Primary Labored CD**	**Repeat Labored CD**	**SVD (ref grp)**	**Operative VD**	
	Deep vein thrombosis	0.2%	0	0.3%	0.1%	0.1%	0.04%	Signficantly different for primary labored CD
	Adj OR (95% CI)	2.3 (0.3; 17.8)	NA	3.9 (1.7; 8.9)	1.9 (0.2; 14.2)	1.0	0.5 (0.1; 2.2)	
van Ham et al., 1997[28] Moderate/Poor		**Primary elective CD**	**Primary acute CD**	**Secondary acute CD**				
	Thrombosis	0.6%	1.0%	0.3%				NR
	Thrombophlebitis	1.1%	1.8%	3.8%				NR
Golfier et al., 2001[67] Low/Not rated		**Elective CD**	**Attemped VD**					
	Deep vein thrombosis	0.1%	0.7%					Outcomes not individually tested
Irion et al., 1998[68] Low/Not rated		**Elective CD**	**Attemped VD**					
	Pulmonary embolism	0.3%	0					*P* = 0.45

Adj, adjusted; AVD, assisted vaginal delivery; CD, cesarean delivery; CI, confidence interval; NA, not applicable; NR, not reported; OR, odds ratio; ref grp, reference group; RR, relative risk; SVD, spontaneous vaginal delivery; VD, vaginal delivery.

Table 20. Thromboembolism (continued)

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups						Statistical Test Results
Koroukian, 2004[69] Low/Not rated		**Elective CD**	**SVD**	**AVD**	**Nonelective CD**			
	Thrombembolic events in entire sample	0.19%	0.07%	0.11%	0.45%			Significantly different
		Elective CD	**Uncomplicated SVD (ref grp)**					
	Thrombembolic events in subset with uncomplicated deliveries	0.19%	0.06%					Significantly different
	RR (95% CI)	3.45 (1.70; 7.00)	1.0					
Krebs and Lanhoff-Roos, 2003[70] Low/Not rated		**Elective CD**	**VD (ref grp)**	**Emergency CD (ref grp)**				
	Thromboembolism	0.1%	0	0.1%				NS
		RR vs vaginal: 1.31 (0.95; 1.32); RR vs. emergency cesarean: 0.80 (0.38; 1.26)						

studies defined thromboembolic measures as deep venous thrombosis,[39,67] whereas another defined it as pulmonary embolism.[68] Yet another study assigned separate categories according to severity, defining "thrombosis" as a major morbidity outcome and "thrombophlebitis" as a minor morbidity outcome.[28]

From the Breech Trial, Hannah et al. reported no cases of either deep vein thrombophlebitis or pulmonary embolism in either the planned vaginal delivery or planned cesarean delivery group.[20] Leiberman et al. had used the composite outcome defined above; contrary to the randomized breech trial, this group reported that this outcome was significantly higher in the planned cesarean groups than in the planned vaginal group.[84]

One moderately relevant study with a vaginal delivery group found that the risk of deep vein thrombosis was higher among both planned "without trial of labor" and "unplanned "with trial of labor" primary cesarean deliveries; the risk was significant only for the unplanned "with trial of labor" cesarean group.[39] The other compared outcomes among planned "elective" and unplanned "acute" cesarean deliveries but did not contain a vaginal comparison group (a major limitation).[28] Thrombosis was part of a composite outcome of postoperative complications; that measure was significantly lower in the planned cesareans than in the unplanned cesareans (no statistical testing provided).

Of the four low relevance studies, three showed neither a significant difference nor a consistent direction of effect between planned "elective" cesarean and either vaginal delivery[70]or planned vaginal delivery.[67,68] The remaining study, from the administrative data set noted above, reported the incidence of thromboembolic events in ascending order per 1,000 deliveries: 0.7, spontaneous vaginal deliveries; 1.1, assisted vaginal deliveries; 1.9, planned "elective" cesarean deliveries; and 4.5, unplanned "non-elective" cesarean deliveries. The rate of thromboembolic events was statistically higher in unplanned cesarean than in planned cesarean deliveries.[69]

Surgical complications. The studies in this group are weighted toward surgical complications associated with cesarean deliveries. Our search parameters (reviewed by the Technical Expert Panel and the SOS Conference panel chair) were not designed to capture perineal and vaginal trauma associated with vaginal delivery. Therefore, we cannot provide a comprehensive assessment of the risks for perineal and vaginal trauma.

Of the 10 studies that compared surgical complications by mode of delivery, 1 was the Breech Trial,[20] 3 were moderately relevant,[28,38,51] and 6 were of low relevance[64,67-70,75] (Table 21).

Similar to the practices seen for other maternal outcomes, we found some studies that defined surgical complications as a single composite measure of injury,[64,68,69] and others that reported specific measures of complications such as bladder or bowel injury.[20,28,38,51,67,70,75]

The Breech Trial (fair quality) found similar rates of genital tract injury (vertical uterine incision, serious extension to transverse uterine incision, cervical laceration extending to lower uterine segment, or vulvar/perineal hematoma requiring evacuation) among the planned vaginal group (0.6%) and the planned cesarean group (0.6%).[20] Neither group experienced genital tract fistulae, bowel obstructions, or injury to bladder, ureter, or bowel.

Two of the three moderately relevant studies were of fair quality[38,51] and one was of poor quality.[28] These three studies varied widely in their choice of comparison groups. The only moderately relevant study that compared planned "elective" cesarean with planned vaginal delivery "intended vaginal birth" focused primarily on perineal surgical injury.[51] In this study, 33.4 percent of women in the planned vaginal delivery group experienced labial, vaginal, or first or second degree perineal lacerations; another 20.2 percent had an episiotomy; and 0.2 percent

Table 21. Surgical complications

Author, Year Relevance/ Quality Rating	Measure	Outcomes for Comparison Groups			Statistical Test Results
Hannah et al., 2000[20] T/Fair		**Planned CD**	**Planned VD**		
	Genital tract injury: vertical uterine incision, serious extension to transverse uterine incision, cervical laceration extending to lower uterine segment, vulvar/perineal hematoma requiring evacuation.	0.6%	0.6%		*P* = 1.0
	Note: There were no genital tract fistula, bowel obstructions, injury to bladder, ureter or bowel.				
van Ham et al. 1997[28] Moderate/Poor		**Primary Elective CD**	**Primary Acute CD**	**Secondary Acute CD**	
	Bladder lesion	1.3%	0.4%	0.9%	NS
	Lesion of the uterine artery/ligamentum latum/bowels	0.4%	0.6%	0.6%	NS
	Cervical/vaginal lesions	0	0.2%	0.6%	NS
Bergholt et al., 2003[38] Moderate/Fair		**Elective CD**		**Emergency CD**	
	Cervical	1.4%		4.6%	*P* < 0.05
	Corporal	0.3%		0.3%	NS
	Vaginal	0		1.7%	< 0.05
	Bladder	0		0.8%	NS
	Bowel	0		0	NS
	All	1.7%		6.8%	*P* < 0.05
Schindl et al., 2003[51] Moderate/Fair		**Elective CD**	**Intended Vaginal**		
	Perineal laceration III/IV	0	0.2%		NR
	Labial, vaginal, perineal laceration I/II	0	33.4%		NR
	Episiotomy	0	20.2%		NR

AVD, assisted vaginal delivery; CD, cesarean delivery; CI, confidence interval; NS, not significant; ref grp, reference group; RR, relative risk; SVD, spontaneous vaginal delivery; VD, vaginal delivery.

Table 21. Surgical complications (continued)

Author, Year Relevance/ Quality Rating	Measure	Outcomes for Comparison Groups				Statistical Test Results
Allen et al., 2003[64] Low/Not rated		**CD Without Labor**	**SVD (ref grp)**	**AVD (ref grp)**	**CD in Labor (ref grp)**	
	Intraoperative trauma (Laceration of uterine artery, bladder, bowel or ureter or severe extension of uterine incision)	0.1%	0.1%	0.1%	2.6%	Only CD in labor is significantly different from CD without labor
		RR vs SVD: 2.2 (0.3; 17.5); RR vs AVD: 1.1(0.1; 9.3); RR vs CD in labor: 0.1 (0.01; 0.4)				
Golfier et al., 2001[67] Low/Not rated		**Elective CD**	**Planned VD**			
	Intestinal	0.1%	0			NR
	Wall complications (abscess/hematoma)	2.5%	4.1%			NR
	Bladder	0	0.7%			NR
Irion et al., 1998[68] Low/Not rated		**Elective CD (ref grp)**	**Trial of Vaginal Delivery**			
	Surgical complications (bladder or other organ injury)	0.3%	0.8%			
	RR (95% CI)	1.0	2.49 (0.26; 23.86)			

Table 21. Surgical complications (continued)

Author, Year Relevance/ Quality Rating	Measure	Outcomes for Comparison Groups				Statistical Test Results
Koroukian 2004[69]		**Elective CD**	**SVD**	**AVD**	**Non-elective CD**	
Low/Not rated	Obstetrical Trauma: Laceration of cervix, high vagical laceration, other injury to pelvic organs, damage to pelvic joints and ligaments, other specified obstetrical trauma, unspecified obstetrical trauma in entire sample	1.09%	7.35%	7.05%	0.57%	
		Elective CD (ref grp)	**Uncomplicated SVD**			
	Obstetrical Trauma: Laceration of cervix, high vaginal laceration, other injury to pelvic organs, damage to pelvic joints and ligaments, other specified obstetrical trauma, unspecified obstetrical trauma in subset of uncomplicated deliveries	1.09%	6.94%			Significantly different
	RR (95% CI)	1.0	0.16 (0.16; 0.20)			
		Elective CD	**SVD**	**AVD**	**Non-elective CD**	
	Obstetrical surgical wound complications: includes hematoma, hemorrhage, or infection of cesarean or perineal wound in entire sample	3.0%	0.25%	0.49%	3.61%	
		Elective CD (ref grp)	**Uncomplicated SVD**			
	Obstetrical surgical wound complications: includes hematoma, hemorrhage, or infection of cesarean or perineal wound in subset of uncomplicated deliveries	3.0%	0.25%			Significantly different
	RR (95% CI)	1.0	12.5 (10.00; 15.63)			

Table 21. Surgical complications (continued)

Author, Year Relevance/ Quality Rating	Measure	Outcomes for Comparison Groups			Statistical Test Results
Krebs and Langhoff-Roos, 2003[70]		**Elective CD**	**VD**	**Emergency CD (ref grp)**	
Low/Not rated	Bladder injury	0.1%,	0	0.20%	
	RR (95% CI)	0.58 (0.23; 1.02)	NA	1.0	
Phipps et al., 2005[75]		**Scheduled CD**	**Urgent CD**	**Emergent CD**	
Low/Not rated	Bladder injury	In this case control study, women with a bladder injury were statistically more likely to have undergone an emergent or urgent cesarean than an elective cesarean			

experienced a third or fourth degree laceration; as expected, no such complications occurred in the elective cesarean group. No abdominal surgical complications were reported for either the planned cesarean or the planned vaginal delivery group.

The two remaining moderately relevant studies were limited to comparisons of outcomes among cesarean deliveries.[28,38] One suggested a higher rate of surgical complications among women with unplanned ("emergency" or "labored") cesarean delivery than among women with planned "elective" or "unlabored" cesarean;[38] the other did not.[28]

Three of the six studies of low relevance to CDMR compared surgical complications between planned "elective" cesarean and planned vaginal delivery.[64,67,68] All three reported slightly higher rates of surgical complications in the planned vaginal delivery group although these were not statistically significant.

Three other low relevance studies compared groups based on actual routes of delivery.[69,70,75] One study using composite outcomes reported a higher rate of obstetrical (pelvic) trauma in spontaneous vaginal delivery (7.35 percent) and assisted vaginal delivery (7.05 percent) than in planned "elective" cesarean (1.09 percent) or unplanned "non-elective" cesarean delivery (0.57 percent). A subanalysis comparing planned cesarean to uncomplicated spontaneous vaginal delivery yielded similar findings. Two studies found that the rate of bladder injury was lower in planned "elective" cesarean than in unplanned "emergency"[70]or "emergent" or "urgent" cesarean deliveries.[75]

Breastfeeding. Two articles (rated poor) from the Breech Trial[18,83] provided evidence on initiation and duration of breastfeeding for women experiencing planned vaginal or planned cesarean delivery. The percentages of women initiating breastfeeding "within a few hours" were 77.6 percent for planned vaginal and 73.3 percent for planned cesarean; the difference bordered on statistical significance ($P = 0.05$).[18] The percentages of women breastfeeding at 3 months and at 2 years were nearly identical.[18,83]

Postpartum pain. Four articles comprising three studies addressed postpartum pain.[18,43,51,83] Two articles reported later analyses for the Breech Trial ("T," both rated poor).[18,83] The other two were moderately relevant, one of fair quality[51] and one of poor quality.[43]

The Breech Trial examined numerous pain outcomes at 3 months postpartum: any pain, location of pain, severity of pain, and use of analgesics during the past 24 hours and found no

difference in the incidence of pain, severity of pain, or use of analgesics.[18] As expected, at 3 months postpartum women in the planned vaginal delivery group were significantly more likely to report pain in the "bottom or genital area," and women in the planned cesarean delivery group were more likely to report pain on the "outside of the abdomen" or "deep inside the abdomen."[18] These difference were no longer significant at 2 years postpartum.[83]

Of the two moderately relevant studies, the fair quality study reported maternal pain using a visual analog scale (VAS) ranging from 1 (no pain) to 10 (most severe pain),[51] that they administered at 3 days and at 4 months postpartum. At the 3-day postpartum evaluation, patients were also asked to rate retrospectively their pain at delivery. The authors presented results only in graphs, with no numerical outcomes for the VAS. They depicted a significantly higher median pain level during birth for the vaginal or assisted vaginal delivery groups than for the cesarean group. However, the authors commented that "peridural" anesthesia was offered to every woman but that only 11 percent chose it.[51] At 4 months postpartum, they observed no significant difference in "momentary birth-related pain" among the groups. The investigators presented data for a group of women who underwent "cesarean on demand" for reasons including anxiety in nulliparous women, previous traumatic birth, coordination problems, and safety considerations. However, they did not report their data in a way that permitted us to abstract usable information, comment on laboring status in this group, or note specific analyses on this subset of patients.

The other moderate relevant (poor quality) study used a one-item Pain Intensity Scale within one week of delivery.[43] This study found no difference in mean pain intensity scores among unplanned cesareans, planned cesareans, and vaginal delivery.

Psychological outcomes: postpartum depression. Four articles comprising two studies dealt with postpartum depression associated with mode of delivery. The Breech Trial (rated "T") contributed one article of fair quality[20] and two of poor quality;[18,83] the fourth study was of low relevance to CDMR.[66]

The Breech Trial report (rated poor) defined depression as a score of more than 12 on the validated Edinburgh Postnatal Depression Scale.[18] The low relevance study used the validated Center for Epidemiologic Studies Depression Scale. Neither study reported significant differences at any time point.[18,20,83]

Psychological outcomes: other. Seven articles representing six studies reported on a variety of psychological outcomes other than depression; these studies used outcomes, measures, instruments, and time points for outcome measurement that have little in common. The two articles from the Breech Trial are rated "T" and are of poor quality,[18,83] two are moderately relevant,[43,51] and three are of low relevance.[66,76,78] In general terms, women who experienced an unplanned cesarean birth or an instrumental vaginal delivery were more likely to experience adverse psychological outcomes than were women who underwent either a spontaneous vaginal or a planned cesarean birth.

The Breech Trial article reporting 3-month outcomes (rated poor) found that women in the planned cesarean delivery group were more likely than those in the planned vaginal birth group to indicate that they "liked being able to schedule their delivery" and "liked that childbirth experience was not very painful."[18] Women in the planned vaginal birth group were more likely than those in the planned cesarean group to indicate that they liked that the delivery was natural, liked actively participating in the birth, and liked that recovering from the childbirth experience was not difficult. These authors reported no differences between planned vaginal and planned cesarean births in women feeling reassured about their own health. In general, despite the differences in likes and dislikes, the planned vaginal and planned cesarean did not differ as to

whether women would "participate in the trial if they had to do it all over again" (p. 1828).[18] The follow-up study reporting outcomes at 2 years (rated poor) found no difference in the experience of being a mother, the relationship with husband or partner, or the relationship with husband or partner compared with that before the child was born.[83]

Of the two moderately relevant studies, one fair-rated study[51] used the Zerrsen test[93] for quantifying momentary personal feelings and a modified version of a birth experience questionnaire by Salmon and Drew.[94]

These investigators reported no differences in momentary personal feelings before birth. At 3 days postpartum, women in the assisted vaginal delivery and emergency cesarean delivery groups reported strong negative feelings. These differences dissipated by 4 months postpartum. In contrast, women planning a cesarean delivery without medical indications had an expectation of a more pleasant birth than did women planning a vaginal delivery or a cesarean for medical indications. Of the 44 cesareans performed "on demand," 20 (45 percent) were for women who had had a previous traumatic birth. At 3 days postpartum, the most positive birth experiences were reported by the group with planned cesarean without medical indications, followed in descending order by those with cesarean for medical indications, vaginal delivery, emergency cesarean, and assisted vaginal delivery. Results were similar at 4 months postpartum.The other moderately relevant (poor) study, using the Perception of Birth Scale[95] found no differences between the vaginal and planned cesarean delivery groups or the planned and unplanned cesarean groups.[43] However, women in the unplanned cesarean group had a more negative perception of the birth experience than did women in the vaginal group.

One low relevance study compared adaptive and ineffective responses during three time periods (1973–1980, 1981–1982, and 1989–1990). In the first and the last time periods, women in the unplanned cesarean group had a significantly lower percentage of adaptive responses and a higher percentage of ineffective responses than women who had a planned cesarean delivery. This finding was not statistically significant in the second time period.[76] A second study of low relevance appraised birth experience, neuroticism, and self-esteem.[66] None of these outcomes differed at 4 or 12 months among planned cesarean, unplanned cesarean, and vaginal delivery groups. A third study of low relevance to CDMR reported that women in the emergency cesarean and the assisted vaginal delivery groups had the most negative cognitions and emotions regarding the delivery overall compared with elective cesarean and normal vaginal delivery.[78]

Maternal length of stay. Four studies reported on length of stay; one was the Breech Trial (fair quality)[20] and three were of moderate relevance (poor quality)[28,43,50] (Table 22). The studies varied in comparison groups. Two investigated outcomes by intended route of delivery: planned vaginal vs. planned cesarean delivery,[20,50] and both reported a significantly higher median length of stay in the planned cesarean group. A third study reported length of stay separately for "planned" and "unplanned" cesarean deliveries and found significantly higher length of hospital stay among "unplanned" and "planned" cesarean compared with vaginal deliveries.[43] The fourth study limited outcomes to cesarean deliveries and found that the length of stay following a planned "elective" cesarean was shorter than among unplanned "acute" deliveries.[28] However, the authors provided no statistical test results. The results were consistent in demonstrating a longer hospital stay following planned or unplanned cesarean than following vaginal delivery.

Table 22. Maternal length of stay

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups			Statistical Test Results
Hannah et al., 2000[20] T/Fair		**Planned CD**	**Planned VD**		
	Median length of hospital stay in days	4	2.8		*P*<0.0001
Fawcett et al., Moderate/Poor		**Planned CD**	**Unplanned CD**	**VD**	
	Mean length of hospital stay in days (range)	4.9 (3-12)	4.8 (3-10)	2.5 (1-14)	*P*<0.05
Sanchez-Ramos et al., 2001[50] Moderate/Poor		**Elective CD**	**Attempted VD**		
	Mean length length of hospital stay in days (range)	4 (4,4)	2 (2,3)		*P*=0.0001
van Ham et al., 1997[28] Moderate/Poor		**Primary Elective CD**	**Primary acute CD**	**Secondary Acute CD**	
	Mean length of stay (SD)	7.2 (2.4)	7.8 (3.1)	7.6 (1.9)	NS, details NR

CD, cesarean delivery; CI, confidence interval; NR, not reported; NS, not significant; SD, standard deviation; VD, vaginal delivery.

Urinary incontinence. Nine articles comprising eight studies reported on urinary incontinence associated with mode of delivery (Table 23). Two articles were from the Breech Trial.[18,83] Two were moderately relevant,[41,44] and five were of low relevance.[70,73,74,79,82]

The Breech Trial was designed primarily to focus on neonatal outcomes following planned vaginal vs. planned cesarean for breech. As such, it has significant limitations to outcomes related to pelvic floor disorders since the study included multiparous women, allowed randomization in labor, suffered from a high degree of crossover, was performed in 26 countries, used nonvalidated instruments in multiple languages, and more than 50 percent of participants required assistance in completing the questionnaires. The 2002 Breech Trial article (poor quality) suggested that planned cesarean delivery significantly reduced the risk of urinary incontinence compared with planned vaginal delivery at 3 months, with a relative risk of 0.62 (95% CI, 0.41-0.93).[18] In the 2-year postpartum article (poor quality), the rates of urinary incontinence remained higher in the planned vaginal group than in the planned cesarean group, but the difference was no longer statistically significant.[83] The rates of urinary incontinence were about three times as high at 2 years in both groups as at 3 months postpartum. The authors suggested that a change in the reference period in the outcome measurement may explain this difference. At 3 months, women were asked about urinary incontinence in the past 7 days; by contrast, at 2 years, women were queried about the past 3 to 6 months.[83]

The two moderately relevant studies (both fair) were prospective cohort studies; they investigated symptoms of stress urinary incontinence according to actual mode of delivery and adjusted for preexisting urinary incontinence. One study found that planned "elective" cesareans performed before labor and cesareans performed during the first stage of labor appeared to be significantly protective against urinary incontinence compared with spontaneous vaginal

Table 23. Urinary incontinence

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups					Controls for Previous Incontinence	Time Period	Statistical Test Results
Hannah et al., 2002[18] T/ Poor		**Planned CD**	**Planned VD**						
	SUI	4.50%	7.30%				No	3 mos PP	*P* = 0.02
	OR (95% CI)	0.62 (0.41; 0.93)							
Hannah et al., 2004[83] T/Poor		**Planned CD**	**Planned VD**						
	SUI	17.80%	21.80%				No	2 yrs PP	*P* = 0.14
	OR (95% CI)	0.81 (0.63; 1.06)							
Farrell et al., 2001[41] Moderate/Fair		**Elective CD**	**SVD**	**Forceps**	**All CD (ref grp)**	**CD in 2nd Stage of Labor**			
	SUI	4.00%	23.00%	35.00%	8.00%	5.00%	Yes	6 wks PP	SVD and forceps significantly different from all CD
	RR (95% CI)		2.8 (1.5; 5.3)	4.3 (2.2; 8.2)					
		5.00%	22.00%	33.00%	10.00%	3.00%	Yes	6 mos PP	SVD and forceps significantly different from all CD
	RR (95% CI)		2.1 (1.1; 3.7)	3.1 (1.7; 5.9)					
Groutz et al., 2004[44] Moderate/Fair		**Elective CD**	**SVD (ref grp)**	**CD for Obstructed Labor**					
	SUI	3.40%	10.30%	12%			Yes	1 yr PP	Elective CD significantly different compared to SVD
		P = 0.02		*P* = 0.7					

CD, cesarean delivery; CI, confidence interval, NR, not reported: NS, not signficant; OR, odds ratio; PP, postpartum; ref grp, reference group; RR, relative risk; SVD, spontaneous vaginal delivery; VD, vaginal delivery.

Table 23. Urinary incontinence (continued)

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups					Controls for Previous Incontinence	Time Period	Statistical Test Results
Krebs et al., 2003[70]		**Elective CD**	**VD**	**Emergency CD**					
Low/Not rated	Hospitalization for either urinary incontinence or vaginal descensus	0.60%	0.60%	0.5% as reported in article, 1.4% as calculated by authors of this report			No	NR	NS
Mason et al., 1999[73]		**Planned CD**	**VD**	**Emergency CD**	**Forceps**	**Ventouse**			
Low/Not rated	SUI	15.90%	34.90%	17.10%	32.10%	40.10%	No	NR	$\chi 2=10.85$, $P=0.0009$ for VD vs elective CD and emergency CD, other comparisons NS
Persson et al., 2000[74]	Surgery for urinary incontinence								Groups and rates NR, but OR for elective cesarean vs. non-instrumental vaginal singleton births among primiparous women: 0.21 (95% 0.13-0.34); OR for any cesarean vs. non-instrumental VD: 0.34 (95% CI 0.23-0.52)
Low/Not rated									

Table 23. Urinary incontinence (continued)

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups				Controls for Previous Incontinence	Time Period	Statistical Test Results
Schytt et al., 2004[79]		**Elective CD**	**SVD (ref grp)**	**Instrumen-tal VD**	**Emer-gency CD**			
Low/Not rated	SUI for primiparous women	0	19.9%	21.8%	11.5%	No	1 yr PP	Multivariate analysis combined elective and emergency CD and found a protective effect compared with SVD (OR: 0.4 95% CI 0.2-0.9); instrumental VD not significantly different from SVD
	OR (95% CI)	NA	1.0	1.1 (0.8; 1.6)	0.6 (0.3; 1.0)			
	SUI for multiparous women	12.9%	25.4%	38.5%	12.7%	No	1 yr PP	Neither CD (emergency and elective combined) nor instrumental VD is significantly different from SVD
	OR (95% CI)	0.5 (0.3; 0.9)	1.0	1.5 (1.0; 2.3)	0.5 (0.3; 1.0)			

Table 23. Urinary incontinence (continued)

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups					Controls for Previous Incontinence	Time Period	Statistical Test Results
Wilson et al., 1996[82] Low/ Not rated		**Elective CD**	**SVD (ref grp)**	**Forceps**	**CD in 1st Stage of Labor**	**CD in 2nd Stage of Labor**			
	SUI among all women with no previous incontinence	8.90%	24.40%	27.00%	12.00%	7.70%	Yes	3 mos PP	Elective CD significantly different compared to SVD
	OR (95% CI)	0.3 (0.1; 0.6)		1.3 (0.8; 2.3)	NR	NR			
		Elective CD	**SVD (ref grp)**	**Forceps**	**CD in 1st Stage of Labor**	**CD in 2nd Stage of Labor**			
	SUI in primaparous subset	0.00%	24.50%	25.20%	6.10%	8.30%	NR	3 mos PP	Elective CD significantly different compared to SVD
	OR (95% CI)	0.2 (0.0; 0.6)		1.0 (0.5; 1.9)	NR	NR			

deliveries.[41] Overall, the risk of postpartum urinary incontinence at 6 weeks was as follows: forceps, 35 percent; spontaneous vaginal delivery, 23 percent; cesarean in labor, 9 percent; and elective cesarean, 4 percent. In the other moderately relevant study, the prevalence of stress urinary incontinence 1 year postpartum was not significantly different among primiparous women who underwent a spontaneous vaginal delivery (10.3 percent) from the rate among women who had a cesarean delivery for obstructed labor (12.0 percent), but was significantly lower for women who underwent an elective cesarean (3.4 percent) ($P = 0.02$).[44]

Three of the five low relevance studies compared symptoms of stress urinary incontinence by actual route of delivery. Two concluded that cesarean delivery had a protective effect relative to vaginal delivery.[73,82] The third showed lower rates of stress urinary incontinence for women who had a cesarean delivery compared with women who had a vaginal delivery; these results were statistically significant for primiparous women only.[79]

The remaining two studies of low relevance to CDMR linked surgical administrative databases and birth registries to assess the association between route of delivery and surgery for stress urinary incontinence[74]or hospitalization for either stress incontinence or "vaginal descensus."[70] They yielded conflicting information about urinary incontinence issues.

Anorectal function. Of the seven articles comprising six studies (Table 24) that reported on anal incontinence associated with mode of delivery, two were from the Breech Trial.[18,83] Two others were moderately relevant,[42,46] and three were of low relevance.[70-72]

Six articles assessed symptoms of anal incontinence.[18,42,46,71,72,83] The seventh, a population-based study, linked an administrative database and birth registry of primiparous women who delivered singleton breech infants at term to assess the association between route of delivery and anal sphincter rupture over a period of up to 23 years.[70]

Of the six studies reporting on symptoms, all but one included flatal incontinence in addition to involuntary loss of solid or liquid stool in their definition of anal incontinence. The remaining study limited its definition of anal incontinence to frank incontinence and fecal urgency.[71]

Three studies assessed women for preexisting anal incontinence.[42,46,71] No study used a validated instrument. The time period for the assessment of anal incontinence ranged from 3 months[18] to 2 years.[83]

The two Breech Trial reports (rated poor)[18,83] used different measures at two time points; questions related to fecal incontinence were added after some participants had already completed the study. At 3 months, the authors queried participants regarding whether they had experienced fecal incontinence in the past 7 days.[18] At 2 years, however, the participants were asked about fecal incontinence over the previous 3 to 6 months.[83] Neither article reported a significant difference in rates of fecal incontinence between planned vaginal and planned cesarean.

The two moderately relevant studies were of fair quality.[42,46] One reported new onset symptoms of anal incontinence in 3 of 80 women (3.8 percent) in the planned "elective" cesarean group, 6 of 104 women (5.8 percent) in the unplanned "emergency" cesarean group, and 8 of 100 (8 percent) in the vaginal delivery group.[46] This progression suggested an increasing risk of fecal incontinence with emergency cesarean and vaginal delivery compared with elective cesarean. However, the authors limited their statistical comparison to overall cesarean (elective and emergency) against vaginal delivery ($P = 0.427$). They also noted a higher risk of severe fecal incontinence after elective cesarean, 2 of 80 women (2.5 percent), than after emergency cesarean, 1 of 104 women (0.96 percent); the latter rate was similar to that for vaginal delivery, 1 of 100 women (1 percent). The authors suggested that elective cesarean is not always protective

Table 24. Anorectal function

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups					Controls for Previous Incontinence	Time Period	Statistical Test Results
Hannah et al., 2002[18] T/Poor		**Planned CD**	**Planned VD**						
	Fecal incontinence	0.8%	1.5%				No	3 mos PP	*P* = 0.29
	RR (95% CI)	0.54 (0.18-1.62)	1.0						
Hannah et al., 2004[83] T/Poor		**Planned CD**	**Planned VD**						
	Fecal incontinence	2.4%	2.2%				No	2 yrs PP	*P* = 0.83
	RR (95% CI)	1.10 (0.47-2.58)	1.0						
Farrell et al., 2001[42] Moderate/Fair		**Elective CD**	**SVD**	**Forceps**	**All CD (ref grp)**	**CD in 2nd Stage of Labor**			
	Flatal incontinence	31%	16%	34%	19%*	17%	Yes	6 wks PP	
	RR (95% CI)		0.8 (0.5; 1.5)	1.8 (1.0; 3.1)					
	Flatal incontinence	0%	17%	44%	18%	21%	Yes	6 mos PP PP	
	RR (95% CI)		1.0 (0.6; 1.8)	2.5 (1.4; 4.5)					
	Fecal incontinence	4%	4%	9%	2%	2%	Yes	6 mos PP PP	
	RR (95% CI)		1.7 (0.5; 5.9)	3.6 (1.0; 13.4)					

CD, cesarean delivery; CI, confidence interval; NR, not reported; NS, not signficant; PP, postpartum; SVD, spontaneous vaginal delivery; VD, vaginal delivery.
*: Note this figure is reported as both 19% and 31% in a single table in the article; the figure of 31% appears to be a typographical error.

Table 24. Anorectal function (continued)

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups						Controls for Previous Incontinence	Time Period	Statistical Test Results
Lal et al., 2003[46] Moderate/Fair		**Elective CD**	**Emergency CD**	**VD (Non-instrumental)**						
	New anal incontinence	3.8%	5.8%	8%				Yes	10+/-2 mos PP	NR
	Severe fecal incontinence	2.5%	0	1%				Yes	10+/-2 mos PP	*P* = 0.716
Krebs and Langhoff-Roos, 2003[70] Low/Not rated		**Elective CD**	**VD**	**Emergency CD**						
	Anal sphincter rupture	0	1.7%	0				No	Up to 23 years PP	NS
MacArthur et al., 2001[72] Low/Not rated		**Elective CD**	**SVD (ref grp)**	**Forceps**	**Vaccum**	**Breech**	**Emergency CD**			
	Fecal incontinence in all women	7.3%	9.6%	13.6%	10.3%	13.8%	7.5%	No	3 mos PP	NR
	Fecal incontinence in primiparous subset	5.4%	8.8%	13.9%	9.3%	12.0%	4.8%	No	3 mos PP	NR
		Multiple regression of primiparous women combined emergency and elective cesareans and showed that cesareans overall had a lower risk of fecal incontinence than did spontaneous vaginal deliveries (OR = 0.58; 95% CI, 0.35-0.97)						No	3 mos PP	Significantly different
	Fecal incontinence in multiparous subset	8.0%	10.0%	12.2%	14.3%	15.0%	12.3%	No	3 mos PP	NR

Table 24. Anorectal function (continued)

Author, Year Relevance/Quality Rating	Measure	Outcomes for Comparison Groups					Controls for Previous Incontinence	Time Period	Statistical Test Results
		Elective CD	**SVD (ref grp)**	**Forceps**	**Vaccum**	**Emergency CD**			
MacArthur et al., 1997[71] Low/Not rated	Fecal incontinence in all women	0	3.2%	7.2%	22.2%	5.3%	Yes	45 weeks PP	Only forceps and vaccum are significantly different from SVD
		NS significant "because of small numbers,"		*P* = 0.027	*P* = 0.002	NR	Yes		
	Fecal incontinence in primiparous subset	0	2.6%	5.8%	21.4%	8.5%	Yes		
	Fecal incontinence in multiparous subset	0	3.4%	12.5%	25.0%	1.9%	Yes		

and that symptoms of fecal incontinence associated with elective delivery can be severe. However, these results need to be interpreted with caution given the low incidence rates overall.

The other moderately relevant study reported a significantly lower rate of flatal incontinence at 6 months in the planned "elective" cesarean group (0 percent) than in the unplanned "in labor" cesareans (21 percent).[42] The authors of the study noted that the risk of flatal incontinence was higher with forceps-assisted delivery than with spontaneous vaginal delivery and that the risk of both flatal and fecal incontinence was higher in both groups than in all cesarean deliveries.

Of the three low relevance studies, one reported that primiparous women had no cases of anal incontinence in the elective cesarean group (0 of 13 women).[71] For the other modes of delivery, the rates of anal incontinence in descending order were as follows: vacuum delivery, 3 of 14 women (21.4 percent); emergency cesarean, 5 of 59 women (8.5 percent); forceps delivery, 5 of 86 women (5.8 percent); and spontaneous vaginal delivery, 5 of 189 women (2.6 percent). Similarly, among multiparous women, no case of anal incontinence occurred in the elective cesarean group (0 of 48 women). The overall rates of fecal incontinence in descending order were as follows: vacuum delivery, 1 of 4 women (25.0 percent); forceps delivery, 3 of 24 women (12.5 percent); spontaneous vaginal delivery, 13 of 379 women (3.4 percent); and emergency cesarean, 1 of 54 women (1.9 percent). The authors reported no statistically significant difference among groups and attribute this to small numbers. The authors performed logistical regression modeling and found that both vacuum and forceps were statistically associated with anal incontinence, $P = 0.002$ and $P = 0.027$, respectively.

Another low relevance study was a prospective questionnaire study comparing symptoms and actual route of delivery.[72] Cesareans overall had a lower risk of fecal incontinence than did spontaneous vaginal deliveries (OR = 0.58; 95% CI, 0.35-0.97). This study also found a higher risk of fecal incontinence associated with forceps deliveries than with spontaneous vaginal delivery (OR = 1.94; 95% CI, 1.30-2.89).

The other low relevance study from the administrative database reported no case of anal sphincter rupture in either the elective (n = 7,503) or emergency cesarean groups (n = 5,575).[70] They did report, however, 41 of 2,363 cases (1.7 percent) in the vaginal delivery group. No group had any hospitalizations for either anal incontinence or fistula.

Pelvic organ prolapse. One low relevance study that examined pelvic organ prolapse associated with various actual modes of delivery, using an administrative data set compared hospitalizations for either vaginal descensus or urinary incontinence between 5 and 18 years after delivery.[70] The publication appears to have a typographical error. The rate of hospitalization for either prolapse or urinary incontinence was reported as 42 of 7,503 (0.6%) for elective cesarean, 13 of 2,363 (0.55%) for vaginal delivery, and 80 of 5,575 (1.4%) for emergency cesareans. However, the actual manuscript reports the rate of hospitalization in the emergency cesarean group as "80/5575 (0.5%)." The authors report that difference in hospitalization for either pelvic organ prolapse or urinary incontinence did not differ statistically, but they state that they are unsure how to interpret these results accurately. The potential error seems limited to the emergency cesarean group.

Sexual function. Two articles comprising the Breech Trial,[18,83] received a relevance rating of T, were of poor quality, and included sexual function outcomes. Sexual function was measured differently at three months and two years after delivery. At three months, measures included sex since birth and pain during sex on most recent occasion. At two years, measures included aparuenia, dysparuenia, the presence and extent of sexual problems and happiness with sexual relations. No statistically significant differences were noted at either time point for any measure.

However, we note that none of the measures was validated and the instruments were administered in multiple languages and with the assistance of translators.

Maternal Outcomes Relevant to Subsequent Cesarean Deliveries

As noted in Chapter 2, our search strategy focused on outcomes of primary cesarean deliveries. However, we recognize that any decision related to CDMR needs to balance the comprehensive risks and benefits for both mother and infant, for short- and long-term complications associated with first and future cesarean deliveries. The following outcomes, as such, are particularly relevant to subsequent cesarean deliveries. We augment the following discussion by summarizing or updating other systematic reviews on the following topics.

Subsequent fertility issues. We identified a single study that examined subsequent fertility issues including admissions for infertility, ectopic pregnancy, and hospitalization for miscarriage. It study reports similar rates among elective cesarean, emergency cesarean, and vaginal delivery.[70] The study controls for mode of delivery in the first pregnancy but not subsequent pregnancies and therefore does not contribute usable data to answer the question.

Subsequent uterine rupture. We identified a single study reporting a higher rate of uterine rupture in emergency cesarean delivery (3/636, 0.5%) compared to "elective" cesarean delivery (0/294).[38] This study did not include a vaginal delivery comparison group, thus limiting its utility. Nonetheless, this issue is of interest to the SOS conference, and we attempted to address it through a summary of results of the recent update[32] of the AHRQ systematic review on vaginal birth after cesarean.[96] The update noted that several large cohort studies of fair or poor quality investigated the incidence of uterine rupture of a cesarean scar and factors that affect the risk, but classification and terminology were inconsistent across the studies. Reports used two definitions: "asymptomatic uterine rupture of a cesarean scar" to indicate the opening of a prior incision with no signs or symptoms, also called uterine dehiscence; and "symptomatic uterine rupture of a cesarean scar" to indicate uterine separation diagnosed at laparotomy performed because of fetal heart rate disturbances, maternal bleeding, or other signs of maternal or neonatal consequences. The update found no statistically significant differences between trial of labor after cesarean and elective repeat cesarean delivery with regard to asymptomatic uterine rupture rates. It also reported two studies of fair or good quality[97] that yielded a higher (but small) risk of symptomatic uterine rupture in women receiving a trial of labor after previous cesarean than among women receiving elective repeat cesarean delivery, with "an increased risk of 2.7/1,000 deliveries"[96] (page 3).

Placenta previa. *Summary of recent meta-analysis.* One frequently cited repercussion of cesarean delivery is abnormal placentation, in particular, placenta previa in subsequent deliveries. For this outcome, we summarized and then updated a recent review by Faiz and Ananth.[31] This meta-analysis examined etiology and risk factors for placenta previa by reviewing 58 observational studies published between 1966 and 2000. These 58 studies included 32 hospital-based retrospective cohort studies, 15 hospital-based case-control studies, 6 population-based case-control studies, and 5 population-based retrospective cohort studies. Study populations ranged from 6,576 to 1,825,998 pregnancies. Placenta previa prevalence estimates were between 1.0 and 19.7 per 1,000 births. Faiz and Ananth derived placenta previa rates of 3.5 to 4.6 per 1,000 pregnancies based on study type and geographic location.

In all, 21 studies evaluated by Faiz and Ananth investigated the association between placenta previa and previous cesarean delivery; of these, they considered 4 to be well-designed studies.

They calculated random-effects pooled odds ratios that ranged from 1.9 (95% CI, 1.7-2.2) for well-designed studies to 3.5 (95% CI, 2.7-4.6) for poorly designed studies.

Advancing maternal age and increasing parity were also associated with increased odds of placenta previa, with the highest risk found in women of both advanced age and advanced parity. As an example provided in the meta-analysis, for a woman age 40 or older, with three previous pregnancies, the odds ratio of placenta previa in this meta-analysis was 11.96 (95% CI, 10.80-13.24); by contrast, for a woman 20 to 24 years of age and of parity one, the odds ratio was1.61 (95% CI, 1.50-1.72). These associations could prove important confounders in any association between previous cesarean delivery and placenta previa.

Our update of recent meta-analysis. Applying the same search methods that Faiz and Ananth used for their meta-analysis,[31] we examined the literature on placenta previa published between 2000 and 2005. We identified 131 articles, reviewed 34 full-text articles, and included all 13 articles that met inclusion criteria (namely, published between March 2000 and May 2005, English language, observational study of placenta previa diagnosed in third trimester or at delivery, with evaluation of cesarean delivery as a risk factor for placenta previa). We excluded case reports and studies without a comparison group. We included five hospital-based case-control studies, four hospital-based retrospective cohort studies, two population-based retrospective cohort studies, and one hospital-based and one clinic-based cross-sectional study. As in the recent meta-analysis, our summary table (Table 25) is presented by study design. Our populations ranged from 272 to 370,374 and up to 740,748 deliveries; prevalence estimates for placenta previa ranged from 1.9 to 5.2 per 1,000 pregnancies. Using Faiz and Ananth's quality scoring system for study design (1–5) and method of diagnosis of placenta previa (1–4), we assigned two quality scores to each study: 5 and 4 represented the best quality, respectively. We gave seven studies quality scores of 4 and six studies quality scores of 3 for diagnostic technique, taking into account how well the technique was specified. For quality of study design, six studies received scores of 4 or 5, five studies received scores of 3, and two studies scores of 2 (Table 26).

Adjusted odds ratios for placenta previa, relative to one or more prior cesarean deliveries ranged from 1.32 (95% CI, 1.04-1.68) to 4.7 (95% CI, 1.9-11.4). Two studies reported increased odds of placenta previa related to the number of previous cesareans and increased parity, as also demonstrated in the Faiz and Anath meta-analysis. The unadjusted odds ratio for six prior cesareans compared with three prior cesareans was 3.8 (95% CI, 1.9-7.4). The highest odds ratio reported was 8.76 (95% CI, 1.58-48.53) for women with parity 4 and four prior cesarean deliveries, but the confidence interval was very wide. One study demonstrated that placenta previa diagnosed during second trimester ultrasound was less likely to resolve in women with a previous cesarean than in women without a prior cesarean delivery.[98] A single study of women with placenta previa, demonstrated a higher adjusted odds of hysterectomy in those with prior cesarean delivery than those without any prior cesarean.[99]

Subsequent stillbirth. We excluded studies of repeat cesarean delivery in accordance with our understanding that this systematic review was to focus on primary CDMR. Thus, our exclusion criteria yielded a pool of studies that is unlikely to be exhaustive for subsequent stillbirth. Only one study that met inclusion criteria for this systematic review also included data on subsequent stillbirths. It did not show a difference in rates of subsequent stillbirth among elective cesarean, emergency cesarean, and vaginal delivery.[70]

Table 25. Description of studies addressing placenta previa relative to a history of previous cesarean delivery

Author Study Location Study dates	Study Design	Data Source	Study Population Size	Effect Measure Crude (COR) or Adjusted (AOR) Odds Ratio (95%C.I.) or Prevalence
Crane et al., 2000[99] Canada 1988-1995	Retrospective cohort, population-based	Nova Scotia Atlee Perinatal Database, all deliveries in Nova Scotia	308 PPs 93,996 deliveries	OR for hysterectomy during CD for PP, relative to prior CD: COR 11.90(3.70,38.26) AOR 16.92(3.51,81.70) (Adjusted for placenta accreta, maternal age, gestational age, antepartum bleed)
Lydon-Rochelle et al., 2001[100] USA 1987-1996	Retrospective cohort, population-based	Washington State Birth Events Record Database from hospital discharge data	493 PPs 95,630 subjects	OR for PP at second birth, relative to prior CD vs. VD at first birth: AOR 1.4(1.1,1.6) (Adjusted for age)
Francois et al., 2001[101] USA 1997-2000	Retrospective cohort, hospital-based	Good Samaritan Regional Medical Center, ICD-9 codes	55 PPs 29,268 deliveries	Percentage of PP deliveries with history of prior CD: 5/55 = 9.1%
Dashe et al., 2002[98] USA 1991-2000	Retrospective cohort, hospital-based	Ultrasound and obstetric database at Parkland Hospital	230 PPs persisted 714 PPs diagnosed	OR for persistent PP relative to prior CD, for diagnosis made at each gestational age category: 15-19 wks: COR 2.6(1.2,5.4) AOR 2.3(1.1,4.9) 20-23 wks: COR 4.7(1.8,12.2) AOR 4.9(1.7,14.0) 24-27 wks: COR 5.3(1.8,15.4) AOR 4.5(1.3,14.9) 28-31 wks: COR 1.2(0.6,2.7) AOR 1.1(0.4,2.6) 32-35 wks: COR 1.5(0.6,3.6) AOR 1.8(0.7,4.9) (Adjusted for age, parity, type of PP)

CD, cesarean delivery; NR, not reported, PP placenta previa; VD, vaginal delivery; USA, United States of America.

Table 25. Description of studies addressing placenta previa relative to a history of previous cesarean delivery (continued)

Author Study Location Study Dates	Study Design	Data Source	Study Population Size	Effect Measure Crude (COR) or Adjusted (AOR) Odds Ratio (95%CI) or Prevalence
Rasmussen et al., 2000[102] Norway 1967-1992	Retrospective cohort, hospital- based	Medical Birth Registry of Norway and population census	826 PPs 370,374 subjects 740,748 deliveries	OR for PP in second pregnancy relative to prior CD in first pregnancy: COR: 1.61(1.28-2.03) AOR: 1.32(1.04-1.68) (Adjusted for age, prior placental previa)
Sheiner et al., 2001[101] Israel 1990-1998	Retrospective cohort, hospital- based	Soroka University Medical Center medical records	298 PPs 78,524 pregnancies	Prevalence of prior CD: In patients with previa: 20.5% In patients without previa: 9.8% ($P < 0.001$) OR for PP, relative to prior CD: AOR 1.8 (1.4-2.4) (Adjusted for ethnicity, age, parity, pregnancy-induced hypertension, infertility treatments, habitual abortions, previous perinatal death)
Hossain et al, 2004[103] Bangladesh 2000 or 2001-2002	Cross-sectional, clinic-based	Mymensingh Centre for Nuclear Medicine and Ultrasound	34 PPs 2,536 subjects	Prevalence of PP in those with prior CD: 0.65% Prevalence of PP in those with prior VD: 1.97%
Makoha et al., 2004[104] Saudi Arabia 1997-2000	Cross-sectional, hospital-based	Maternal and Children's Hospital clinical records	162 PPs 3,191 subjects	Prevalence of PP associated with the number of prior CDs: 1: 3.9% 2: 3.2% 3: 5.1% 4: 6.9% 5: 9.4% 6+: 16.9% ($P = 0.005$ for 3-6+) OR for PP, relative to the quantity of prior CDs, compared to 3 prior CDs: COR: 4 vs.3: 1.4(0.8,2.2) COR: 5 vs.3: 1.9(1.0,3.5) COR: 6 vs.3: 3.8(1.9,7.4)

Table 25. Description of studies addressing placenta previa relative to a history of previous cesarean delivery (continued)

Author Study Location Study Dates	Study Design	Data Source	Study Population Size	Effect Measure Crude (COR) or Adjusted (AOR) Odds Ratio (95%C.I.) or Prevalence
Gilliam et al., 2002[105] USA 1986-1989	Case-control, hospital-based	University of Illinois Perinatal Center and the Cook County Perinatal Center registries	316 PPs 2051 controls	OR for the number of prior CDs vs. 0: 1 vs. 0: COR: 1.18(0.84,1.64) 2 vs. 0: COR: 2.56(1.64,4.00) 3+ vs. 0: COR: 3.62(1.45,9.10) OR for PP, relative to parity and prior CDs: Parity 1, 1 prior CD: AOR: 1.28(0.82,1.99) Parity 2, 2 prior CDs: AOR: 1.95(1.13,3.39) Parity 3, 3 prior CDs: AOR: 4.09(1.53,10.96) Parity 4, 4 prior CDs: AOR: 8.76 (1.58, 48.53) Parity 4, 1 prior CD: AOR: 1.72(1.12, 2.64)
Eniola et al., 2002[106] Nigeria NR	Case-control, hospital-based	Obafemi Awolowo University Teaching Hospitals Complex	136 PPs 136 controls	OR for PP, relative to prior CD: COR: 5.3(2.3,12.5) AOR: 4.7(1.9,11.4) (Adjusted for age, education, gravidity, prior placenta previa, prior retained placenta, abortion)
Johnson et al., 2003[107] USA 1990-1992	Case-control, hospital-based	5 major obstetrics hospitals, identified potential subjects by ICD-9, then interviewed	192 PPs 622 controls	Prevalence of prior CD among parous cases and controls: Cases: 28.6% Controls: 27.1%
Tuzovic et al., 2003[108] Croatia 1992-2001	Case-control, hospital-based	Women's Hospital, Zagreb University School of Medicine	202 PPs 1004 controls	OR for PP, relative to prior CD: 1 prior CD: COR: 1.45(0.73,2.9) ≥ 1 prior CDs: COR: 2.0(1.17,3.44) ≥ 2 prior CDs: COR: 7.32 (2.1,25)
Laughon et al., 2005[109] USA 2000-2003	Case-control, hospital-based	University of North Carolina hospital medical records, ultrasound database, perinatal database	88 PPs 264 controls	OR for PP, relative to 1 prior CD: OR 3.95(1.49,10.50) OR for PP, relative to each additional CD: OR 2.93 (1.60, 5.39)

Table 26. Description of study quality and inclusion and exclusion criteria for update of placenta previa

Author	Placenta Previas per 1,000 births	Inclusion Criteria	Exclusion Criteria	Study Question	Quality Rating	
					Design (1-5)	Diagnosis (1-4)
Crane et al., 2000[99]	3.3	All deliveries >20 weeks in the province of Nova Scotia	NR	To describe the maternal complications of previa, to describe the factors associated with complications	Logistic regression, adjusted for confounders 5	Ultrasound, confirmed at delivery 4
Lydon-Rochelle et al., 2001[100]	5.2	Primiparas with singleton live birth followed by a singleton birth during study period, in civilian hospital in Washington	Placental abruption or previa at first-birth	To evaluate the association between first birth cesarean delivery and placenta abruption or previa at second birth	Logistic regression, clear inclusion and exclusion criteria, looked for interaction and confounding 5	ICD-9 code generated from delivery 3
Francois et al., 2003[110]	1.9	Placenta previa or marginal previa (≤ 1 cm from os)	Low-lying placenta > 1 cm from os	To compare the occurrence of placenta previa between singleton and multiple gestation	No comparison group for prevalence of prior CD in deliveries without PP 2	Confirmed at delivery 4
Dashe et al., 2002[98]	NR	Complete or incomplete PP by ultrasound, liveborn singletons ≥ 25 weeks	Low lying placenta, women delivered vaginally for incomplete previas	To measure the persistence of placenta previa associated with diagnosis at increasing gestational age, to estimate effect of prior cesarean on previa persistence	Analyzed only the cohort of PP that had been diagnosed by ultrasound during pregnancy and confirmed at delivery = "persistent previa" Adjusted 3	Ultrasound, confirmed at delivery 4
Rasmussenet al., 2000[102]	2.3	NR	Women with only one delivery in study period, first delivery before study period, sibships with multiple births, those without complete information	To evaluate trends for placenta previa and whether previa is associated with previous pregnancies, cesarean deliveries, or socioeconomic factors	Logistic regression, adjusted for confounders, appropriate exclusions, but included PP in first delivery 4	Unclear basis for diagnosis, assume at delivery given data source 3

CD, cesarean delivery; ICD-9, International Classification of Diseases, 9th Revision; NA, not available; OR, odds ratio; PP, placenta previa; VD, vaginal delivery.

Table 26. Description of study quality and inclusion and exclusion criteria for update of placenta previa review (continued)

Author	Placenta Previas Per 1000 Births	Inclusion Criteria	Exclusion Criteria	Study Question	Quality Rating	
Sheiner et al., 2001[101]	3.8	All singleton deliveries with complete PP	NR	To determine the incidence of and the epidemiological risk factors and outcome for pregnancies complicated by placenta previa	Logistic regression, adjusted for confounders 5	Ultrasound, confirmed at delivery 4
Hossain et al., 2004[103]	NR	Presented for ultrasound at ≥ 28 wks, partial, marginal, or complete previas	Less than 28 wks gestation	To assess the prevalence of lower segment placenta (placenta previa) and its association with previous cesarean delivery, parity, and maternal age	Unclear exclusion criteria, no measures of significance given 2	Ultrasound at 28 wks or later 3
Makoha et al., 2004[104]	NR	Women with ≥ 1 CD with complete, partial or marginal PP	Prior uterine rupture, scar dehiscence, or rupture of CD scar; prior classical CD; any missing data from any indicator variable	To quantify maternal risk associated with cesarean delivery and to determine if a third cesarean is a threshold for increased morbidity	All patients had prior CD, addressed confounders, risk for potential bias in choice of subjects 3	Ultrasound at 28-32 wks 3
Gilliam et al., 2002[105]	NR	Partial or total previa, singleton pregnancy, multiparous	NR	To estimate the likelihood of placenta previa after multiple cesarean deliveries and to adjust for parity and the effect of other risks factors for previa	Adjusted for confounders 4	Medical record generated from delivery 3
Eniola et al., 2002[106]	NR	Controls: first delivery after case delivery without previa at >37wks, ≥ 2500 g, included twins	NR	To determine the risk factors for placental previa in Nigeria	Logistic regression, adjusted for confounders 4	Confirmed at delivery 4

Table 26. Description of study quality and inclusion and exclusion criteria for update of placenta previa review (continued)

Author	Placenta Previas Per 1000 Births	Inclusion Criteria	Exclusion Criteria	Study Question	Quality Rating	
Johnson et al., 2003[107]	NR	Singleton birth	Multiples, < 20 wks gestation, <500 g birth weight	To evaluate the risk of placenta previa associated with a history of induced abortion	No significance reported, OR not reported for CD and not adjusted 3	ICD-9 screening followed by subject interview, but not specified criteria for diagnosis 3
Tuzovic et al., 2003[108]	3.8	Complete, partial, marginal PP	Low-lying placenta, incomplete data, multiple gestations, placenta abruption, succenturiate placenta, placenta acreta	To evaluate potential risk factors and assess perinatal outcome for pregnancies complicated by placenta previa	Univariate analysis with stratification, presented crude OR 3	Ultrasound, confirmed at delivery 4
Laughon et al., 2005[109]	NR	Singleton pregnancies with ultrasound during second trimester, complete PP	Low-lying placenta	To determine whether the apparent increased risk in placenta previa associated with cesarean delivery is due to abnormal placentation or lower likelihood of resolution of previa diagnosed in second trimester	Case-control OR for PP at delivery were not described as adjusted, multiple sources of bias 3	Ultrasound, confirmed at delivery 4

Neonatal Outcomes

We examined all included studies for a range of neonatal outcomes summarized below in text and tables. Evidence Table 2 (Appendix C)[†] provides the detailed information on all articles cited below. The approaches to determining relevance and grading the quality of individual studies are the same as for maternal outcomes (above).

Fetal mortality. We did not identify any studies with data on fetal mortality.

Neonatal mortality. A moderately relevant study of fair quality reported no neonatal mortality in either the elective cesarean delivery or the trial of vaginal delivery group, but it was underpowered to detect differences.[53,81]

The low relevance study reported neonatal deaths by mode of delivery.[81] The authors reported death before discharge in 1 per 10,000 infants delivered spontaneously, 3 per 10,000 delivered by vacuum extraction, 5 per 10,000 delivered with the use of forceps, 6 per 10,000 delivered with the use of vacuum extraction and forceps combined, and 8 per 10,000 delivered by cesarean. The death rate did not differ significantly between infants delivered spontaneously and those delivered by vacuum extraction (OR = 1.5; 95% CI, 0.8-2.8, by forceps delivery (OR = 1.9; 95% CI, 0.60- 5.4), or vacuum extraction combined with forceps delivery (OR = 2.6; 95% CI, 0.4- 5.4). Significantly more deaths occurred among infants delivered by cesarean delivery than among those delivered spontaneously (OR = 3.7; 95% CI, 2.6-5.4). The death rate was the same for infants born by cesarean delivery during labor and for those born by cesarean delivery with no labor (0.8 per 1,000). These results did not adjust for underlying maternal or neonatal indications that might have dictated the choice of delivery route.

Unexpected (iatrogenic) prematurity. We found no studies that addressed unexpected (iatrogenic) prematurity as an outcome. The only valid method to determine whether the problem of unexpected prematurity exists is to analyze studies that included cesarean deliveries performed solely because of maternal choice in comparison with studies involving other modes of delivery. Because we did not identify articles that received a high relevance rating (specifically, maternal choice cesarean), we cannot comment on this outcome.

Other studies we reviewed may have included some "elective" cesarean deliveries. However, all had some maternal or neonatal indication that led to cesarean, and potentially a preterm delivery, such as placenta previa, breech, hypertension, or fetal distress; they would not provide an appropriate base on which to comment on this particular outcome.

Respiratory morbidity. Of the eight studies (nine articles) that included respiratory morbidity as an outcome, we rated four as moderately relevant, all of fair quality,[47,48,51-53] and four as low relevance.[65,77,80,81] (Table 27).

Studies generally defined respiratory morbidity clinically as transient tachypnea of the newborn (TTN), respiratory distress syndrome (RDS), and persistent pulmonary hypertension (PPH). Our search strategy required a comparison of planned cesarean with planned vaginal delivery; as a consequence, our review did not include studies of meconium aspiration syndrome (MAS). One study reported "respiratory adaptation problems" without further explanation.[51] However, some studies reported surrogate outcomes such as neonatal intensive care unit (NICU) admission or need for positive pressure ventilation (PPV).[53]

The inverse relationship between respiratory morbidity and gestational age is well known. However, two of the eight studies included extremely premature infants under 27 weeks'

[†] Appendixes and Evidence Tables for this report are provided electronically at http://www.ahrq.gov/downloads/pub/evidence/pdf/cesarean/cesarreq.pdf

gestation;[65,77] a third study included infants with gestational age ≥ 35 weeks;[47] and a fourth study of an administrative database included infants between 2,500 and 4,000 grams but did not report gestational age.[81] The remaining four studies included infants ≥ 37 weeks.[48,51-53,80]

Four studies provide a subanalysis of outcomes by gestational age.[48,52,53,77,80] No study reported on severity of respiratory morbidity by gestational age.

With respect to the four moderately relevant studies, three included TTN and RDS as outcomes.[47,48,52,53] Additionally, the Levine study included PPH,[47] and the Zanardo study reported the incidence of PPV.[53] Two moderately relevant studies provided a subanalysis by gestational age.[48,52,53]

Three of these studies reported a significantly higher risk of respiratory morbidity associated with elective cesarean delivery than with vaginal delivery.[47,48,52,53]

Both moderately relevant studies with gestational age subanalyses showed a reduction in respiratory morbidity associated with advancing gestational age.[48,52,53] One study found that the risk of RDS but not TTN was significantly higher with "elective" cesarean from 37 weeks through 38 weeks and 6 days gestation.[52,53] However, neither RDS or TTN was significantly different from 39 weeks through 41 weeks and 6 days gestations.

The other moderately relevant study combined RDS or TTN requiring an NICU admission into a composite measure of respiratory morbidity in the subanalysis for gestational age.[48] The rate of respiratory morbidity was significantly higher among prelabor cesarean deliveries than among vaginal deliveries from 37 weeks through 39 weeks and 6 days gestation, but the rate did not differ significantly between these groups thereafter.

The fourth moderately relevant study compared "elective cesarean" with intended vaginal delivery. The authors reported a single case of "respiratory adaptation problems" in 147 elective cesareans, but they did not report any statistical testing.[51]

Table 27. Respiratory morbidity

Author, Year Relevance/ Quality Rating	Measure	Outcomes for Comparison Groups			Statistical Test Results
Levine et al., 2001[47] Moderate/Fair		**Elective CD**	**VD (ref grp)**	**All CD**	
	TTN	3.10%	1.10%	3.50%	*P* < 0.001
	OR (95% CI)	2.8 (2.1; 3.8)	1.0	3.3 (2.6; 3.9)	
	RDS	0.20%	0.16%	0.47%	Only all CD vs vaginal is significant
	OR (95% CI)	3.0 (1.6; 5.3)	1.0	1.3 (0.; 3.8)	
	PPH	0.37%	0.08%	0.40%	*P* < 0.01
	OR (95% CI)	4.6 (1.3; 11)	1.0	4.9 (2.2; 8.8)	
Morrison et al., 1995[48] Moderate/Fair		**Prelabor CD**	**VD (ref grp)**	**CD in labor**	
	TTN	2.26%	0.41%	0.84%	NR
	RDS	1.28%	0.11%	0.38%	NR
	RDS+TTN	3.55%	0.51%	1.22%	
	OR (95% CI)	6.8 (5.2; 8.9)	1.0	2.3 (1.6; 3.5)	
Zanardo et al., 2004;[53] Zanardo et al., 2004[52] Moderate/Fair		**Elective CD**	**VD (ref grp)**		
	TTN	0.93%	0.85%		NR
	RDS	2.26%	0.39%		*P* < 0.01
	OR (95% CI)	2.60 (1.35; 5.90)	1.0		
	Need for positive pressure ventilation (PPV)	3.4%	1.4%		*P* < 0.01
	OR (95% CI)	2.05 (1.25; 5.67)	1.0		

TTN, transient tachypnea of the newborn; RDS, Respiratory distress syndrome; PPH, persistent pulmonary hypertension; AVD, assisted vaginal delivery; ref grp, reference group; NS, not significant; NR, not reported; OR, odds ratio; CI, confidence interval.

Table 27. Respiratory morbidity (continued)

Author, Year Relevance/ Quality Rating	Measure	Outcomes for Comparison Groups								Statistical Test Results
Schindl et al., 2003[51]		**Elective CD**	**Intended VD**							
Moderate/Fair	Respiratory adaptation problems	0.70%	0.00%							NR
Dani et al., 1999[65]		**Elective CD**	**VD (ref grp)**	**AVD**	**Emergency CD**					
Low/Not rated	RDS	1.43%	0.49%	0.06%	26.65%					
	OR (95% CI)	1.88 (1.42; 2.48)	1.0	NR	OR: 3.46 (2.69; 4.44)					*P* < 0.0001
	TTN	1.42%	0.51%	0.80%	14.66%					
	OR (95% CI)	1.86 (1.48; 2.33)	1.0	NR	2.86 (2.25; 3.63)					*P* < 0.0001
Sutton et al., 2001[80]		**Elective CD**	**VD (ref grp)**	**Forceps Delivery**	**Emergency CD**					
Low/Not rated	RDS	NR	NR	NR	NR					Significantly different
	OR (95% CI)	2.64 (1.42; 4.90)	1.0	4.47 (2.11; 9.44	4.07 (2.13; 7.78)					
Towner et al., 1999[81]		**Unlabored CD**	**Spontaneous vaginal (ref grp)**	**Vacuum extraction**	**Forceps**	**Forceps and Vacuum**	**Labored CD**	**Labored CD with Attempt at Vacuum or Forceps**	**Labored CD, no Attempt at Vacuum or Forceps**	
Low/Not rated	Mechanical Ventilation	0.71	0.258	0.39	0.45	0.50	1.03	1.56	1.02	Significantly different
	OR (95% CI)	2.8 (2.4; 3.3)	1.0	1.5 (1.3; 1.8)	1.8 (1.4; 2.3)	1.9 (1.1; 3.4)	OR: 4 (3.6; 4.3)	OR: 6 (4.3; 8.3)	OR: 2.6 (2.2; 3.0)	
Rubaltelli et al., 1998[77]		**Elective CD**	**VD (ref grp)**	**Forceps (Subset of Vaginal)**	**Emergency CD**					
Low/Not rated	TTN	1.5%	NR	3.8%	4.2%					*P* < 0.0001 for: Elective CD compared to vaginal

We also reviewed four low relevance studies. Two reported on PPV alone.[80,81] Two studies provide a subanalysis by gestational age.[77,80]

Both studies limited to PPV found a higher risk of PPV among prelabor cesareans than among vaginal deliverues.[80,81] Indications for PPV in this study included TTN, RDS, MAS, pulmonary hypertension, infection without neurological symptoms, pneumothorax, amniotic fluid aspiration, and pneumomediastinum. Of these studies, only one provided a subanalysis by gestational age, finding a significantly higher risk for PPV at gestational age of 37 to 38 weeks compared with >38 weeks.[80]

Two of the four low relevance studies defined respiratory morbidity as RDS or TTN.[65,77] Both studies showed a higher risk of TTN among "elective" cesarean deliveries than among vaginal deliveries. One study showed a higher risk of RDS among "elective" cesareans than among vaginal delivery.[65] The other study did not report overall incidence rates of RDS by mode of delivery, but in the subanalysis by gestational age, the investigators showed declines in the rates of RDS and TTN with increasing gestational age.[77]

Overall, the results showed a higher risk of respiratory morbidity from TTN or RDS among elective cesarean births than among vaginal delivery and a consistent reduction in risk with advancing gestational age approaching equality at 39 through 40 weeks.

We further analyzed these studies to assess the effect of labor on the incidence of respiratory morbidity. One of four studies that compared TTN and RDS between prelabor and labored cesarean deliveries showed a lower risk of respiratory morbidity in labored cesarean deliveries.[48] However, the three remaining studies showed a higher risk of respiratory morbidity in labored cesarean deliveries.[47,80,81] We cannot determine whether the higher riskof respiratory morbidity associated with labored cesarean deliveries in these three studies is due to TTN, RDS, or MAS. Similarly, we can not determine whether the higher rate can be attributed to a higher rate of emergency cesareans for complications related to prematurity because the data are not presented in a manner that allowed us to answer this question.

We did not identify any studies that compared MAS between modes of delivery. Two studies that focused on TTN and RDS excluded MAS.[47,48] Others reported on positive pressure ventilation for indications that included MAS.[77,80] An accurate and comprehensive assessment of neonatal respiratory morbidity would ideally account for TTN, RDS, and MAS by planned route of delivery and separated by gestational age.

Transition. One study of low relevance that reported on feeding difficulty as a measure of transition found a higher risk with all modes of delivery except for spontaneous vaginal delivery.[81] The risk was not significantly higher for vacuum, forceps, vacuum or forceps, or cesarean "during labor after a failed attempt at vaginal delivery." By contrast, it was significantly higher after cesarean "during labor with no attempt at vaginal delivery" and cesarean "without labor." This study did not distinguish between planned and unplanned cesarean deliveries. Women who had a cesarean delivery without labor or with labor, with no attempt at vaginal delivery, may have had maternal or neonatal indications for emergency cesarean delivery that also influenced neonatal transition.

Neonatal asphyxia and encephalopathy. Encephalopathy is a broad category. We limited our review to outcomes that were associated with hypoxic-ischemic encephalopathy. Two studies included outcomes related to neonatal encephalopathy, one of moderate relevance and fair quality,[37] and one of low relevance.[81] The moderately relevant study defined neonatal encephalopathy as either seizures alone or any two of the following conditions that lasted for longer than 24 hours: abnormal consciousness, difficulty maintaining respiration (of presumed

central origin), difficulty feeding (of presumed central origin), or abnormal tone and reflexes. It found a significantly lower risk of newborn encephalopathy associated with "elective cesarean section" than with spontaneous vaginal delivery (OR = 0.17; 95% CI, 0.05-0.56. Both instrumental vaginal delivery and emergency cesarean delivery were associated with significantly higher rates of newborn encephalopathy than spontaneous vaginal delivery (respectively, OR = 2.34; 95% CI, 1.16-4.70, and OR = 2.17, 95% CI, 1.01-4.64).

The low relevance study used Current Procedural Terminology (CPT and ICD-9 codes for convulsions and central nervous system (CNS) depression as outcomes. The authors found a higher risk of both convulsions and CNS depression among "unlabored cesarean sections" than among spontaneous vaginal delivery. However, these results were significant only for CNS depression (OR, 2.2; 95% CI,1.3-3.6).[81] This study showed a significantly higher risk of both convulsions and CNS depression with vacuum, vacuum and forceps, and cesarean during labor than with spontaneous vaginal delivery.

Intracranial hemorrhage. One low relevance study reported on subdural or cerebral hemorrhage, intraventricular hemorrhage, and subarachnoid hemorrhage among various modes of delivery.[81] Overall, the hemorrhage rates were similar between spontaneous vaginal delivery and "prelabor" cesareans. The results showed a consistently higher risk for all three injuries with vacuum, forceps, vacuum and forceps, and cesarean during labor but were not universally statistically significant.

Facial nerve injury. One low relevance study specifically addressed facial nerve injury through use of ICD-9 and CPT code data.[81] The study found no significant differences in the incidence of facial nerve injury associated with vacuum (OR = 1.7; 95% CI, 0.9-2.1) or "prelabor" cesarean delivery (OR = 1.5; 95% CI, 0.8-2.6) compared with facial nerve injury incidence associated with spontaneous vaginal delivery. However, the study found a significantly higher rate of facial nerve injury among forceps delivery (OR = 13.6; 95% CI, 10.0-18.4), the composite attempt at vacuum and forceps (OR = 8.5; 95% CI, 3.9-18.0), and the subgroup of cesareans that failed an attempt at vaginal delivery with either vacuum or forceps (OR = 3.8; 95% CI 1.2-12.1).

Brachial plexus injury. One low relevance study reported on brachial plexus injury related to mode of delivery.[81] The rate of brachial plexus injury was significantly higher in vacuum, forceps, and the combined attempt at vacuum and forceps than in spontaneous vaginal delivery (respectively: OR = 2.3; 95% CI, 1.8-2.9; OR= 3.2; 95% CI, 2.3-4.6; and OR = 6.0; 95% CI, 3.3-10.7). It was significantly lower in cesareans overall as well as in cesareans performed "during labor" than in spontaneous vaginal delivery (respectively, OR = 0.4; 95% CI, 0.3-0.5; OR = 0.2; 95% CI, 0.1-0.4). The rate was lower in "prelabor" cesarean deliveries than in spontaneous vaginal delivery, (OR = 0.5; 95% CI, 0.3-1.0).

Fetal laceration. Two moderately relevant studies of poor quality included fetal lacerations as a neonatal outcome by mode of delivery.[28,40] One study reported on mild, moderate, and severe fetal lacerations among "scheduled," "unscheduled," and "emergency" cesarean deliveries.[40] The study found a significantly higher rate of fetal lacerations among emergency cesareans (OR = 1.7) than among either scheduled cesareans (OR = 0.34) or unscheduled cesareans (OR = 0.57). The authors calculated the odds ratios by comparing the odds for each of the three categories with the composite odds for all fetal lacerations among all three types of cesareans. All moderate and severe fetal lacerations were in the emergency cesarean group.

The other study compared outcomes among "primary elective" cesareans, "primary acute" cesareans, and "secondary acute" cesareans.[28] This study reported a "fetal complication" rate of

1.3 percent. The authors noted that the "most frequent fetal complication was an accidental incision of the fetal skin while opening the uterus" (p. 4).[28] The rates of fetal complication (which we interpret to mean primarily fetal laceration) by mode of delivery in descending order of incidence were "secondary acute" cesarean (1.5%), "primary acute" cesarean (1.4%), and "primary elective cesarean (0.8%).

Neonatal length of stay. One study of moderate relevance and fair quality reported on length of hospital stay in two articles.[52,53] The mean length of stay was higher in the "elective" cesarean group (6 days) than in the vaginal delivery group (4 days). The authors did not report statistical test results.

Long-term bonding, behavioral issues, and physical development. We found no studies that addressed any of these issues.

Key Question 3
What factors affect the magnitude of the benefits and harms identified in KQ 2?

We limited this key question to studies comparing planned CDMR with planned vaginal delivery and to studies assessing effect modifiers in planned CDMR. The outcomes of interest initially were those specified for KQ 2.

We did not include studies that evaluated effect modifiers exclusively in populations with planned vaginal delivery (i.e., studies without planned CDMR as a control group). An extensive body of literature exists on effects of factors such as comorbidities, settings, patient characteristics, and many others on the outcomes of vaginal delivery. Effect modifiers for vaginal deliveries, however, were beyond the scope of this review.

We defined effect modifiers as maternal or fetal characteristics that modify the effect of either planned CDMR or planned vaginal delivery on an outcome of interest. In addition, we included time of day of delivery, physician experience, quality of nursing, labor support, type of delivery, pregnancy dating, and level of perinatal care as general characteristics. Table 28 summarizes effect modifiers that we considered of primary interest.

Table 28. Potential effect modifiers for planned CDMR and planned vaginal delivery

Maternal Characteristics	Fetal Characteristics	General
Maternal age	Sex	Time of day of delivery
Parity	Fetal size	Physician experience or specialty
Race or ethnicity	Gestational age	Labor support
Body mass index		Quality of nursing
Socioeconomic status		Level of perinatal care
Medical characteristics		Type of labor Pregnancy dating

We did not regard differences in interventions, such as antibiotic prophylaxis or operation techniques, as being effect modifiers. Differences in outcomes based on interventions are attributable to cause and effect relationships rather than to interacting variables.

Only five studies met our inclusion criteria and assessed factors that have the potential to alter the benefits and harms of planned CDMR or planned vaginal delivery.[48,53-55,82] We did not

find any evidence for most of the KQ 2 outcomes of interest. The outcomes reported in the existing evidence were limited to fetal respiratory morbidity, infectious morbidity, and urinary incontinence.

We rated three studies as moderately relevant[53-55,82] and one as being of low relevance.[48] Only two studies controlled for confounding factors by employing a multivariate regression model to determine effect modifiers.[54,82] Results of all remaining studies are crude estimates, uncontrolled for confounders. Characteristics of included studies are presented in Table 29 (in order by relevance and then quality rating).

Table 29. Characteristics of included studies for key question 3

Author, Year Relevance, Quality	Study Design Population	Sample Size	Definition of "Elective Cesarean"	Definition of Planned Vaginal Delivery	Outcome of Interest Effect Modifier	Adjusted for Confounders
Myles et al., 2002[54] Moderate Good	Retrospective cohort study Patients with elective cesarean	214	Patients who had reassuring fetal heart tones and did not have active labor or rupture of the membranes prior to surgery	Not applicable	Post-cesarean infectious morbidity BMI, race	Yes
van den Berg et al., 2001[55] Moderate Fair	Retrospective cohort study Patients with elective cesarean	433	Surgery was performed after 37th week of pregnancy without compli-cating factors influencing the timing of delivery and without preceding labor	Not applicable	Neonatal respiratory distress Gestational age	No
Zanardo 2004[53] Moderate Fair	Retrospective cohort study Patients with elective cesarean	1,284	Delivered before onset of labor	Not applicable	Neonatal respiratory distress / gestational age	No
Morrison et al., 1995[48] Low Not rated	Retrospective cohort study All deliveries	36,461	Before onset of labor	Not reported	Neonatal respiratory distress Gestational age	No
Wilson et al., 1996[82] Low Not rated	Cross-sectional survey Women 3 months postpartum	1,505	Not reported	Not reported	Urinary incontinence Pelvic floor exercises, Body mass index	Yes

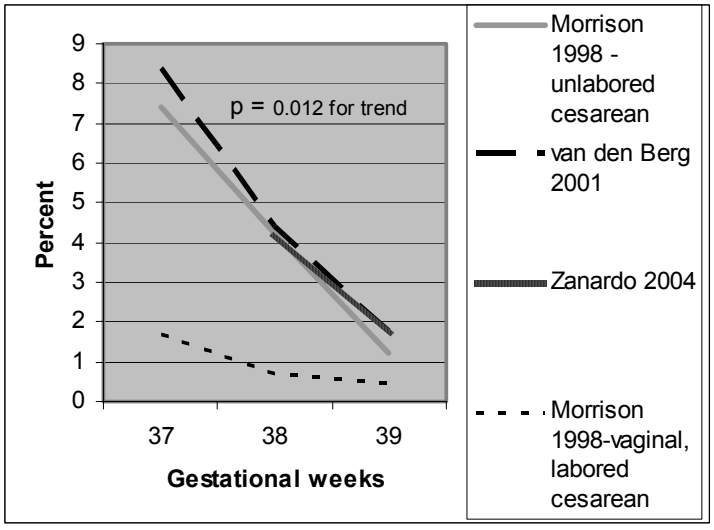
Three retrospective cohort studies assessed the influence of gestational age on neonatal respiratory distress after "elective cesarean."[48,53,55] Populations were not limited to those with CDMR. All three studies determined gestational age using chart information on menstrual history and ultrasound data obtained in the first trimester, but their definitions of "elective cesarean" and neonatal respiratory distress varied. Three moderately relevant studies[48,53,55] included patients who had "elective cesarean delivery" after 37 weeks of pregnancy in the absence of complicating factors influencing the timing of delivery and neonatal outcomes. One of these two studies, however, included only patients with spinal anesthesia.[53] By contrast, the third study, rated as having low relevance, did not exclude patients with comorbidities or patients undergoing general anesthesia.[48] All three studies based respiratory distress on the presence of clinical symptoms of respiratory distress such as tachypnea, retractions, nasal flaring, or cyanosis. In addition, two studies used radiographic features of RDS and TTN as additional criteria.[48,53]

Despite these differences, results consistently presented a decrease of respiratory morbidity with increasing gestational age. Table 30 and Figure 5 summarize the prevalence of neonatal respiratory morbidity following "elective cesarean section" at different gestational ages. Cuzick's test for trend indicated a statistically significant trend for the combined data of the included studies ($P = 0.012$). These findings are also consistent with a Dutch study published in English as an abstract only.[111]

Table 30. Number of cases (and percentage) of neonatal respiratory morbidity by gestational week following elective cesarean delivery

Gestational Age	Morrison et al.[48]	van den Berg et al.[55]	Zanardo et al.[53]
37 weeks to 37 weeks, 6 days	27 of 366 (7.4%)	8 of 95 (8.4%)	Not reported
38 weeks to 38 weeks, 6 days	45 of 1,063 (4.2%)	8 of 183 (4.4%)	32 of 765 (4.2%) (total for less than 38 weeks, 6 days
39 weeks or more	11 of 912 (1.2%)	1 of 55 (1.8%)	9 of 519 (1.7%)

Figure 5. Prevalence of neonatal respiratory morbidity by gestational week following elective cesarean or vaginal and labored cesarean



Only one study (low relevance) provided data on the effect of gestational age on neonatal respiratory morbidity for patients with vaginal delivery and labored cesarean.[48] Gestational age appeared to have a lesser effect on neonatal respiratory morbidity in combined patients with vaginal delivery or labored cesarean delivery. In this population, in gestational week 37, only 1.68 percent of neonates suffered from respiratory morbidity. The prevalence declined to 0.48 percent for deliveries at or after week 39.

A different retrospective cohort study (moderate relevance) did not find gestational age to be a risk factor for post-cesarean infectious morbidity.[54] In this study, after multivariate analysis BMI and race were the only risk factors that remained statistically significant for post-cesarean infectious morbidity in patients undergoing "elective cesarean." The relative risk for postoperative infectious morbidity in obese patients was 1.6 (95% CI, 1.2-2.0). In addition, black patients had a significantly higher rate of infection (RR not reported). Other factors such as physician's experience, incision type, maternal age, and prophylactic antibiotics were statistically significant in the univariate analysis but did not maintain statistical significance in the multivariate model.

A cross-sectional survey (low relevance; response rate 70.5 percent) of 1,505 women 3 months after delivery examined the relation between obstetric factors and incontinence.[82] For both vaginal and cesarean deliveries, combined pelvic floor exercises significantly reduced the prevalence of incontinence at 3 months (OR = 0.6; 95% CI, 0.4-0.9). Prepregnancy BMI significantly increased the risk of incontinence (OR = 1.07; 95% CI, 1.04-1.10), but the clinical significance of this finding might be questionable. Results were not stratified by planned CDMR and planned vaginal delivery. However, women with previous incontinence had higher rates of incontinence at 3 months than those without previous incontinence (elective cesarean: 38.1 percent vs. 8.8 percent; vaginal delivery: 28.2 percent vs. 24.8 percent).

Chapter 4. Discussion

This chapter first discusses our findings for three key questions (KQ) relating to incidence and trends for cesarean delivery on maternal request (CDMR), maternal and neonatal outcomes of a variety of delivery routes relative to CDMR or proxies for CDMR, and factors that may influence those outcomes. We also address KQ 4, which concerns limitations of the evidence base and our recommendations for future research.

As explained in Chapters 2 and 3, few studies dealt directly with CDMR, so we developed relevance ratings of studies in addition to the typical ratings done with respect to the quality of individual studies. Relevance ratings could be high (essentially nonexistent in this evidence base), moderate, or low; quality ratings, derived from commonly adopted approaches, could be good, fair, or poor. In all, we included 69 articles that pertained to KQ 1, 2, or 3.

We also developed definitions for the strength of the evidence base for these three issues. Chapter 2 provides details; the basic categories are as follows:

I. Strong evidence: The evidence is from studies of strong design; results are both clinically important and consistent with minor exceptions at most; results are free from serious doubts about generalizability, bias, or flaws in research design. Studies with negative results have sufficiently large samples to have adequate statistical power.
II. Moderate evidence: The evidence is from studies of strong design, but some uncertainty remains because of inconsistencies or concern about generalizability, bias, research design flaws, or adequate sample size. Alternatively, the evidence is consistent but derives from studies of weaker design.
III. Weak evidence: The evidence is from a limited number of studies of weaker design. Studies with strong design either have not been done or are inconclusive.
IV. No evidence: No published literature.

For KQ 1, one study was of high relevance and remaining studies were of fair or poor quality; thus, information to answer KQ 1 was weak. With respect to KQ 2, generally only weak evidence was available to characterize most maternal and neonatal outcomes involving a comparison of planned CDMR with planned vaginal delivery (KQ 2). Evidence to address the question of modifiers of outcomes of planned CDMR and planned vaginal delivery (KQ 3) was also at best only weak.

Results

KQ 1: Incidence and Trends of Cesarean Delivery on Maternal Request

KQ 1 referred to the incidence and trends in cesarean deliveries over time in developed countries; it made specific reference to primary cesarean before onset of labor, CDMR, medical indications, and malpresentation as proportions of total cesarean deliveries. The absence of data to answer this question is striking. Regarding incidence, the available literature yielded rates of cesarean deliveries as a proportion of all deliveries for a wide array of time points and countries.

For 2001 in the United States, data suggest rates of more than 25 percent.[3] Elsewhere in the developed world for 2001, rates of cesarean delivery ranged from 14 percent in the Netherlands to 35 percent in Italy.[112] Since 2001, the rates of cesarean delivery have risen in the United States; recent figures put the rate at more than 29 percent for 2004.[2]

The rate of cesarean deliveries is rising worldwide. Both "elective" cesarean deliveries (sometimes defined as unlabored) and "nonelective" cesarean deliveries contribute to this rise; however, the proportions vary by country, study, and time period. Four studies distinguished between prelabor primary and repeat cesareans. An Irish study reported an unlabored primary cesarean delivery rate of 18.9 percent of all cesarean deliveries during the 12-year period from 1989 to 2000.[35] One study in Australia showed that prelabor primary cesarean delivery as a percentage of all deliveries rose from 4.1 percent in 1980 to 4.8 percent in 1987.[34] In the United States, primary prelabor cesarean delivery rates were approximately 5 percent of all deliveries in 1996[3,56] and approximately 7 percent in 2001.[3] In 2001, "primary elective" prelabor cesarean rate as a proportion of all cesarean deliveries was 28.3 percent in the United States.[3]

The extent to which CDMR is contributing to the rise in cesareans remains unclear. We found a single study addressing CDMR, but its data are more than a decade old and were drawn from a single area (Scotland).[33] All other studies that we identified either made no attempt to define "elective" cesarean or included such a variety of indications that precluded them from being acceptable proxies for CDMR. Thus, we identified no recent data regarding the rate of CDMR.

A more fundamental problem is that administrative records used to compile such statistics do not contain the details necessary to discern whether the expectant mother desired a vaginal delivery or a cesarean delivery; nor do they provide insight into the decisionmaking process that produced a preference (either the mother's or the clinician's) or who else may have been involved in that process.

Finally, we did not find sufficient data to comment on medical indications or malpresentation as a proportion of all cesarean deliveries.

KQ 2: Outcomes of Cesarean Delivery on Maternal Request

We discuss below maternal and neonatal outcomes of interest to the State-of-the-Science (SOS) planning committee. Overall, few moderately relevant studies were available, and the strength of evidence is weak (category III) for nearly all outcomes. We summarize the direction of effect and strength of evidence and enumerate the number of trials of planned vaginal delivery to planned cesarean delivery or studies of moderate relevance to CDMR in two tables below: Table 31 (immediately below) deals with maternal outcomes (both primary cesarean and subsequent cesarean deliveries; Table 32 (later) covers neonatal outcomes.

Maternal outcomes for primary cesarean deliveries. *Mortality.* Four studies[20,28,64,70] suggested no evidence of difference in maternal mortality associated with planned vaginal versus planned cesarean delivery. These studies provide weak evidence overall. The 2000 report from the International Term Breech Trial (hereafter Breech Trial; which randomized women to planned vaginal vs. planned cesarean for breech) received a quality rating of fair.[20] The only moderately relevant study was of poor quality. The remaining two studies were of low relevance to CDMR and were not graded for quality.

Table 31. Summary of maternal outcomes, directions of effect, and strength of evidence

Maternal Outcome	Direction of Effect	Strength of Evidence
Maternal Outcomes Relevant to Primary Cesarean Deliveries		
Maternal mortality	No evidence of difference between cesarean and vaginal delivery (planned or actual)	II
Infection	Lower risk with planned "elective" than labored or emergency cesarean; higher risk with cesarean overall compared with vaginal delivery	III
Anesthetic complications	Lower risk with planned vaginal delivery from limited evidence	III
Hemorrhage/blood transfusion	Lower risk with planned "elective" than vaginal or unplanned cesarean delivery	II
Hysterectomy	No evidence of difference from underpowered studies	II
Thromboembolism	No consistent evidence of direction or magnitude of difference	III
Surgical complications	Lower risk of surgical complications with elective or unlabored cesarean compared with labored or emergency cesarean births, lower risk of perineal trauma with elective cesarean compared with spontaneous vaginal deliveries and assisted vaginal deliveries	III
Breastfeeding	No evidence of difference in the duration of breastfeeding, previous reviews suggest higher risk of bottle feeding compared with breastfeeding for cesareans overall compared with vaginal delivery	III
Postpartum pain	No evidence of difference	III
Psychological outcomes: postpartum depression	No evidence of difference; however, trial of breech presentation likely overestimates challenges, interventions, and resultant negative psychological outcomes in the planned vaginal delivery group	III
Psychological outcomes: other	Lower risk of negative birth experience with planned cesarean or spontaneous vaginal delivery compared with unplanned cesarean or instrumental vaginal delivery, other outcomes too varied to summarize	III
Maternal length of stay	Longer hospital stay with planned and unplanned cesarean compared with vaginal delivery	II
Urinary incontinence	Lower risk with primary elective cesarean than vaginal delivery, protective effect may diminish with increasing age, parity, and BMI	III
Anorectal function	Lower risk with planned cesarean deliveries compared with unplanned cesarean or instrumental vaginal deliveries. Inconsistent evidence of difference between planned cesarean and spontaneous vaginal delivery	III
Pelvic organ prolapse	No evidence	IV
Sexual function	No evidence of difference	III
Maternal Outcomes Relevant to Subsequent Cesarean Deliveries		
Subsequent fertility issues	Higher risks with all cesarean, no reliable evidence of difference relevant to CDMR	IV
Subsequent uterine rupture	No difference in asymptomatic uterine rupture, small higher risk of symptomatic rupture with trial of labor compared with elective repeat cesarean	II
Subsequent placenta previa	Higher risk with cesarean, risk increases with advancing maternal age, parity, and number of prior cesareans	II
Subsequent stillbirth	Higher risks with all cesarean, no reliable evidence of difference relevant to CDMR	IV

An often quoted statistic included in a letter to the editor by Hall and Bewley, extrapolates a higher relative risk (RR) of mortality associated with elective (RR: 2·84. 95% CI 1.72–4.70) and emergency cesarean (RR: 8·84, 95% CI 5.60–13.94) compared with vaginal delivery.[113] However, careful examination of the original source of their data finds that "elective" cesareans included no CDMR. In fact, "in many cases of elective cesarean section the woman had significant underlying medical problems, such as primary pulmonary hypertension, or other cardiac disease."[114]

Furthermore, comparisons are not made by planned routes of delivery but rather actual routes of delivery. In an appropriate analysis, mortality associated with planned vaginal deliveries would include maternal deaths following both actual vaginal deliveries and unplanned cesarean deliveries.

Overall, the incidence of maternal mortality was very low. This finding may be an artifact of our restricting our review to studies from developed countries where maternal mortality is generally low (e.g., in the range of 1 in 10,000 cases).[115] Other factors related to the overall low rate of maternal mortality include ready access to antibiotics, emergency cesarean, anesthetic specialists, and blood banking capabilities.

Infection. The 12 studies that included maternal infection as an outcome provided weak evidence regarding its association with planned vaginal and planned cesarean delivery.[20,28,39,45,49,51,64,67-70,84] Generally, the risk of maternal infection was lower with planned cesarean than with unplanned cesarean delivery and lower for vaginal than for cesarean delivery.

The failings in this evidence stem primarily from a lack of appropriate comparison groups, a lack of consistency in outcome definitions, and the frequent use of composite outcomes that combine infectious and noninfectious outcomes or combine infectious outcomes of differing severity. Some studies reported specific maternal infections, whereas others grouped infectious outcomes into a single measure of maternal infectious morbidity or combined infectious outcomes with unrelated outcomes such as blood loss, bladder paralysis, ileus, hematoma, or an undefined "other" category. Also problematic was that studies that used composite measures of infectious morbidity often combined outcomes with significantly different severities such as urinary tract infection (UTI), endometritis, and pneumonia. These limitations preclude our ability to make conclusive assessments of the maternal infection literature.

Anesthetic complications. Two studies showed a lower rate of anesthetic complications with planned vaginal than with planned cesarean delivery;[51,69] the third reported no significant difference between these two routes.[50] This is at best weak evidence suggesting a lower rate of anesthetic complications with planned vaginal delivery. The finding results from only two articles: one based on administrative data and the other that did no statistical testing. Given the increase in the use of regional anesthesia (epidural and spinal) in both planned vaginal and planned cesarean deliveries, analyzing anesthetic outcomes by intent-to-treat is especially important as was done by two of the three studies.[50,51] The weakness of this evidence is attributable to the paucity of studies, the lack of consistent definitions, and the inclusion of possible confounders (potentially higher rate of general anesthesia used for emergency cesareans and potentially higher rates of vacuum, forceps, and cesareans in labor associated with the use of epidurals.

Hemorrhage and blood transfusion. Eleven studies provided moderate strength of evidence showing a lower risk of hemorrhage and blood transfusion in planned cesareans than in vaginal

delivery.[20,28,38,39,45,50,51,64,67-69] These studies also yielded evidence of lower hemorrhage or blood transfusion in planned cesareans than in unplanned cesareans.

Of these 11 studies, 1 was the initial report from the Breech Trial,[20] 6 studies were of moderate relevance,[28,38,39,45,50,51] and 4 were of low relevance.[64,67-69] Of the moderately relevant studies, 3 were of fair quality[38,39,51] and 3 of poor quality.[28,45,50]

The majority of the evidence showed a lower risk of blood loss associated with planned cesarean than with both planned vaginal delivery and unplanned cesarean delivery; this finding was consistent across the Breech Trial and two other fair-quality studies.[20,38,51]

Several challenges arise in interpreting this body of evidence. The studies often compared actual, rather than planned, routes of delivery; frequently, they compared only various types of cesarean delivery and lacked a vaginal comparison group. Studies also varied in their definition of excess blood loss from a gross estimation of increased blood loss to an objective and clinically meaningful definition of blood transfusion. Some studies used retrospective data (e.g., at times relying on International Classification of Diseases, Ninth Edition [ICD-9] codes, which may be of questionable reliability for this outcome).

Hysterectomy. Three studies (the Breech Trial, one study of moderate relevance, and one of low relevance) yielded weak evidence on the association between emergency hysterectomy after childbirth and either planned vaginal or planned cesarean delivery. These studies generally lacked the power to examine rare outcomes: a total of three peripartum hysterectomies were performed in all included studies. Although a hysterectomy is certainly a profound event for women who experience it, the number reported in these studies is insufficient to draw firm conclusions regarding the risk associated with either delivery route.

Thromboembolism. We have only weak evidence about any association between thromboembolism and planned vaginal or planned cesarean delivery. Studies did not consistently report a significantly higher rate of thromboembolic events associated with planned cesarean. In the only moderately relevant study (fair quality) that compared cesarean and vaginal deliveries,[39] the rate of deep vein thrombosis was higher for both planned "without labor" and unplanned "with trial of labor" cesareans, but the risk was significant only for the unplanned group. The remaining moderately relevant study (poor quality) limited comparisons to various types of cesareans and reported a higher (nonsignificant) thrombosis rate in the unplanned cesarean group.[28]

Of the four low-relevance relevant studies, three did not show either a significant difference or consistent direction for thromboembolism risk between planned cesarean and planned vaginal delivery.[67,68,70] The fourth study reported that the rate of thromboembolic events was statistically higher in unplanned cesareans than in planned cesarean deliveries;[69] a subanalysis showed that thromboembolism was lower in "uncomplicated" vaginal delivery than in elective cesarean delivery.

For risks of thromboembolism, the number of moderately relevant studies was small; outcomes were rare (usually under 1% for either arm); definitions were inconsistent; and results from the two trials of planned vaginal versus cesarean delivery for breech conflicted.[20,84] The lack of consistent direction of effect limits our ability to draw any firm conclusions regarding the risk of thromboembolism associated with CDMR.

Surgical complications. Ten studies provided weak evidence on surgical complications associated with planned vaginal and planned cesarean delivery. These included the Breech Trial,[20] 3 studies of moderate relevance (2 of fair quality[38,51] and 1 of poor quality[28]), and 6 of

low relevance.[64,67-70,75] Studies generally showed a lower risk of surgical complications in planned "elective" cesarean than in unplanned "emergency" or "labored" cesarean deliveries. When investigators expanded definitions of surgical complications to include obstetrical perineal trauma and compared actual instead of planned routes of delivery, the evidence shows a significantly higher rate of obstetrical trauma among spontaneous vaginal deliveries and assisted vaginal deliveries than among elective cesarean deliveries. Of course, perineal trauma does not occur when cesarean delivery is scheduled; consequently, planned vaginal birth and emergency cesareans are the only routes expected to be associated with perineal trauma, so it would be more common in those circumstances. Clearly, surgical complications such as fourth-degree lacerations or abdominal wound infections are associated with actual vaginal and cesarean deliveries, respectively.

We had not designed this review to provide a comprehensive assessment of obstetrical trauma among vaginal deliveries. Nonetheless, obstetrical injury can be reduced by changing clinical practice. For example, reducing routine use of episiotomy (according to a recent review from this same team) is likely to reduce the risk of obstetrical injury.[116] A recent review suggests that antenatal perineal massage may reduce perineal trauma during birth and pain afterwards.[117]

We encountered significant challenges in summarizing the risk of surgical complications associated with a planned "elective" cesarean delivery. Chief among these were the variable relevance of included studies; use of individual measures in some studies and composite measures in others; and differences in comparison groups across studies, comparison in some studies with only various types of cesarean deliveries, and the recurring problem of analysis based on actual, not planned, route of delivery. Despite the consistently low risk of surgical complications overall associated with planned "elective" or "unlabored" cesarean deliveries, the wide variability in specific outcomes studied and the widespread use of inconsistent composite outcomes limits both the utility of these data and our ability to draw definitive conclusions.

Breastfeeding. Two Breech Trial articles (poor quality) provided weak evidence that although women with planned vaginal deliveries may initiate breastfeeding sooner than women with planned cesarean deliveries, they do not report any difference in the duration of breastfeeding.[18,83] No studies among our included articles addressed the probability of either successfully starting breastfeeding if planned or attaining appropriate infant growth and development as measures of successful nutritional support from nursing. A meta-analysis of cesarean childbirth and psychosocial outcomes found that women with cesarean deliveries (planned and unplanned combined) were more likely to bottle feed than breastfeed compared with women with vaginal deliveries.[118]

Postpartum pain. Four articles (from three studies) reported on postpartum pain using various pain measures at different time periods.[18,43,51,83] One was the Breech Trial (two articles were graded poor[18,83]), and the other two were of moderate relevance. Together, these studies provide weak evidence of no differences. No study reported a significant difference in pain between modes of delivery.

Psychological outcomes: postpartum depression. Two studies (the Breech Trial and another study of low relevance) provided weak evidence suggesting no differences in postpartum depression by delivery route. As with pain, the Breech Trial likely overestimated the rate of complications, interventions, and possible negative psychological outcomes in the planned vaginal delivery group.

Psychological outcomes: other. Seven articles (from six studies) yielded weak evidence about a range of other psychological outcomes; they included two articles from the Breech Trial (poor quality),[18,83] two moderately relevant studies (one of fair quality[51] and one of poor quality[43]), and three of low relevance.[66,76,78] The data were consistent in reporting that women who had an unplanned cesarean delivery or an instrumental vaginal delivery were more likely to experience adverse psychological outcomes than were women who either underwent a spontaneous vaginal or a planned cesarean birth. Nonetheless, the variety of outcomes and measures makes a summative assessment of this literature extremely challenging. No studies, making appropriate comparisons, addressed maternal-infant attachment and satisfaction with the birth experience.

Maternal length of stay. Four studies, the original article from the Breech Trial (fair quality)[20] and three of moderate relevance (poor quality)[28,43,50] provided moderate evidence that length of stay is higher for cesarean delivery, planned or otherwise, than for vaginal delivery. Numerous external factors influence length of hospital stay, however, including insurance coverage, regional practice patterns, physician and patient preference, and neonatal hospital stay. Better measures of maternal recovery would assess quality of life, but this literature did not report on such measures.

Urinary incontinence. Nine articles (from eight studies) provided weak evidence that rates of stress urinary incontinence for planned "elective" cesarean delivery were either lower than or no different from those for vaginal delivery.[18,41,44,70,73,74,79,82,83] The two Breech Trial articles were of poor quality; the two moderately relevant studies were of fair quality.[41,44] Five were of low relevance.[70,73,74,79,82]

We had several challenges in interpreting the body of evidence about urinary incontinence. The articles that reported on symptoms of stress urinary incontinence generally defined this condition as some involuntary leakage of urine associated with various maneuvers such as coughing, laughing, or sneezing, but the particular definitions varied considerably, and no study used a validated urinary incontinence questionnaire. One study accounted for severity of urinary incontinence but compared groups by symptoms only.[79] The use of questionnaires, while appropriate for this outcome, may introduce both selection and recall bias when sent to women who were not prospectively recruited for enrollment. Another problem identified is that the time period for the assessment of urinary incontinence was generally short-term and varied widely from 6 weeks to 2 years postpartum. The two studies that linked surgical administrative databases and birth registries reported outcomes from 18 to 23 years after delivery.[70,74] Because these two studies are limited to surgery or hospitalization for urinary incontinence, they most likely select for severe incontinence and may not fully capture the prevalence and association of mild and moderate urinary incontinence with mode of delivery. All the other studies reported on symptoms of urinary incontinence and captured milder forms of incontinence, but the followup periods were short.

Finally, only four studies accounted for preexisting urinary incontinence.[41,44,79,82] In short, numerous problems limit evidence on this outcome: lack of high-quality prospective studies that compare planned routes of delivery, have adequate power, include comprehensive long-term followup, account for multiple deliveries, account for variations in practice patterns including use of epidural anesthesia and episiotomy, use validated urinary questionnaires administered at consistent time points from delivery, and define incontinence in a standardized fashion by its

occurrence, severity, and impact on quality of life. We note that future research should include studies of pathophysiological pathways for pelvic floor disorders.

Recent studies have attempted to identify unique populations to study the influence of mode of delivery on future risks of urinary incontinence and have arrived at conflicting results. Buchsbaum et al. compared urinary incontinence in a group of nulliparous nuns with their parous sisters and found no statistically significant difference between these groups suggesting a familial influence not related to mode of delivery.[119] Conversely, Goldberg et al. compared urinary incontinence among identical twin sisters and found that incontinence was associated with age, obesity, and mode of delivery with vaginal delivery conferring an increased risk relative to cesarean delivery (OR 2.28, CI 1.14-4.55).[120] We note that a fundamental difference between these two studies is the age of the populations. The mean age of patients in the Buchsbaum study was 61 years compared with 47 years in the Goldberg study. This difference suggests that urinary incontinence is likely multifactorial and that any reduced risk associated with CDMR may be overridden by age. Future research should consider risks of urinary incontinence associated with cumulative pregnancies and deliveries, as any protective effect afforded by CDMR may also be reduced with increasing parity.

Anorectal function. Seven articles (from six studies) provided weak evidence showing a reduced risk of anal incontinence in planned cesarean deliveries compared with unplanned cesarean or instrumental vaginal deliveries. There was inconsistent evidence of difference between planned cesarean and spontaneous vaginal delivery. The two Breech Trial articles (poor quality)[18] did not show any significant differences in fecal incontinence at either 3 months or 2 years, but several factors make it difficult to draw conclusions from this trial. It was designed to focus primarily on neonatal outcomes following planned vaginal versus planned cesarean for breech. It used different measures of anorectal function at each of the two time points, included multiparous women, allowed randomization in labor, had a high degree of crossover, was performed in 26 countries, and used nonvalidated instruments in multiple languages with more than 50 percent of participants requiring assistance in completing the questionnaire.

Of the remaining five articles, two were moderately relevant (fair quality)[42,46] but varied in their comparison groups, timing of assessment, and questionnaires used. One assessed severity and reported lower rates (3 of 80 women) of new onset anal incontinence in the elective cesarean group;[46] two of these cases were of higher severity, suggesting that pregnancy itself might lead to anal incontinence. The other study reported a significantly lower rate of flatal incontinence but not fecal incontinence at 6 months in the planned "elective" cesarean than in the unplanned "in labor" cesareans.[42] The remaining studies were of low relevance to CDMR.

As with studies on urinary incontinence, the limited sample sizes and lack of a consistent direction of effect precludes definitive interpretation. Other factors also impede interpretation: studies used various instruments, often either completely unvalidated or unvalidated in the language of the study population; and studies were small and thus unable to characterize this disorder fully; studies lacked a consistent time period for assessment of anal incontinence and varied in the definitions used (some restricting their definition to incontinence of fecal matter and others including incontinence of flatus). Until studies adopt a more uniform set of operational definitions and outcome measures, information on this outcome will continue to be scanty and problematic.

Pelvic organ prolapse. We found no evidence on the association between pelvic organ prolapse and planned vaginal or planned cesarean delivery. A single study of low relevance

(from an administrative data set) examined hospitalization for either "vaginal descensus" or urinary incontinence as one of several secondary outcomes associated with actual modes of delivery.[70] Because of a possible typographical error in the results section of the article, we could not make any definitive comments about this article or outcome.

Sexual function. Two Breech Trial articles (poor quality) provided weak evidence that sexual function does not differ by planned route of delivery.[18,83] This study used unvalidated measures that were administered in multiple languages and required the assistance of translators.

Maternal outcomes relevant to subsequent cesarean delivery. As noted in previous chapters, our systematic review focused on primary cesarean deliveries. The following discussion is limited to summaries or updates of existing systematic reviews for three outcomes that we believe are of interest to the SOS conference panel.

Subsequent fertility issues. We found no evidence on the association between subsequent fertility issues and planned vaginal or planned cesarean delivery among our included articles. A review of cesarean deliveries on future pregnancy noted that the procedure is a risk factor for lowered fertility, for uncompleted pregnancy, for complications in the next pregnancy and birth, and for health problems in the next infant. The study notes that all reviews potentially suffer from selection bias by indication and that reproductive outcomes after a cesarean delivery can be attributed to either the cesarean or to factor causing it.[121] As with subsequent stillbirth, the issue of potential bias reduces the utility of these findings to CDMR.

Subsequent uterine rupture. A recent update[32]of a systematic review[96] on the outcomes of vaginal birth after cesarean (VBAC) provided moderate evidence on subsequent uterine rupture. The update found no statistically significant differences between trial of labor after cesarean and elective repeat cesarean delivery with regard to rates of *asymptomatic* uterine rupture rates. The update noted that two studies of fair or good quality found a small but higher risk of *symptomatic* uterine rupture in trial of labor after cesarean than in elective repeat cesarean delivery (2.7 per 1,000).[97,122] A large multicenter prospective observational study of 33,699 women carrying singleton pregnancies following earlier cesarean delivery provided similar evidence: the study reported an incidence of uterine rupture of 0.7 (124 per 17,898 deliveries) for a trial of labor and no cases of uterine rupture for elective repeat cesarean delivery (0 of 15,801 deliveries). Maternal death and hysterectomy did not differ between groups.[123]

Placenta previa. Given that placenta previa is the most common placental implantation anomaly, we updated a recent meta-analysis by Faiz and Ananth examining the relationship between placenta previa and a history of cesarean delivery.[31] Our update supports the earlier meta-analytic conclusion that placenta previa is associated with advancing maternal age and increasing parity. The literature provided moderate evidence that the risk of placenta previa increases with previous cesarean delivery.

Subsequent stillbirth. The only study we found (low relevance to CDMR) did not show a difference in the rates of subsequent stillbirth among elective cesarean, emergency cesarean, and vaginal delivery.[70] This study followed a cohort of breech deliveries and did not control for breech presentation in subsequent deliveries; the results are of limited utility to CDMR. A recent retrospective cohort study by Smith et al. suggested a twofold higher risk of stillbirth in subsequent pregnancies in women who had had a previous cesarean than in women who had delivered only vaginally (3.8 per 1,000 vs. 2.3 per 1,000, respectively).**[124]** The authors did not record the indication for the first cesarean delivery, however, and the higher risk of stillbirth observed may have been associated with the medical conditions that warranted the cesarean

deliveries in the first place, not the cesarean deliveries themselves. The issue of potential bias reduces the utility of these findings to CDMR.

Neonatal outcomes. Table 32 provides the direction of effect and strength of evidence for the neonatal outcomes for which we sought evidence in this review. The evidence was either weak or nonexistent for every outcome examined.

Table 32. Summary of neonatal outcomes, directions of effect, and strength of evidence

Neonatal Outcomes	Direction of Effect	Strength of Evidence
Fetal mortality	No evidence	IV
Neonatal mortality	Higher risk for "cesarean" than for spontaneous vaginal delivery; no controls for underlying maternal or neonatal indications for cesarean	III
Unexpected (iatrogenic) prematurity	No evidence allows comparison of unlabored cesarean and planned vaginal birth	IV
Respiratory morbidity	Higher risk with cesarean; risk drops with advancing gestational age; no study evaluated meconium aspiration syndrome by mode of delivery	II
Transition	Insufficient evidence to judge direction or magnitude of effect	III
Neonatal asphyxia/ encephalopathy	Inconsistent evidence of risk with elective cesarean; higher risk for operative vaginal deliveries and emergency or labored cesareans than for spontaneous vaginal delivery	III
Intracranial hemorrhage	No difference between prelabor cesarean and spontaneous vaginal delivery; higher risk for assisted vaginal deliveries and cesarean deliveries in labor than for spontaneous vaginal delivery	III
Facial nerve injury	No difference between vacuum or prelabor cesarean delivery and spontaneous vaginal delivery; higher risk for forceps and combined vacuum and forceps than for either a vaginal or cesarean delivery	III
Brachial plexus injury	Lower risk for all cesareans than for spontaneous vaginal delivery; higher risk for vacuum, forceps, and combined vacuum and forceps delivery than for spontaneous vaginal delivery	III
Fetal lacerations	Lower risk for elective cesarean than for unplanned cesarean	III
Neonatal length of stay	Higher risk of longer hospital stay with elective compared with vaginal delivery	III
Long-term outcomes	No evidence	IV

*Fetal mortality***.** We found no studies that addressed fetal (in utero) deaths. Fetal mortality can occur at any gestational age, including at term or postterm.[125] A purported benefit of CDMR is the prevention of fetal (in utero) death in late-term or post-term pregnancies. A comprehensive assessment of CDMR ought to compare fetal deaths at all gestational ages by planned route of delivery.

Neonatal mortality. One study of moderate relevance (fair quality)[53] and one of low relevance[81] provided weak evidence on neonatal mortality. The moderately relevant study compared "elective" cesarean with vaginal delivery. This study reported no neonatal mortality but was underpowered for such a rare outcome.[53]

The low relevance study used a large administrative data set that offered a sample size sufficient to examine rare outcomes, but its retrospective classification of mode of delivery limited its usefulness. For instance, the classification of the cesarean deliveries was limited to either "labored" or "unlabored." The unlabored cesarean deliveries likely included emergency cesareans and those performed for serious maternal and neonatal indications such as placenta previa, severe preeclampsia, breech presentation, fetal distress, and major fetal anomalies. Such maternal and neonatal disorders could seriously affect neonatal mortality and seriously confound the underlying association between neonatal mortality and mode of delivery.

Unexpected (iatrogenic) prematurity. We found no study that addressed unexpected prematurity and allowed comparisons by type of cesarean with intended or actual vaginal delivery.

Respiratory morbidity. Measures of respiratory morbidity range from transient tachypnea of the newborn (TTN) to severe respiratory distress syndrome (RDS) with long-term sequelae. Overall, nine articles (for eight studies) yielded moderate evidence on the association of neonatal respiratory problems and delivery route.[47,48,51-53,65,77,80,81] Four studies of moderate relevance (fair quality) suggested that the risk of variably defined "respiratory morbidity" was higher for all cesarean births than for vaginal deliveries. This finding is consistent with the long-held belief that neonatal passage through the birth canal improves the neonatal pulmonary transition from amniotic fluid to breathing air. No study assessed TTN and RDS and also stratified results by gestational age.

We did not find sufficient evidence to determine whether gestational age alone accounts for the differential risk of respiratory neonatal morbidity associated with cesarean delivery. Five articles (from four studies) that accounted for gestational age consistently reported a significant reduction in the risk of neonatal morbidity as gestational age advanced, approaching equality at 39 to 40 weeks.[48,52,53,77,80]

Clinicians believe that the experience of labor itself results in a lower risk of neonatal respiratory morbidity (TTN and RDS), but we found no conclusive evidence that labor before cesarean delivery offers a protective effect. This may be due to confounders such as inclusion of meconium aspiration syndrome in a composite measure of respiratory distress.

One of four studies that compared TTN and RDS between prelabor and labored cesarean deliveries showed a lower risk of respiratory morbidity in labored cesarean deliveries.[48] However, the remaining three studies showed a higher risk of respiratory morbidity in labored cesarean deliveries.[47]

We cannot determine whether the higher risk of respiratory morbidity associated with labored cesarean deliveries in these three studies is due to TTN, RDS, or MAS. Similarly, we cannot determine whether the higher rate can be attributed to a higher rate of emergency cesarean for complications relating to prematurity.

The pathophysiological mechanism by which labor may influence the risk of respiratory morbidity associated with TTN and RDS is unclear and may extend beyond the physical effects of labor on the fetus (thoracic compression).

Finally, we found insufficient evidence to be able to comment on meconium aspiration syndrome.

Transition issues. The same low relevance study[81]reported on this outcome, but the significant issues of appropriate categorization in this study make interpreting the data difficult. We consider the available evidence insufficient to judge the direction of effect.

Neonatal asphyxia or encephalopathy. Two studies provided weak evidence of a higher risk of neonatal encephalopathy associated with operative vaginal deliveries and "emergency" or "labored" cesareans than with spontaneous vaginal delivery. One case-control study of moderate relevance (fair quality) found a significantly reduced risk of neonatal encephalopathy associated with planned "elective" cesareans deliveries.[37] The large administrative database study (low relevance) found an increased risk of convulsions and central nervous system depression associated with "prelabored" cesareans than with spontaneous vaginal deliveries.[81]

These studies have differing relative strengths. The moderately relevant study has a superior proxy for planned cesarean delivery, but as a case-control study it cannot be used to comment on absolute risks. The low relevance study is appropriate for calculating absolute risks; however, the study defined the key comparison group as "unlabored" cesarean and may, therefore, include cesareans performed because of nonreassuring fetal status, which represents a significant confounder for route of delivery and for this particular outcome.

Intracranial hemorrhage. The administrative database study (low relevance) also provided weak evidence on intracranial (subdural/cerebral, intraventricular, and subarachnoid) hemorrhage.[81] The prelabor cesarean deliveries included those done for maternal or neonatal indications, so they likely involved cesareans for placenta previa and fetal anomalies, which may independently increase the risk of intracranial hemorrhage. Despite the higher theoretical risk for prelabor cesarean deliveries, this study did not find any significant difference between spontaneous vaginal delivery and prelabor cesarean deliveries. It did show consistently higher rates of intracranial hemorrhage for assisted vaginal deliveries and cesarean deliveries in labor. The results suggest that CDMR poses no greater risk for intracranial hemorrhage than does planned vaginal delivery.

Facial nerve injury. The administrative database study (low relevance) provided weak evidence that the risk of facial nerve injury varies by mode of delivery; the risk is higher for forceps and the combined use of forceps and vacuum delivery than for spontaneous vaginal delivery.[81] These findings suggested that CDMR posed no risk for facial nerve injury greater than that associated with planned vaginal delivery.

Brachial plexus injury. The administrative database study (low relevance) provides weak evidence that the incidence of brachial plexus injury is lower in cesarean delivery than in vaginal delivery;[81] these results are consistent with *a priori* expectations. In this study, the rate of brachial plexus injury was significantly higher in vacuum, forceps, and the combined attempt at vacuum and forceps deliveries than in spontaneous vaginal delivery. The rate of brachial plexus injury was significantly lower for cesareans overall and for those performed after labor than for spontaneous vaginal delivery; it was also lower (approaching statistical significance) for cesareans performed before labor than for spontaneous vaginal delivery. Clinicians generally accept that shoulder dystocias and resultant brachial plexus injuries are primarily associated with vaginal deliveries. To what extent brachial plexus injuries resolve spontaneously or results in long-term permanent disability has not been clearly documented.

Fetal laceration. Two studies of moderate relevance (poor quality) provided weak evidence on fetal lacerations based on data limited to cesarean deliveries. They reported a higher rate of fetal lacerations among emergency and labored cesarean than among elective cesarean delivery.[28,40] The higher risk of fetal laceration associated with an emergency or labored cesarean may have several explanations: entering the uterus more rapidly in cases of fetal distress, having a thin lower uterine segment after labor, and having less or no amniotic fluid after rupture of

membranes (which places the fetal skin in almost direct contact with the uterine wall). These results suggested that CDMR posed no additional risk for fetal lacerations beyond those associated with planned vaginal delivery.

Neonatal length of hospital stay. One study (two articles) of moderate relevance (fair quality) provided weak evidence that the neonatal length of hospital stay is higher for "elective" cesarean delivery than for vaginal delivery.[52,53]

Long-term neonatal outcomes. We did not find any evidence on long-term neonatal outcomes.

KQ 3: Modifiers of Cesarean Delivery on Maternal Request

The evidence on effect modifiers is sparse and pertains to only a few outcomes for KQ 2. Five studies provided evidence on the modifiers of CDMR, specifically neonatal respiratory distress,[53,55] infectious morbidity,[54] and urinary incontinence.[82]

With regard to respiratory morbidity, results showed a consistent decrease in respiratory morbidity as gestational age rises, despite differences in inclusion criteria and definitions of elective cesarean delivery.[48,53,55] Gestational age appears to play a lesser role as a risk factor for fetal respiratory distress in planned vaginal delivery than in planned cesarean.

With regard to infectious morbidity, the single study we found suggested no effect of physician experience, incision type, maternal age, or prophylactic antibiotics on infectious morbidity; it did suggest that the risk was higher among obese or black patients than among other women.[54] Pelvic floor exercises decreased the risk of urinary incontinence; prepregnancy body mass index (BMI) increased it.[82]

Given the lack of evidence directly comparing effect modifiers in a population with planned CDMR with those in a population with planned vaginal delivery, inferences about effect modifiers must be drawn cautiously. Furthermore, most studies did not adjust for confounders, so results must be interpreted as crude estimates.

A multitude of factors can conceivably affect outcomes of planned CDMR and planned vaginal delivery. An extensive body of literature exists on how factors such as comorbidities, settings, and patient characteristics influence outcomes of vaginal delivery, but reviewing it was beyond the scope of this report. Furthermore, indirectly comparing results of these studies with results of studies on planned CDMR could be misleading because of the heterogeneity of populations, differences in definitions, and varying standards of care.

Limitations of Our Review

We designed our search strategies to answer questions for the SOS conference scheduled for March 2006. Thus, our aim was to compare primary planned cesarean delivery (cesarean delivery on maternal request, or CDMR) with planned vaginal delivery. Time and resources did not permit us to review comprehensively the benefits and harms associated solely or primarily with vaginal delivery, or with repeat cesarean deliveries.

In addition, for similar time and resource reasons, we did not conduct dual, independent, blinded review of articles for inclusion or abstraction of information into evidence tables. Instead, one reviewer performed the initial review, and a second reviewer examined that input and recommended changes or corrections when needed. These two reviewers reconciled any

differences by consensus discussion. To enable us to evaluate rigorously any systematic bias in our work, however, we did apply dual review for assigning relevance ratings, assessing the quality of individual articles, and grading the strength of evidence.

Limitations of the Evidence Base

Lack of Consistent Terminology

Studies lacked consistent and clear definitions of routes of delivery, maternal outcomes, and neonatal outcomes. They inconsistently took into account whether "planning" occurred before delivery, indications for cesarean, and laboring status in their categories of mode of delivery. Moreover, ambiguities and discrepancies in how outcomes were defined and measured were frequent. These variations across studies made comparing outcomes for planned routes of delivery extremely challenging and sometimes impossible.

Inappropriate Comparisons: Planned versus Actual Delivery Modes

As explained in detail in Chapters 1 and 2, the appropriate comparison to address the SOS conference issues is that of intent: *planned* vaginal delivery or *planned* CDMR. The great majority of studies in this systematic review report outcomes by actual route of delivery. Failure to use intent-to-treat approaches can bias results.

The absence of data on appropriate routes of planned deliveries required us to use proxies for CDMR. These proxies usually compared actual routes of delivery, not planned routes of delivery, similarly leading to bias from failure to account for intent-to-treat.

The SOS Conference panel and the TEP recommended that, for proxies, we use studies comparing routes of delivery for breech presentation. We recognized the significant confounding effect this indication would have on neonatal outcomes, so we used it as a proxy only for maternal outcomes. As noted in Chapter 1, however, the extent to which studies of breech presentation serve as appropriate proxies for maternal outcomes of planned vaginal delivery compared with those of planned CDMR is unclear. For instance, the risk of infection may be higher in planned cesarean for breech, if the length of time between labor onset or rupture of membranes to cesarean delivery is higher than it would be in true CDMR. Conversely, the risk of infection in the planned vaginal delivery group may be higher because the number of women undergoing a labored cesarean is greater than the number expected in a typical population of women with vertex presentations.

Inappropriate Study Designs

No clinical trial addressed the question of true CDMR. The only randomized controlled trial of route of delivery was for breech presentations, and it had several limitations that have been noted elsewhere in this review. Studies generally relied on retrospective data with attendant issues of poorly defined routes of delivery and outcomes. Few studies provided power calculations to support their estimates.

Inadequate Controls for Confounders

Studies infrequently accounted for confounders such as morbid obesity, multiple gestations, placenta previa, and polyhydramnios (excess amniotic fluid) that influence the recommended route of delivery and also lead to poor maternal and neonatal outcomes. The extent to which these confounders influenced these outcomes is generally unknown because authors rarely controlled for such variables. A striking example of poor assessment of confounding arises in the studies of neonatal respiratory morbidity. Several of these studies included preterm infants, suggesting failure to account for underlying maternal or neonatal indications that could have influenced both route of delivery and respiratory outcomes.

Inadequate Assessment of Modifiers of Outcomes

Most studies included in this systematic review do not adequately report on the standards of care associated with a particular route of delivery that could potentially modify outcomes. For instance, few studies address potential modifiers of outcomes associated with vaginal delivery such as too early hospital admission in labor, lack of adequate emotional support, electronic fetal monitoring, epidurals for pain management, laboring and pushing in bed, IV fluids, too many vaginal exams, strict time limits for duration of labor, valsalva pushing as soon as the cervix is completely dilated, lithotomy position for birth, and episiotomy. Similarly, studies do not address potential modifiers of outcomes associated with planned cesarean delivery such as variations in operative technique (single versus double layer uterine closure, extraabdominal uterine exteriorization to facilitate closure of incision or uterine massage, closure of vesicouterine (visceral) peritoneum, closure of parietal peritoneum), physician expertise, and access to emergency care. We are therefore unable to comment on whether the risks of any particular outcome are associated with "ideal" practice environments or whether these risks can be appreciably modified by changes in the practice environment.

Inadequate Quality of Studies

Nonrandomized observational cohort studies were universally of fair or poor quality; the limitations of these studies were noted in Chapter 3 and above.

A single randomized controlled trial, the Breech Trial, was in principle the best study we had available to us because it used intent-to-treat analysis and reported on maternal surgical, pelvic floor, and pain outcomes. It offered high quality data on mode of delivery for neonatal outcomes, but the findings were specific to breech deliveries and could not be extrapolated to vertex pregnancies. We therefore excluded studies of breech deliveries from our review of neonatal outcomes.

For the broader purposes of this review, however, the Breech Trial had some limitations. It included multiparous patients and allowed women to be randomized even if in labor; it was not designed to address pelvic floor outcomes; and it had a high rate of cross-over. Finally, it used unvalidated instruments in multiple languages (as the study was done in 26 countries) and more than 50 percent of the participants required assistance in completing the questionnaires; moreover, the questionnaires changed throughout the study period, and different questionnaires were used at 3 months and at 2 years.

Inappropriate Outcome Measures: Timing, Severity, and Utility

Studies reporting maternal and neonatal outcomes that were not immediately evident at delivery measured outcomes at varying lengths of time from delivery. This lack of a standard time period to assess long-term outcomes makes comparing studies problematic. Further, outcomes such as urinary incontinence, pelvic organ prolapse, and anal incontinence were usually measured a few weeks to a few months from delivery; they are, therefore, of limited clinical relevance. Studies that measured pelvic floor disorders more than 2 years from delivery were limited to administrative databases; they could not control for variables such as interval pregnancies and deliveries, length of labor, use of vacuum or forceps (or both), obesity, smoking, constipation or chronic straining, or previous reconstructive pelvic surgery.

The severity of the maternal and neonatal outcomes we examined for the SOS conference varied appreciably with respect to severity; the gravity of the outcomes clearly differs across such outcomes as UTI, sepsis, or death (for mothers) or across TTN, RDS, scalp lacerations, and intracranial hemorrhage (for infants). However, few studies rated the severity of any particular outcome.

No study provided any assessment of the utility (to either mothers or, by proxy, infants) of these different outcomes. Conspicuously absent was any measure of health-related quality of life in the face of different outcomes. The issue of severity rating and quality of life is particularly relevant to pelvic floor outcomes such as urinary incontinence, pelvic organ prolapse, or anal incontinence.

Future Research Directions (Key Question 4)

Medicine is often practiced beyond the boundaries of robust research evidence. In such instances, providers and patients may experience little discomfort making decisions based on well-established patterns of care. However, when new treatments, technologies, or concepts appear that result in new patterns of care, substantial anxiety about the best way to chart a course may occur.

CDMR is an exemplar of a challenge to conventional practice that arises quickly, gains momentum, and generates numerous questions in its wake. CDMR is particularly challenging given the complexity of issues that need to be addressed both individually by the patient and provider and by society. Issues relevant to patients and providers include balancing short- and long-term risks and benefits for the woman and her infant, assessing such risks in both the first pregnancy and any subsequent pregnancies, and determining the validity and value (utility) of the benefits asserted. Societal concerns range broadly: the extent of individual autonomy to make informed health care decisions, including the choice of CDMR; the impact that CDMR may have on health care costs; ethical implications of elective surgery to avoid a physiologic process; modern medicalization of birth; influence of consumerism; fear of litigation; and motivations of the professional groups who advocate for answers.

The need for high-quality research evidence to inform care is of paramount importance. For instance, some practices, such as the use of routine episiotomy, have been adopted widely but remain without evidence of benefit.[116] Some practices that had been widely adopted were only later proven ineffective: examples include hormone replacement therapy[126,127] and a common arthroscopic knee surgery.[128] Such examples force the biomedical and clinical communities and

patients and consumers to acknowledge that "intuition, unsystematic experience, and pathophysiologic rationale are insufficient grounds for clinical decision-making."[129]

Women and their providers make decisions about CDMR every day. An individual woman's desire for a CDMR may be supported or rejected by her prenatal care provider or by the clinician to whom she is referred for consultation if the original provider does not perform cesareans or does not support CDMR. Some observers suggest that few women would *spontaneously* request a cesarean; they hold that care providers introduce the idea with the intent (and effect) of making the option seem "normal" and prompting women to consider and, later, perhaps request CDMR. Regardless of the mechanism that leads to these discussions, at present they happen without evidence that is sufficient to bear the weight of the decision for or against CDMR.

An accurate assessment of maternal and neonatal risks and benefits associated with CDMR requires a comprehensive and explicit estimation of utility or value that women, their families, and others place on each outcome. Setting values separately on short- and long-term outcomes for mothers and for infants, in both the first and subsequent pregnancies, is challenging indeed, but it is necessary to understand fully the implications of a decision to choose CDMR.

This systematic review underscores the striking paucity of helpful data related to CDMR. The following section provides a framework for structuring future research on these topics, with particular reference to the numerous gaps and limitations that we identified.

Terminology

The lack of standardized definitions of planned modes of delivery, required to establish valid groups for comparison of outcomes, extends to measures of maternal and neonatal outcomes. This evidence review points to a need for greater uniformity and sophistication in the collection of data, clear operational definition of the exposure groups, and improved operational definitions of the outcomes to be compared.

The fundamental difficulty with summarizing the body of literature identified was the lack of standardization of definitions for mode of delivery. Operational definitions varied widely and at times were not defined at all. Categorization of type of cesarean took many guises: maternal request, planned or unplanned, scheduled or unscheduled, emergency vs nonemergency vs urgent, labored or unlabored, "elective," and specific maternal or neonatal indications for a particular mode of delivery.

For the benefit of this literature as well as the broader literature on birth outcomes, we strongly recommend that significant resources be designated to arriving at precise operational definitions for all applicable categories of delivery modes, including clear specification of maternal and neonatal indications. Without early consensus on these definitions, we are unlikely to arrive at reliable estimates of the trend and incidence of CDMR (or other reasons for cesarean delivery more generally) or of the benefits and harms associated with any particular mode of delivery in comparison with another.

In addition, we strongly recommend establishing a minimum data set for maternal and neonatal outcomes to help clarify the terminology but also to provide a mechanism for doing long-term prospective investigations. This will require thoughtful collaboration among appropriate stakeholders, including family physicians, midwives, obstetricians, neonatologists, pediatricians, urogynecologists, and experts in public health.

Appropriate Study Design

Although clinical trials are the usual touchstone and highest standard for aiding clinical decisionmaking, the feasibility of conducting a trial on CDMR is questionable. Researchers will need groups of women who opt to have cesarean births based on their own desire, and not as a result of a previous cesarean, or groups of women who are willing to be assigned randomly to either scheduled cesarean or conventional expectant management and labor, which could include cesarean based on medical need.

Currently, prospective observational studies provide the best initial approach to defining and describing outcomes of planned routes of delivery adequately. However, we recognize that prospective studies may be inadequately powered to examine rare outcomes such as maternal or neonatal death, hysterectomy, or shoulder dystocia. Universal adoption of consistent terminology and recordkeeping on planned route of delivery will increase the usefulness of retrospective data in addressing rare outcomes, especially data in large administrative databases.

Appropriate Statistical Methods and Reporting

Investigators must address a variety of statistical issues. Paramount are ensuring adequate sample size and doing power calculations. Most studies (other than those relying on surveys or administrative data) were relatively small. Some may have been underpowered for all but the most basic comparisons, and most were underpowered for subgroup analyses. Investigators should consider a priori what comparisons they want to make (and report) on the relevant power calculations. This is especially critical if researchers wish to track rare outcomes.

We recognize that some research teams may well have attended to these concerns. If so, they did not report them. Thus, we encourage those conducting trials or other studies to report all power calculations and otherwise make available data that will enable groups doing systematic reviews in the future to understand clearly and possibly use those data in quantitative analyses. In addition, we caution that researchers should take care to deal with statistical problems of multiple comparisons, possibly with appropriate corrections for statistical significance. Finally, we suggest that all research reports directly report or provide information sufficient to understand the statistical significance (or lack of it) for all reported comparisons.

Appropriate Comparisons

Studies designed to compare outcomes of CDMR need to compare outcome by *planned* routes of delivery. Such intent-to-treat analysis should not, and need not, be limited to randomized controlled trials. At the current time, given the lack of any mechanism to record intent in a standardized fashion, prospective studies are the only reliable source for obtaining appropriate comparisons based on planned routes of delivery.

We strongly recommend that clinicians routinely record the planned route of delivery at term in prenatal records. Such data would allow for appropriate comparisons based on intent-to-treat even with retrospective studies. We acknowledge, however, that liability issues and fear of discord with peers, especially for conducting CDMR, might well dissuade clinicians from making such notes.

Future studies should limit the use of proxies for CDMR. Caution should be exercised in interpreting results of studies that use such proxies, because they often introduce bias from uncontrolled confounding effects. All analysts should consider carefully the potential magnitude and direction of effect from such bias.

Important Outcomes

We draw attention to two specific outcomes, one maternal and one neonatal, that we believe require special thinking when investigators are planning future research. For mothers, reduced urinary incontinence is often cited as a major benefit of CDMR, and significant resources ought to be allocated to provide evidence to support or refute this claim. An outcome such as urinary incontinence requires a *long-term*, comprehensive study that assesses a wide range of variables: mode of delivery, number of births, presence and severity of urinary incontinence, and other factors that have been suggested as confounders such as constipation, smoking, and chronic cough.

For infants, the primary morbidity associated with prematurity is lung immaturity. The evidence is strong for an association between gestational age and lung maturity. For those reasons, prospectively and accurately documenting estimated gestational age and respiratory outcomes among maternal choice cesareans is critical. If CDMR rates continue to increase, clinicians and patients may tend to want to do cesareans at an earlier gestational age for maternal convenience arising from discomfort from a gravid uterus. The benefits and harms of such practices, particularly for the neonate, must be well understood by all parties, and providing that information will require additional research.

Severity

The issue of severity rating is particularly important for pelvic floor outcomes such as urinary incontinence, pelvic organ prolapse, or anal incontinence. An undifferentiated measure of urinary incontinence that does not account for severity would mask the considerable differences in quality of life between a small amount of leakage that occurs rarely and severe and daily urinary leakage.

Similarly, neonatal outcomes such as respiratory morbidity need to be categorized and analyzed by degree of severity. For instance, TTN and RDS represent extremes of severity; investigators should not group them into a single measure of respiratory morbidity because doing so may obscure meaningful differences among groups.

Appropriate Measures

Future studies will require a comprehensive assessment of outcomes using validated questionnaires with a standardized timing of outcome measures, with measures of severity and utility.

Comprehensive outcomes. Ideally, a systematic review of the outcomes of planned route of delivery should provide a comprehensive assessment of outcomes, accounting for the severity of symptoms and the utility of various outcomes to patients. For instance, accurate measurement of neonatal respiratory morbidity should include the risks of all forms of harm associated with

planned route of delivery, including potentially higher risks of meconium aspiration in planned vaginal deliveries and potentially higher risks of TTN and RDS in planned cesarean deliveries.

Validated questionnaires. Researchers should be encouraged to use reliable and valid questionnaires for assessing outcomes such as health-related quality of life, maternal-infant attachment, birth satisfaction, pelvic floor disorders (urinary incontinence, pelvic organ prolapse, and anal incontinence), and sexual function. These instruments must appropriately capture both short- and long-term consequences of decisions related to mode of delivery. When validated instruments do not exist or are too long to administer in these circumstances, investigatators should either develop (and validate) or adapt existing ones into shorter forms.

Standardized times for outcome measurement. Ideally, outcomes should be measured over time periods that are appropriate and clinically relevant. In addition to reaching consensus on terminology, researchers in the field should develop consensus on the minimum clinically relevant time period from delivery to measurement for outcomes, particularly for outcomes of importance beyond the postpartum period.

Confounders

Future studies need to describe and control for potential confounders of route of delivery and outcomes. The nature of these confounders may vary depending upon the specific outcome of interest.

At a minimum, studies of maternal outcomes should account for age, BMI, parity, previous cesarean deliveries, multiple gestation, maternal medical conditions such as diabetes mellitus, abnormal placental implantation (e.g., previa and accreta), and epidural use. Studies of neonatal outcomes should additionally account for gestational age, fetal presentation, and fetal anomalies or medical condition. Finally, future studies should also control for health system variables such as access to antibiotics, anesthesia, blood banking, and providers with adequate surgical training to perform an emergency cesarean delivery, which together are important components of a high standard of care.

Utility of Outcomes

Factoring in both severity and utility when assessing the overall benefit and harm of CDMR is critically important. A woman considering a *planned* route of cesarean delivery needs to assess comprehensively both short- and long-term risks, to both herself and her infant, and in both the current pregnancy and future pregnancies.

Currently, clinicians and others have little or no way to judge the “priority” of a range of possible outcomes. For instance, urinary incontinence needs to be described in a manner that relates both its occurrence and severity and that provides a utility weighting relative to other potential outcomes such as wound infection. Similarly, in assessing overall harms and benefits to the neonate, the potentially higher risk of neonatal respiratory morbidity (TTN and RDS) associated with a *planned* CDMR needs to be weighed against the potential reduction in the rate of other outcomes such as stillbirths after 39 weeks, intrapartum deaths, and shoulder dystocias (an emergency occurring when the infant’s shoulder gets “stuck”) associated with a *planned* vaginal delivery.

New Areas for Research

Costs. A thorough evaluation of the costs associated with CDMR is warranted given the finite health care resources available in this country. Such a cost analysis needs to be done from various perspectives: the patient and her family, the health system (e.g., hospital, physician group), the health plan or insurance carrier (both public, as in Medicaid, and private), and the health care system more generally. To be most informative, such a cost analysis would factor in the costs associated with subsequent deliveries. It should account for all appropriate intrapartum and postpartum expenses attributable to each pathway of delivery, for both mother and infant.

We draw attention, in this regard, to the flowchart figure in Chapter 1, which documents the considerable complexity of the pathways as they diverge from initial planned route to the actual route of delivery, particularly in that the planned and actual routes diverge at different points. Whether the costs associated with the higher numbers of planned cesareans in the CDMR arm (primarily surgical costs) will be balanced by the costs associated with planned vaginal delivery (labor and delivery nursing time, supplies, epidural management, medications, and the surgical costs associated with labored cesareans) remains to be determined. Psychosocial burdens and the influence of satisfaction with the birth experience, infant feeding, and neonatal and infant development, including any decrements in maternal and infant attachment, remain uninformed by adequate comparisons; more to the point, their costs cannot be reduced to simple economic terms.

Apart from gaining data simply on costs per se, the question of cost-effectiveness may arise. Which delivery path is more cost effective is impossible to say for two reasons. First, as we have documented, little is known about the comparative effectiveness of different modes of delivery. Second, no studies compare the costs of CDMR with those of planned vaginal delivery. Thus, the task of examining any issues related to cost-effectiveness lies well into the future.

Medical and legal concerns. If the rate of CDMR were to continue to increase, how and to what degree this pattern would affect the medicolegal environment within which obstetrics is currently practiced in developed countries (particularly the United States) remains an open question. Future research in this area would help us understand to what extent a decision to perform a cesarean after labor in a woman who planned a vaginal delivery was influenced by the provider's fear of litigation. Future research could also investigate whether medicolegal exposure or malpractice insurance premiums rise or fall depending on patterns of CDMR vs. planned vaginal delivery.

Conclusions

The incidence of CDMR appears to be increasing. However, accurately assessing its true incidence or trends over time is difficult because currently CDMR is neither a well-recognized clinical entity nor an accurately reported indication for diagnostic coding or reimbursement. More information is available on this question from nations other than the United States, and they differ from this country in health systems, cultural attitudes, patient demographics, and other factors. Drawing inferences from non-US sources, therefore, must be done with caution.

Virtually no studies exist on CDMR per se, so the knowledge base rests chiefly on indirect evidence from proxies such as cesareans performed for breech presentation. These proxies each possess unique and significant limitations. Furthermore, the vast majority of studies to date

compared outcomes by actual routes of delivery, not planned routes of delivery. Therefore, significant uncertainty remains regarding the "ideal" route of delivery. Primary CDMR and planned vaginal delivery likely do differ with respect to individual outcomes for either mothers or infants. However, our comprehensive assessment, across many different outcomes, suggests that no major differences exist between primary CDMR and planned vaginal delivery, but the evidence is too weak to conclude definitively that differences are completely absent. If a woman chooses to have a cesarean delivery in her first delivery, she is more likely to have subsequent deliveries by cesarean. With increasing numbers of cesarean delivery, risks occur with increasing frequency.

Given the limited data available, we cannot draw definitive conclusions about factors that might influence outcomes of planned CDMR vs. planned vaginal delivery. Neither is the knowledge base adequate to comment definitively on many factors that influence the outcomes of actual cesarean and vaginal deliveries.

Our review focused on primary CDMR. We note that a comprehensive assessment of the risks and benefits of CDMR extends beyond the first cesarean. Future research needs to account for complications and risks associated with repeat cesarean deliveries such as adhesions, placenta previa and accreta, and subsequent stillbirths.

Significant resources will need to be allocated to study CDMR if the nation is to be well informed about the benefits and harms to mothers and infants in both the first and subsequent pregnancies. To realize the maximum gain from such work, research intended to answer questions about maternal and neonatal outcomes of CDMR must study them by intent-to-treat methods. This means comparing outcomes of planned CDMR with those of planned vaginal delivery, not comparing outcomes by actual routes of delivery.

Future research efforts need to focus on a substantial set of problems: developing consensus about terminology for both delivery routes and outcomes; creating a minimum data set of information about CDMR; improving study design and statistical analyses; attending to major outcomes and their special measurement issues; assessing both short- and long-term outcomes with better measurement strategies; dealing better with confounders; and considering the value or utility (in quality-of-life terms) of different outcomes. Examining the costs and cost-effectiveness of different pathways of delivery and considering the impact of CDMR on the medicolegal system also warrant attention.

Finally, if we are to gain meaningful data on short- and long-term maternal and neonatal outcomes associated with CDMR (whether or not compared with planned vaginal delivery), we should define success as a healthy mother and infant in the broadest sense of well-being possible. Studies ought to be well-designed, prospective, with adequate sample sizes and clearly described power analyses for both common and rare outcomes. Accumulating such high-quality evidence is possible with cooperation from all stakeholders; acquiring it is imperative if women and care providers are to be able to make informed decisions about CDMR.

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Appendix A
Exact Search Strings

Exact Search Strings

Focused Search No. 1

#3	Search "Cesarean Section"[MeSH] =	21612
#4	Search "Cesarean Section"[MeSH] Field: All Fields, Limits: Publication Date from 1990, English, Humans =	8641
#7	Search request OR elective OR planned OR pre-labor OR non-labor =	61448
#8	Search #4 AND #7 =	1457
#9	Search ("Cesarean Section/statistics and numerical data"[MeSH] OR "Cesarean Section/trends"[MeSH]) =	2569
#10	Search #7 AND #9 =	282
#11	Search #7 AND #9 Field: All Fields, Limits: Publication Date from 1990, English, Humans =	230
#12	Search #4 AND #7 Field: All Fields, Limits: Publication Date from 1990, English, Review, Humans =	103
#13	Search #4 AND #7 Field: All Fields, Limits: Publication Date from 1990, English, Meta-Analysis, Humans =	16
#21	Search "Epidemiologic Methods"[MeSH] OR "Randomized Controlled Trials"[MeSH] Field: All Fields =	2165030
#22	Search #8 AND #21 =	799
#23	Search #8 AND #21 Field: All Fields, Limits: Publication Date from 1990, English, Randomized Controlled Trial, Humans =	225
#24	Search #22 NOT #23 =	574
#29	Search ("Outcome Assessment (Health Care)"[MeSH] OR "Pregnancy Outcome"[MeSH]) OR "Reproductive History"[MeSH] OR "Treatment Outcome"[MeSH] OR "Outcome and Process Assessment (Health Care)"[MeSH] =	287783
#30	Search #29 AND #24 =	194
#31	Search ("Cesarean Section/adverse effects"[MeSH] OR "Cesarean Section/mortality"[MeSH]) =	2409
#39	Search "Risk Factors"[MeSH] OR "Fetal Death"[MeSH] OR ("Urinary Incontinence"[MeSH] OR "Urinary Incontinence, Stress"[MeSH]) OR "Respiratory Distress Syndrome, Newborn"[MeSH] OR "Pelvic Floor"[MeSH] OR ("Prolapse"[MeSH] OR "Uterine Prolapse"[MeSH] OR "Rectal Prolapse"[MeSH]) OR "Fecal =Incontinence"[MeSH]	309733
#40	Search #8 AND #39 =	220
#41	Search #31 AND #7 =	233
#42	Search #40 OR #41 =	398
#43	Search #40 OR #41 Field: All Fields, Limits: Publication Date from 1990,	311

	English, Humans =	
47	Search "Urinary Incontinence"[MeSH] AND "Delivery, Obstetric"[MeSH] Limits: Publication Date from 1990, English, Humans =	118
EMBASE Search:		
Cesarean AND (Request OR Elective OR Planned OR Pre-Labor OR Non-Labor) =		77
(Several of these were discarded because they were not in English)		
Cochrane Search:		
Reviews:		
Cesarean AND (Request OR Elective OR Planned OR Pre-Labor OR Non-Labor) =		8
Cochrane Clinical Trial Registry (Central OR CCTR)		
Cesarean AND (Request OR Elective OR Planned OR Pre-Labor OR Non-Labor) =		59
Total, unduplicated database =		926

Focused Search No. 2

#3	Search "Infant, Newborn"[MeSH]Or neonate =	357815
#8	Search "Cesarean Section"[MeSH] =	21710
#9	Search #8 AND #3 =	7096
#15	Search "Infant, Premature"[MeSH] =	24780
#16	Search #13 NOT #15 =	930
#12	Search ("Outcome Assessment (Health Care)"[MeSH] OR "Fatal Outcome"[MeSH] OR "Pregnancy Outcome"[MeSH]) OR ("Treatment Outcome"[MeSH] OR "Outcome and Process Assessment (Health Care)"[MeSH]) =	300710
#13	Search #9 AND #12 =	1020
#22	Search #16 AND #21 =	71
#21	Search "Randomized Controlled Trial"[Publication Type] OR "Randomized Controlled Trials"[MeSH]) OR "Single-Blind Method"[MeSH] OR "Double-Blind Method"[MeSH] OR "Random Allocation"[MeSH] =	287666
#23	Search #16 AND #21 Field: All Fields, Limits: English, Humans =	64

Focused Search No. 3

#6	Search "Infant, Newborn"[MeSH]OR neonate =	357988
#8	Search "Cesarean Section"[MeSH] =	21716
#9	Search #6 AND #8 =	7098
#10	Search infant, premature [MeSH] =	24804
#11	Search #9 NOT #10 =	6541
#14	Search ("Outcome Assessment (Health Care)"[MeSH] OR "Fatal Outcome"[MeSH] OR "Pregnancy Outcome"[MeSH]) OR ("Treatment Outcome"[MeSH] OR "Outcome and Process Assessment (Health Care)"[MeSH]) =	301265
#15	Search #11 AND #14 =	930
#16	Search #11 AND #14 Field: All Fields, Limits: English, Humans =	730
#22	Search "Epidemiologic Research Design"[MeSH] =	403194
#23	Search #22 AND #16 =	33
#26	Search "Delivery, Obstetric"[MeSH] OR "Extraction, Obstetrical"[MeSH] =	40646
#27	Search #8 AND #26 =	21716
#28	Search Comparative Study [mh] =	1181123
#29	Search #27 AND #28 =	2667
#30	Search epidemiologic study design =	92338
#31	Search #29 AND #30 =	176
#32	Search #29 AND #30 Field: All Fields, Limits: English, Humans =	163
#37	Search ("Randomized Controlled Trial"[Publication Type] OR "Randomized Controlled Trials"[MeSH]) OR "Double-Blind Method"[MeSH] OR "Random Allocation"[MeSH] OR "Single-Blind Method"[MeSH] Limits: English, Humans =	243752
#38	Search #37 AND #29 Limits: English, Humans =	565
#39	Search #31 OR #38 Limits: English, Humans =	691
#40	Search #39 AND #14 Limits: English, Humans =	139

Focused Search No. 4

#6	Search Infant, Newborn [mh] AND Cesarean Section/adverse effects [mh] =	454
#7	Search Infant, Newborn [mh] AND Cesarean Section/adverse effects [mh] Field: All Fields, Limits: English, Humans =	303
#8	Search Infant, premature [mh] =	24809
#10	Search #7 NOT #8 =	282
#11	Search #7 NOT #8 Field: All Fields, Limits: Editorial =	7
#12	Search #7 NOT #8 Field: All Fields, Limits: Letter =	25
#13	Search #7 NOT #8 Field: All Fields, Limits: Review =	20
#14	Search #11 OR #12 OR #13 =	52
#15	Search #10 NOT #14 =	230

Focused Search No. 5

#1	Search cesarean section	31631
#2	Search risk	717885
#3	Search #1 AND #2	5712
#7	Search "Placenta Praevia/etiology"[MeSH] OR ("Placenta Accreta/epidemiology"[MeSH] OR "Placenta Accreta/etiology"[MeSH])	712
#8	Search #3 AND #7	82
#9	Search #3 AND #7 Field: All Fields, Limits: English, Humans	69
#10	Search #7 AND #2 Limits: English, Humans	145
#11	Search #9 OR #10 Limits: English, Humans	145

Focused search #6: Faiz & Ananth Meta-Analysis Update: Literature Search

#9	Search "Placenta Praevia"[MeSH]OR "Placental disorder" [tw] OR "antepartum hemorrhage" [tw] OR "antepartum bleeding" [tw] OR "uteroplacental bleeding" [tw] =	1551
#10	Search "maternal age" OR gravidity OR parity OR "cesarean section" OR "uterine surgery" OR "uterine instrumentation" OR "abortion" OR hypertension OR pre-eclampsia OR eclampsia OR "smoking" OR "drug use"	
=	476526	
#11	Search #9 AND #10 =	717
#12	Search #9 AND #10 Field: All Fields, Limits: Publication Date from 2000 to 2005 =	145
#13	Search #9 AND #10 Field: All Fields, Limits: Publication Date from 2000 to 2005, Review =	13
#14	Search #9 AND #10 Field: All Fields, Limits: Publication Date from 2000 to 2005, Meta-Analysis =	1
#16	Search #13 OR #14 Field: All Fields =	14
#17	Search #12 NOT #16 =	131

****

This was the search as described in the Faiz and Ananth meta-analysis that was used as a guideline. This updated the literature through the end of May 2005.

Faiz AS, Ananth CV.
Etiology and risk factors for placenta previa: an overview and meta-analysis of observational studies.
J Matern Fetal Neonatal Med. 2003 Mar;13(3):175-90.
PMID: 12820840 [PubMed - indexed for MEDLINE]

Search strategy as described in the methods section: Observational studies published in the English language between January 1966 and March 2000 were potentially eligible for inclusion in this overview. Identification of such studies was based on a comprehensive MEDLINE search, as well as by identifying studies cited in the references of published papers. The MEDLINE search was based on the following medical subject headings (MeSH): placenta pr(a)evia, placental disorders, antepartum h(a)emorrhage, and antepartum and uteroplacental bleeding. The other key words used in conjunction with previa were maternal age, gravidity, parity, C(a)esarean delivery/section, uterine surgery, uterine instrumentation, abortion, spontaneous abortion, induced abortion, elective abortion, chronic hypertension, pregnancy-induced hypertension, pre-eclampsia, eclampsia, cigarette smoking and drug use....Published case reports on placenta previa and studies on placental abruption were excluded.

Appendix B
Sample Review Forms/
Quality Rating Forms

Systematic Review of Cesarean Delivery on Maternal Request
Data Abstraction Form

Reference ID Number: ___ ___ ___ ___ Reviewer's Initials: ___ ___ Date of Review: ___/___/2005

***Directions**: Please complete ALL questions below.*
***Note**: These questions are for whether an article will be included in the review. There is an opportunity at the bottom of the page to request an article for background or the decision analysis even if it doesn't meet criteria for the review.*

1. Published between 1990 and 2005	Yes	No	Cannot Determine
2. Published in English	Yes	No	Cannot Determine
3. Study located in any of the following: United States, Canada, United Kingdom, Western Europe, Japan, Australia, New Zealand	Yes *If No, check one of the following:*	No Brazil Israel	Cannot Determine S. Africa Other: _____
4. Includes women of reproductive age or older with singleton birth(s)	Yes	No	Cannot Determine
5. Addresses one or more of the following (*check all that apply*) Trend & incidence of cesarean delivery *(KQ1)* Maternal & infant short- and long-term outcomes of elective cesarean. NOTE: A comparison between elective cesarean and attempted vaginal delivery is required in order to answer this key question *(KQ2)* Factors affect magnitude of the benefits & harms of elective cesarean *(KQ3)* Future research directions *(KQ4)*	Yes	No	Cannot Determine
6. Study design is one of the following *(check one box if "Yes"):* RCT Observational Study	Yes	No	Cannot Determine
7. Sample size is appropriate *(Please check correct sample size if Yes)* If RCT, N≥50 *(NOTE: This refers to the # randomized)* If Observational, N≥100	Yes *If No, check if maternal psychosocial outcomes were measured in the study*	No	Cannot Determine

Please check one of the options below based on your answers to Q1-Q7 above

PULL Article	Abstract meets ALL inclusion criteria above
	Abstract meets some inclusion criteria above; we cannot determine some criteria
	Abstract does NOT meet one or more of the inclusion criteria above but may be important for the background, the discussion, hand searching the references, or the decision analysis
DO NOT Pull Article	Abstract does NOT meet one or more of the criteria above and we do not need it for any other purpose

Systematic Review of Cesarean Delivery on Maternal Request
Data Abstraction Form

Reference ID Number: ___ ___ ___ ___ Reviewer's Initials: ___ ___ Date of Review: ___/___/2005

***Directions**: This form contains questions pertaining to whether an article will be included in the review or excluded. Please complete **ALL** of the questions unless otherwise directed. If there is an asterisk next to an answer, please complete the necessary information in the left column.*

Inclusion Criteria	**Does article meet criteria?**	
1. Is the article published between January 1990 and May 2005?	Yes	No
2. Is the article published in English?	Yes	No
3. Is the article original research? *e.g., RCTs, cohort studies, case control studies, case series >100*	Yes ***(Go to Q5)***	No ***(Go to Q4)***
4. Is the article a meta-analysis or systematic review? **As directed, please separate these from the rest of the articles when returning*	Yes* ***(Complete Q7 & Final Status)***	No
Q7 should be completed for all articles; Q5-6, Q8-10 should be completed for original research ONLY		
5. Is the study located in any of the following: United States, Canada, United Kingdom, Western Europe, Japan, Australia, New Zealand **If NO, please check one of the following:* *Brazil* *Israel* *S. Africa* *Other: _____*	Yes	No*
6. Does the study include women of reproductive age or older with term, singleton births AND/OR neonates/infants/newborns/etc?	Yes	No
7. Does the study address one or more of the following key questions? **If YES, please check all that apply:* Trend & incidence of cesarean delivery *(KQ1)* Maternal & infant short- and long-term outcomes of elective cesarean *(KQ2)* • ***NOTE:** A comparison between elective cesarean and attempted vaginal delivery is required in order to answer this key question* Factors that affect magnitude of the benefits & harms of elective cesarean *(KQ3)* • ***NOTE**: This question refers to modifiers of outcomes of cesarean (KQ2), NOT the incidence/risk of cesarean (KQ1)* • ***NOTE**: A comparison between elective cesarean and attempted vaginal delivery is NOT necessary to answer this question. However, if the article addresses only vaginal delivery, it is not eligible for this question* Future research directions *(KQ4)*	Yes*	No

(Continued)

Inclusion Criteria	**Does article meet criteria?**	
8. Is the study an RCT or observational study? **If YES, please check one of the following:* RCT Observational Study	Yes*	No ***(STOP! Go to Final Status)***
9. Is the sample size appropriate? **If YES, please check which scenario applies:* If RCT, N≥50 *(NOTE: This refers to the # randomized)* If Observational, N≥100 ** *If NO, check here if psychosocial outcomes were measured*	Yes*	No**
10. What is the total sample size of this study?	**N= _____**	

FINAL STATUS OF FULL-TEXT ARTICLE

Check here if "YES" is circled for all questions above, except Q4
STOP! Article will be included in the review & data will be abstracted.

Check here if any "NO" is circled above
(Check one or more of the boxes below for final action)

Hand search refs

Use for background

Use for discussion

Use for decision analysis

Exclude from everything

Systematic Review of Cesarean Delivery on Maternal Request
Data Abstraction Form

SECTION 1: REVIEWER & ARTICLE IDENTIFIERS

1. **Abstractor's Initials: ___ ___**
2. **Date of Abstraction: ___ / ___ / ___**
3. **Article Number: ___ ___ ___ ___**
4. **Date of Publication: ___ / ___ / ___**

SECTION 2: FUNDING & SETTINGS

5. **How was the study funded? (***check all that apply***)**

Industry
Government
Professional Society
Not reported or unclear
Private Foundation
Hospital / Managed Care Organization
Consumer / Patient Foundation
Other (please specify):

_____

6. **In what countries does the study take place? (***check all that apply***)**

United States Canada United Kingdom (*includes England, Scotland, Wales, 1/6 of Ireland*)

Japan Brazil Israel Australia New Zealand

Western Europe (*please check all that apply below*)

Andorra	*Austria*	*Azores*	*Belgium*	*Denmark*	*Faroe Island*
Finland	*France*	*Germany*	*Gibraltar*	*Greece*	*Greenland*
Iceland	*Ireland*	*Italy*	*Liechtenstein*	*Luxembourg*	*Madeira*
Malta	*Monaco*	*Netherlands*	*Norway*	*Portugal*	*San Marino*
Spain	*Sweden*	*Switzerland*			

*If countries are other than above, please explain here: _____
_____
_____

7. **What is the source of the populations? (*check all that apply and describe below*)**

Hospital/Labor & Delivery Unit/Maternity Unit/Outpatient Clinic/NICU (*specific*)
Community based (*clustering of above, not quite as specific*)
Population based (*entire city/country/etc such as from an administrative database*)

Description of population:

_____
_____
_____
_____
_____

8. **What are the sources of data? (*check all that apply)***

Survey

_____

Questionnaire(s) in person
_____
Questionnaire(s) via mail, email, or internet
_____
Administrative database (**describe* ⟶)
_____
Physical Exam
_____
Interview in person
_____
Interview via telephone
_____
Medical records query
_____

9. Data was collected between ___/___/___ and ___/___/___ *(In other words, when was the study?)*

SECTION 3: INCLUSION & EXCLUSION CRITERIA

10. Please list the criteria for inclusion and/or exclusion (*however presented in the article***) below:**

Inclusion	**Exclusion**

SECTION 4: STUDY DESIGN

11. Is the study a randomized controlled trial of unlabored/planned/elective cesarean delivery compared to an attempted vaginal delivery? (*NOTE: attempted vaginal delivery could result in a labored cesarean***)**

Yes (*Complete section 4A*)
No (*Complete section 4B*)

SECTION 4A: RANDOMIZED CONTROLLED TRIAL (RCT)

12. Briefly describe the randomization method: _____

13. How many randomized groups are in this study? _____

14. Was the randomization method sound? Yes *Notes*: _____

No

_____

_____

15. Describe the randomized groups (*Note: Continue to keep this order throughout the rest of the form***):**

a. _____
b. _____
c. _____
d. _____
e. _____
f. _____
g. _____

16. Were statistical tests of the groups reported? Yes No

17. Was true randomization achieved? Yes No

Describe the evidence for or against balance among the groups: _____

_____

_____

18. Were there any post-randomization exclusions? Yes No

Describe the post-randomization exclusions: _____

_____

_____

19. Give the number of women randomized to each group at the beginning of the study:

a. _____ **e.** _____
b. _____ **f.** _____
c. _____ **g.** _____

d. _____ **TOTAL # randomized in the study = _____**

20. Describe WHEN randomization took place (*i.e., in relationship to labor & delivery***)**

_____

_____

21. Was any form of masking attempted & carried out during the study? (*NOTE: This could occur, for example, if the staff person interviewing the woman 6 months after delivery does not know what the woman had been randomized to***)**

Yes → (*Describe*): _____
No _____

22. Was there any cross-over in this study?

Yes (*Describe*): _____
No _____

23. Was an intent-to-treat analysis conducted? Yes No

24. Which analysis is presented?

As randomized *(intent-to-treat)*
As happened *(removing post-randomization exclusions and crossovers)*
Both **Abstract both sets of data*

SECTION 4B: OBSERVATIONAL STUDY (OBS)

25. What is the design of this observational study? (*Check one***)**

Cohort
Case-control
Large case-series
Cross-sectional *(e.g., survey, admin dataset, medical record query)*

NOTE*: If the study was an RCT that randomized women to groups other than unlabored cesareans vs attempted vaginal birth BUT the data is presented using these groups, we will consider the study an observational cohort study. If applicable, please describe:*

_____

_____

26. Is the data collected prospectively or retrospectively? Prospectively Retrospectively

27. DESCRIBE AND DEFINE the mode of delivery groups being compared in this study:

NOTE*: If the study ONLY addresses KQ3, we are not comparing mode of delivery groups. You will either have one group of elective cesarean or one group of cesarean that includes both elective (unlabored) and non-elective (labored, emergency) cesareans. If the study includes both of these cesarean groups, include both groups below.*

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

h. _____

SECTION 5: FOLLOW UP OF PARTICIPANTS

28. In the table below, please document the timepoints of follow up in the study in relationship to either randomization or the beginning of the study. Please also document the number of participants, as a fraction, who were available for follow up at that timepoint within each group. The denominator should be the number randomized, with necessary adjustments, or the number of participants at the beginning of the study, who are eligible to provide data at that timepoint. (*Note: Use the largest numerator that was available during each timepoint, even if not all the participants supplied data for every outcome***).**

Timepoint of Data Collection ↓	Group A _____	Group B _____	Group C _____	Group D _____	Group E _____
a. Number enrolled *(X/X should =100%)*	/	/	/	/	/
b. Number randomized (RCT) or selected (OBS) at start of study	/	/	/	/	/
c.	/	/	/	/	/
d.	/	/	/	/	/
e.	/	/	/	/	/
f.	/	/	/	/	/
g.	/	/	/	/	/
h.	/	/	/	/	/

29. Was any loss-to-followup differential across study groups? Yes No

Describe: _____

_____

_____

SECTION 6: CHARACTERISTICS OF PARTICIPANTS

Characteristic	How defined/measured	Data (Raw data, Point estimates) Study Groups A _____ _____	B _____ _____	C _____ _____	D _____ _____	Total
30. Maternal Age						
31. Maternal Race						
32. Maternal BMI						
33. Education						
34. Marital Status						
35. Income/SES						
36. Gravidity/Parity						
37. Previous C/S						
38. Medical Conditions						
39. Previous Pelvic or Abdominal Surgery						
40. Other characteristic of participant						
41. Other characteristic of participant						

42. Other characteristic of participant						

43. Is this population of women homogenous with regards to one of the participant characteristics (i.e., all nulliparous, all women with previous cesarean deliveries)?

Yes* ⟶ Describe: _____

No

_____

NOTE: This study may be included for Key Question 2B---outcomes of elective cesarean vs trial of labor in a subpopulation of women---if you answered yes to the question above.

SECTION 7: CHARACTERISTICS OF THE PREGNANCY, LABOR & DELIVERY

44. How are labor and/or the stages of labor defined in this study?

_____

_____

_____

Characteristic	How defined/measured	Data (Raw data, Point estimates) Study Groups A _____ _____	B _____ _____	C _____ _____	D _____ _____	Total
45. Prenatal care						
46. Gestational Age/Pregnancy Dating						
47. Pregnancy related conditions (e.g., Preeclampsia)						
48. Abnormal placentation						

49. Presentation						

Characteristic	How defined/measured	Data (Raw data, Point estimates) Study Groups A _____ _____	B _____ _____	C _____ _____	D _____ _____	Total
50. Other contraindications to labor						
51. Augmentation of labor (e.g., induction)						
52. Rupture of membranes						
53. Fetal heart rate (i.e., abnormal heart rate)						
54. Meconium						
55. Fetal weight						
56. Fetal sex						
57. Anesthesia						
58. Episiotomy						
59. Timing of delivery/Length of labor						
60. Mode of delivery						

61. Complications during delivery (e.g., cord prolapse, chorioamnio.)						
62. Characteristic of delivery technique						

Characteristic	**How defined/measured**	**Data (Raw data, Point estimates) Study Groups A** _____ _____	**B** _____ _____	**C** _____ _____	**D** _____ _____	**Total**
63. Characteristic of repair/suture technique/materials						
64. Other characteristic of labor/delivery						
65. Other characteristic of labor/delivery						
66. Other characteristic of labor/delivery						

67. Is this population of infants homogeneous with regards to one of the characteristics (i.e., all breech)?

Yes* ⟶ Describe: _____

No

_____

NOTE: This study may be included for Key Question 2B---outcomes of elective cesarean vs trial of labor in a subpopulation of infants---if you answered yes to #68.

SECTION 8: CHARACTERISTICS OF THE SETTING

Characteristic	**How defined/measured**	**Data (Raw data, Point estimates) Study Groups A** _____ _____	**B** _____ _____	**C** _____ _____	**D** _____ _____	**Total**

68. Time of day of delivery						
69. Physician Experience						
70. Standard of care/delivery volume*						

**If a study is comparing two hospitals or delivery units, this question will be especially pertinent*

SECTION 9: OUTCOMES OF ELECTIVE C/S VS. TRIAL OF LABOR

If the study reports outcome data comparing an elective cesarean/unlabored cesarean group to one or more groups that began with a trial of labor, report the outcomes below. There are four sections: maternal short-term outcomes, maternal long-term outcomes, neonatal short-term outcomes, and neonatal long-term outcomes. Short term is defined as before one year post-delivery. Long term outcomes are those occurring at one year past delivery and beyond.

THE STUDY MUST REPORT DATA FOR AN ELECTIVE, UNLABORED CESAREAN GROUP AND AT LEAST ONE TRIAL OF LABOR GROUP, WHICH COULD INCLUDE LABORED C/S, TO BE INCLUDED IN THIS SECTION!

An explanation of the columns in the tables:

Code: *Outcomes will be grouped with like outcomes, using a numerical code. The codes for each outcome can be found before each of the tables in the four sections of outcomes.*

Outcome: *What is the specific outcome? How is it labeled in the study results?*

Definition: *How does the study define the outcome?*

Measured How: *How did the study measure this particular outcome and who measured it?*

Measured When: *At what timepoint was this outcome measured in the study?*

Data: *Enter the raw data, with both numerator and denominators, for each mode of delivery group. Also enter any of the statistical findings here. If there are no numbers, enter p-values, exact quotes, etc that explain the findings.*

NOTE: Each row in the table corresponds to an outcome at one timepoint. If the outcome is assessed at more than one timepoint, the data should be reported on as many rows as there are timepoints.

71. MATERNAL SHORT-TERM OUTCOMES (A)

A1=Mortality
A2=Intraoperative/Intrapartum Complications (e.g., injury to bladder/ureter/bowel, extension of incisions, perineal lacerations, haematoma)
A3=Anesthesia Issues (e.g., complications from)
A4=Hemorrhage (e.g., require blood transfusion, require D&C, blood loss, require gravid hysterectomy)
A5=Postoperative or postpartum pain
A6=Wound Complications (e.g., infection, breakdown, dehiscence)
A7=Infection (NOT of the incision) (e.g., pneumonia, UTI, mastitis, other infection)
A8=Thromboembolic Complications (e.g., deep-vein thrombosis (DVT), pulmonary embolism)
A9=Other Complications (e.g., acute respiratory distress syndrome, hypertension, ileus, bowl obstruction)
A10=Breastfeeding (e.g., ability/desire to breastfeed)
A11=Psychological (e.g., general feeling regarding birth experience, early post-partum depression, transition issues)
A12=Maternal Recovery (e.g., length of stay in hospital, need for ICU admit, hospital readmit)

Extra table space for additional outcomes or extra study groups can be found on the back of this

Outcome Code	Specific Name of Outcome as described by study	Definition of Outcome (Include all details presented by study)	How is the outcome measured & by whom?	When is this outcome measured?	Outcome Data by Study Groups				Total
					A _____ _____	B _____ _____	C _____ _____	D _____ _____	
(Example from reference #31)					**Unlabored C/S**	**SVD *Referent**	**Assisted VD *Referent**	**Labored C/S *Referent**	
A6	"Wound infection" (*see table 3*)	Infected abdominal or episiotomy wound	Nova Scotia Atlee Perinatal Database	Not reported	11 / 721 (1.5%)	55 / 12,607 (0.4%) RR=3.5 (1.8, 6.7)* *P<0.001	70 / 3,613 (2.0%) RR=0.8 (0.4, 1.5)	32 / 1,480 (2.2%) RR=0.7 (0.4, 1.4)	Not applicable

71. MATERNAL SHORT-TERM OUTCOMES (A)

A1=Mortality
A2=Intraoperative/Intrapartum Complications (e.g., injury to bladder/ureter/bowel, extension of incisions, perineal lacerations, haematoma)
A3=Anesthesia Issues (e.g., complications from)
A4=Hemorrhage (e.g., require blood transfusion, require D&C, blood loss, require gravid hysterectomy)
A5=Postoperative or postpartum pain
A6=Wound Complications (e.g., infection, breakdown, dehiscence)
A7=Infection (NOT of the incision) (e.g., pneumonia, UTI, mastitis, other infection)
A8=Thromboembolic Complications (e.g., deep-vein thrombosis (DVT), pulmonary embolism)
A9=Other Complications (e.g., acute respiratory distress syndrome, hypertension, ileus, bowl obstruction)
A10=Breastfeeding (e.g., ability/desire to breastfeed)
A11=Psychological (e.g., general feeling regarding birth experience, early post-partum depression, transition issues)
A12=Maternal Recovery (e.g., length of stay in hospital, need for ICU admit, hospital readmit)

EXTRA SPACE!

Outcome Code	Specific Name of Outcome as described by study	Definition of Outcome (Include all details presented by study)	How is the outcome measured & by whom?	When is this outcome measured?	Outcome Data by Study Groups				
					A _____ _____	B _____ _____	C _____ _____	D _____ _____	Total

72. MATERNAL LONG-TERM OUTCOMES (B)

Extra table space for additional outcomes or extra study groups can be found on the back of this

B1=Urinary Function (e.g., urinary incontinence, vesicovaginal fistulas)
B2=Pelvic Organ Prolapse
B3=Anorectal Function (e.g., fecal/flatus incontinence, rectovaginal fistulas)
B4=Sexual Function/Dyspareunia
B5=Subsequent Uterine Rupture
B6=Subsequent Placental Implantation Issues (e.g., previa, accrete)
B7=Future Obstetric or Gynecological Issues (e.g., infertility, endometriosis, pelvic pain, subsequent ectopic pregnancy, subsequent stillbirth)
B8=Psychological (e.g., post-partum depression, anxiety)

Outcome Code	Specific Name of Outcome as described by study	Definition of Outcome (Include all details presented by study)	How is the outcome measured & by whom?	When is this outcome measured?	Outcome Data by Study Groups				
					A _____ _____	B _____ _____	C _____ _____	D _____ _____	Total

72. MATERNAL LONG-TERM OUTCOMES (B)

B1=Urinary Function (e.g., urinary incontinence, vesicovaginal fistulas)
B2=Pelvic Organ Prolapse
B3=Anorectal Function (e.g., fecal/flatus incontinence, rectovaginal fistulas)
B4=Sexual Function/Dyspareunia
B5=Subsequent Uterine Rupture
B6=Subsequent Placental Implantation Issues (e.g., previa, accrete)
B7=Future Obstetric or Gynecological Issues (e.g., infertility, endometriosis, pelvic pain, subsequent ectopic pregnancy, subsequent stillbirth)
B8=Psychological (e.g., post-partum depression, anxiety)

EXTRA SPACE!

Outcome Code	Specific Name of Outcome as described by study	Definition of Outcome (Include all details presented by study)	How is the outcome measured & by whom?	When is this outcome measured?	Outcome Data by Study Groups				
					A _____ _____	B _____ _____	C _____ _____	D _____ _____	Total

73. NEONATAL SHORT-TERM OUTCOMES (C)

Extra table space for additional outcomes or extra study groups can be found on the back of this

C1=Mortality (e.g., neonatal or fetal)
C2=APGAR Scores
C3=Birth Injury (e.g., lacerations, fractures, brachial plexus injury, spinal cord injury, intraventricular hemorrhage, subdural/cerebral hemorrhage, subarachnoid hemmorhage)
C4=Respiratory Complications (e.g., Transient tachypnea, respiratory distress syndrome, persistent pulmonary hypertension, requires mechanical ventilation/intubation; NOTE: iatrogenic prematurity often results in respiratory complications and should be included in this category)
C5=Neurologic Complications (e.g., Encephalopathy/asphyxia, seizures, cerebral accidents, stroke)
C6=Infections (e.g., Group B streptococcus infection, sepsis, pneumonia, necrotizing enterocolitis)
C7=Other Complications (e.g., gastrointestinal, metabolic)
C8=Bonding/Transition (e.g., breastfeeding, bonding)
C9=Recovery (e.g., unplanned NICU stay, special care nursery, length of stay)

Outcome Code	**Specific Name of Outcome as described by study**	**Definition of Outcome (Include all details presented by study)**	**How is the outcome measured & by whom?**	**When is this outcome measured?**	**Outcome Data by Study Groups**				
					A _____ _____	**B** _____ _____	**C** _____ _____	**D** _____ _____	**Total**

73. NEONATAL SHORT-TERM OUTCOMES (C)

EXTRA SPACE!

C1=Mortality (e.g., neonatal or fetal)
C2=APGAR Scores
C3=Birth Injury (e.g., lacerations, fractures, brachial plexus injury, spinal cord injury, intraventricular hemorrhage, subdural/cerebral hemorrhage, subarachnoid hemmorhage)
C4=Respiratory Complications (e.g., Transient tachypnea, respiratory distress syndrome, persistent pulmonary hypertension, requires mechanical ventilation/intubation; NOTE: iatrogenic prematurity often results in respiratory complications and should be included in this category)
C5=Neurologic Complications (e.g., Encephalopathy/asphyxia, seizures, cerebral accidents, stroke)
C6=Infections (e.g., Group B streptococcus infection, sepsis, pneumonia, necrotizing enterocolitis)
C7=Other Complications (e.g., gastrointestinal, metabolic)
C8=Bonding/Transition (e.g., breastfeeding, bonding)
C9=Recovery (e.g., unplanned NICU stay, special care nursery, length of stay)

Outcome Code	Specific Name of Outcome as described	Definition of Outcome (Include all details presented by study)	How is the outcome measured & by whom?	When is this outcome measured?	Outcome Data by Study Groups				
					A _____ _____	B _____ _____	C _____ _____	D _____ _____	Total

	by study								

74. NEONATAL LONG-TERM OUTCOMES (D)

Extra table space for additional outcomes or extra study groups can be found on the back of this

D1=Bonding & Behavioral Issues (e.g., transitional issues)
D2=Long-term physical development

Outcome Code	**Specific Name of Outcome as described by study**	**Definition of Outcome (Include all details presented by study)**	**How is the outcome measured & by whom?**	**When is this outcome measured?**	**Outcome Data by Study Groups**				
					A _____ _____	**B** _____ _____	**C** _____ _____	**D** _____ _____	**Total**

74. NEONATAL LONG-TERM OUTCOMES (D)

D1=Bonding & Behavioral Issues (e.g., transitional issues)
D2=Long-term physical development

EXTRA SPACE!

Outcome Code	Specific Name of Outcome as described by study	Definition of Outcome (Include all details presented by study)	How is the outcome measured & by whom?	When is this outcome measured?	Outcome Data by Study Groups				Total
					A _____ _____	B _____ _____	C _____ _____	D _____ _____	

75. SECTION 10: MODIFIERS OF OUTCOMES OF ELECTIVE C/S

Extra table space for additional outcomes or extra study groups can be found on the back of this

NOTE: The study must meet two criteria to be included in this section

1. The modifier under study needs to have a comparison group. In other words, the outcome should be studied in more than one strata of the modifier (i.e., with
and without the modifier, several strata of the modifier compared to a referent strata of the modifier).

2. We only need to see the outcome by strata of modifier within the elective c/s group. If there is only a cesarean group, and we know that it is a mix of elective/unlabored cesareans in it, we will collect that data. If the only cesarean group is only comprised of labored cesareans, we will not include the study in this section.

The outcome codes may be found above in section 9. They include A1 through A12, B1 through B8, C1 through C9, and D1 through D2.

Modifier	How is the modifier defined? What are the strata?	How is the modifier measured and by whom?	Outcome code from section 9	Specific Outcome & When Measured	Outcome data by cesarean study groups Group A _____ _____	 Group B _____ _____
(Example from Reference #72)					***Group=Cesarean***	
Birth Weight (g) *from table 4*	<3000g 3000g-3999g ≥4000g	Not explained but probably understood to be weighed by nurse in delivery room	A4	Intraoperative blood loss ≥1000mL during the C/S	247/923 (26.8%) 505/923 (54.7%) 171/923 (18.5%)	Adj OR=1.5 (1.2-4.6) Adj OR=1.0 (*ref*) Adj OR=2.7 (2.0-8.1)

75. SECTION 10: MODIFIERS OF OUTCOMES OF ELECTIVE C/S

EXTRA SPACE!

NOTE: The study must meet two criteria to be included in this section

1. The modifier under study needs to have a comparison group. In other words, the outcome should be studied in more than one strata of the modifier (i.e., with
and without the modifier, several strata of the modifier compared to a referent strata of the modifier).

2. We only need to see the outcome by strata of modifier within the elective c/s group. If there is only a cesarean group, and we know that it is a mix of elective/unlabored cesareans in it, we will collect that data. If the only cesarean group is only comprised of labored cesareans, we will not include the study in this section.

The outcome codes may be found above in section 9. They include A1 through A12, B1 through B8, C1 through C9, and D1 through D2.

Modifier	How is the modifier defined? What are the strata?	How is the modifier measured and by whom?	Outcome code from section 9	Specific Outcome & When Measured	Outcome data by cesarean study groups Group A _____ _____	 Group B _____ _____

76. SECTION 11: FUTURE RESEARCH

The article may speak to the need for future research (KQ4). If you want to highlight direct quotes or ideas from the paper, please give the page number, other location information, and the quote or idea below.

Page	Other location information (e.g., column,	Quote, idea, etc.

Number	paragraph number.) *NOTE: Feel free to highlight or underline on the actual article to aid in location*	*NOTE: If you've given good location information, don't write the entire quote out here.*

SECTION 12: PRELIMINARY ASSESSMENT OF QUALITY

77. How would you rate the study's ability to operationalize their definitions of characteristics, outcomes, and modifiers? (*Circle one*)

GOOD FAIR POOR

78. Overall, how would you rate this article? (*Circle one*)
NOTE: Keep in mind their randomization techniques, loss-to-followup problems, their ability to define everything clearly, possible selection bias, and analysis methods.

GOOD FAIR POOR

Reference ID: _____ *Check one:* **Maternal Outcomes** Short-term Long-term **Neonatal Outcomes** Short-term Long-term

Outcome Code (*see long form*)	**Specific Name of Outcome as described by study**	**Definition of Outcome (Include all details presented by study)**	**How is the outcome measured & by whom?**	**When is this outcome measured?**	**Outcome Data by Study Groups**				
					A _____ _____	**B** _____ _____	**C** _____ _____	**D** _____ _____	**Total**

Systematic Review of Cesarean Delivery on Maternal Request
Full Text Review Form: Previa Meta-Analysis Update

Reference ID Number: ___ ___ ___ ___ Reviewer's Initials: ___ ___ Date of Review: ___/___/2005

NOTE: This form is to evaluate the inclusion of article pertaining to placenta previa according to the original meta-analysis (Ref #1212, Faiz AS & Ananth CV, "Etiology and risk factors for placenta previa: an overview and meta-analysis of observational studies."). Follow the directions after each answer you circle.

1. Is the study published between March 2000 and May 2005?	**Yes** *Continue*	**No** *STOP-Exclude*
2. Is the study published in English?	**Yes** *Continue*	**No** *STOP-Exclude*
3. Is the study an observational study of placenta previa? **NOTE**: Case reports on placenta previa and studies on placental abruption will NOT be included	**Yes** *Continue*	**No** *STOP-Exclude*
4. Is placenta previa diagnosed in early pregnancy (first or second trimester)?	**Yes** *STOP-Exclude*	**No** *Continue*
5. Are data about cesarean delivery as a risk factor for placenta previa presented?	**Yes** *Continue*	**No** *STOP-Exclude*

Please check one option below based on your answers to Q1-Q5.

INCLUDE "Yes" is circled for all questions above

EXCLUDE Any "No" is circled above

Systematic Review of Cesarean Delivery on Maternal Request

Abstract Review Form: Previa Meta-Analysis Update

Reference ID Number: ___ ___ ___ ___ Reviewer's Initials: ___ ___ Date of Review: ___/___/2005

NOTE: This form is to evaluate the inclusion of article pertaining to placenta previa according to the original meta-analysis (Ref #1212, Faiz AS & Ananth CV, "Etiology and risk factors for placenta previa: an overview and meta-analysis of observational studies."). Follow the directions after each answer you circle.

1. Is the study published between March 2000 and May 2005?	**Yes** *Continue*	**No** *STOP-Exclude*	**Cannot Determine** *Continue*
2. Is the study published in English?	**Yes** *Continue*	**No** *STOP-Exclude*	**Cannot Determine** *Continue*
3. Is the study an observational study of placenta previa? **NOTE**: Case reports on placenta previa and studies on placental abruption will NOT be included	**Yes** *Continue*	**No** *STOP-Exclude*	**Cannot Determine** *Continue*
4. Is placenta previa diagnosed in early pregnancy (first or second trimester)?	**Yes** *STOP-Exclude*	**No** *Continue*	**Cannot Determine** *Continue*
5. Are data about cesarean delivery as a risk factor for placenta previa presented?	**Yes** *Continue*	**No** *STOP-Exclude*	**Cannot Determine** *Continue*

Please check one option below based on your answers to Q1-Q5.

Pull Article Any combination of "Yes" and/or "Cannot Determine" is circled above

Do NOT Pull Article Any "No" is circled above

Assessment of Quality of Individual Articles for RCT's

<table>
<tr><th>Randomization Approach</th><th>Randomization Implementation</th><th>Masking of Outcome Assessors</th><th>Operational Definitions and Measurements</th></tr>
<tr><td>Is there description of the approach to randomization?

Yes No

Is there a fatal flaw in the approach (such as lottery cards)?

Yes[1] No

Explain:</td><td>Is there proven good balance with statistical significance?

Yes No

Is there good balance achieved as shown in table?

Yes No</td><td>(Please circle one)

Good Fair Poor

NR

Notes:</td><td>(Please circle one)

Good Fair Poor

Notes:</td></tr>
<tr><td colspan="2">Overall Randomization Approach and Implementation
(Please circle one)

Good[2] Fair Poor</td><td colspan="2"></td></tr>
<tr><th>Post-Randomization Exclusions</th><th>Loss to Follow-up: Short-term</th><th>Loss to Follow-up: Long-term</th><th>Statistical analysis</th></tr>
<tr><td>(Please circle one)

Yes No

Please describe:</td><td>(Please list numbers and percentages for each follow-up time point)

T1 (describe):

T2 (describe):

T3 (describe):

T4 (describe):</td><td>(Please list numbers and percentages for each follow-up time point)

T1 (describe):

T2 (describe):

T3 (describe):

T4 (describe):</td><td>Please circle one)

Good Fair Poor

NR

Notes:</td></tr>
<tr><td colspan="4">Overall Quality[3]
(Please circle one) GOOD FAIR POOR</td></tr>
</table>

[1] If fatal flaw in randomization approach exists, overall randomization approach and implementation is poor and overall quality of the article/trial is also poor

[2] Approach must be described and there must be good balance in order to achieve an overall randomization and implementation score of good

[3] All component ratings must be good with minimal loss to follow-up for the article/trial to receive an overall quality rating of good. If an article has one or two fair or poor ratings, an overall quality score of fair should be assigned. If an article/trial has three or more fair or poor ratings and/or large loss to follow-up, the overall quality should be poor.

Assessment of Quality of Individual Articles for Nonrandomized Observational Cohorts

Domains	Elements	Score	Assessment (good, fair, poor)
Study design	Prospective	Yes/No	Yes=good/fair
Study Population	**Description of study populations, study report**		
	The base population from which cohort participants were sought	Yes/No	**All 3 yes= good; 2 yes and 1 NA**
	The number of eligible women in that base population (a denominator)	Yes/No	**2 yes= fair**
	The number of eligible women who were ultimately enrolled in the cohort	Yes/No	**>2 yes= poor**
Comparability of subjects	**For all observational studies:**		**For non-case controls, 4-5 yes = good; 2-3 yes = fair; 0-1 yes = poor**
	▪ Specific inclusion/exclusion criteria for all groups	Yes/No	
	▪ Criteria applied equally to all groups	Yes/No	
	▪ Study groups comparable at baseline w/ reference to variables not unique to mode of delivery	Yes/No	
	▪ Study groups comparable to non-participants with regard to confounding factors (study should thoroughly enumeration of the number of cohort participants, the characteristics of their birth experience, confounders, and general descriptive characteristics)	Yes/No	
	▪ Study groups comparable with regard to followup	Yes/No	
	Continue below for case-control studies:	For case control studies: Good: ALL 3 Yes: Fair: 2 Yes; Poor: 0-1 Yes	
	Explicit case definition	Yes/No	

	Case ascertainment not influenced by exposure status	Yes/No	
	Controls similar to cases except without condition of interest and with equal opportunity for exposure	Yes/No	
Statistical Analysis	**Overall statistics analysis**		
	Statistical tests appropriate	Yes/No	**5-6 yes= good; 3-4 yes = fair;1-2 yes = poor**
	Modeling and multivariate techniques and/or multiple comparisons taken into consideration	Yes/No	
	Power calculation provided and sample size achieved	Yes/No	
	Assessment of confounding ▪ assessment of confounding and modifying factors by bivariate analysis, stratified analysis, or multivariable modeling	Yes/No	
	▪ reporting of adjusted estimates for main effects that took into account identified confounding or modifying factors (stratified or separate analyses were acceptable for simple constructs)	Yes/No	
	▪ presentation of adjusted results with a measure of statistical precision such as a confidence interval or *P*-value	Yes/No	
Results	**Overall results**		
	Measure of effect for outcomes and appropriate measure of precision	Yes/No	**For panel studies, 3-4 yes=good; 2 yes=fair; 0-1 yes=poor; for single timepoint studies, yes=good/fair**
	Adequacy of follow-up for each study group, study describes ▪ the number of participants in the sample at the time of followup,	Yes/No	
	▪ analysis of how respondents differed from nonrespondents if loss exceeded 20 percent, and	Yes/No	
	▪ absolute loss to followup >25 percent	Yes/No	
Overall rating	**5 goods/fair: Good** **3-4 good/fair: Fair** **0-2 good/fair: Poor**		

Appendix C
Evidence Tables

Glossary

BMI	body mass index
BPD	biparetal diameter
c/d	cesarean delivery
CES-D	Center for Epidemiologic Studies – Depression Scale
cm	centimeters
CPD	cephalopelvic disproportion
CT	computer tomography
d	day
Dec	December
Dept	department
EFW	estimated fetal weight
Feb	February
F/U	follow-up
G	group
GA	gestational age
gms	grams
HELLP	Hemolysis Elevated Liver Enzymes and Low Platelet Count
Hr(s)	hour(s)
HSV	herpes simpleton virus
HTN	hypertension
hx	history
IQ	intraquartile
IUGR	intrauterine growth restriction
Jan	January
kg	kilograms
LMP	last menstrual period
Ml	milliliter
mm	millimeter
mos	months
multip	multiparous
N	number
NICU	Neonatal Intensive Care Unit
NR	not reported
Ob/Gyn	obstetrics/gynecology
OR	odds ratio
P	probability
post-op	post operative
PP	postpartum
PPH	persistent pulmonary hypterension
primp	primiparous
PROM	premature rupture of membranes
RCT	randomized controlled trial
RDS	Respiratory Distress Syndrome
RR	relative risk
SD	standard deviation
Sept	September
SUI	stress urinary incontinence
TTN	transient tachypnea of the newborn
UK	United Kingdom
u/s	ultrasonography
US	United States
VAS	Visual Analog Scale
VD	vaginal delivery
vs	versus
wks	weeks
w/o	without
w/in	within
yr(s)	year(s)

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Allen et al., 2003 **Setting** Canada, Population-based **Study design** Retrospective cohort **Inclusion criteria** • Pregnancies to Novia Scotia resident, ≥ 500 grm birthweight • Between 1/1/88 and 12/31/01 • Liveborn singleton at term (37 to 42 wks) • Born to a nulliparous woman **Exclusion criteria** • Major fetal anomaly • Labor induced • Nonvertex presentation with spontaneous labor • Preexisting maternal disease • Fetal growth restriction (< 10th percentile for GA) • Pregnancy complications (i.e., gestational diabetes pregnancy induced HTN, premature rupture of membranes) **Groups** **G1**: c/d without labor **G2:** Spontaneous onset of labor: • **G2a**: Spontaneous vaginal delivery • **G2b**: Assisted vaginal delivery • **G2c**: c/d in labor	**Objective of the study** To estimate the maternal morbidity associated with cesarean deliveries performed at term without labor compared with morbidity associated with spontaneous labor **Definition of elective cesarean** The term “elective” is not used at all. Referent group is cesarean (planned and unplanned) without labor for maternal and neonatal indications Category includes: • Breech (86%) • Fetal distress (4.2%) • Dystocia (5.1%) • Malpresentation (1.1%) • Maternal HSV (0.4%) • Others (2.6%) • Diseases of the cervix (0.1%)	**Maternal age, mean ± SD** **G1**: 27.3 (5.3) **G2**: 25.3 (5.1) *P* < 0.001 **Maternal weight at delivery in kgs ± SD** **G1**: 81.6 (15.2) **G2**: 78.5 (12.9) *P* < 0.001 **Gravidity** All nulliparous **N of previous cesareans** NA **Diabetes** None, all excluded **Gestational age in wks ± SD** **G1**: 39.3 ± 1.2 **G2**: 39.8 ± 1.2 *P* < 0.001 **Type of labor** NR **Type of anesthesia** NR **Fetal weight** NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Wound infection, N (%) **G1**: 11/721 (1.5) **G2A**: 55/12,607 (0.4) RR = 3.5 (1.8, 6.7) *P* < 0.001 **G2b**: 70/3,613 (2.0) RR = 0.8 (0.4, 1.5) **G2c**: 32/1,480 (2.2) RR = 0.7 (0.4, 1.4)	NR	**Relevance** Low **Quality Rating** Not rated
Blood transfusions, N (%) **G1**: 2/721 (0.3) **G2a**: 38/12,607 (0.3) RR = 0.9 (0.2, 3.8) **G2b**: 27/3,613 (0.8) RR = 0.4 (0.1, 1.6) **G2c**: 8/1,480 (0.5) RR = 0.5 (0.1, 2.4)		
Puerperal febrile morbidity, N (%) **G1**: 8/721 (1.1) **G2a**: 26/12,607 (0.2) RR = 5.4 (2.4, 11.8) *P* < 0.001 **G2b**: 14/3,613 (0.4) RR = 3.0 (1.2, 7.2) *P* < 0.05 **G2c**: 49/1,480 (3.3) RR = 0.3 (0.2, 0.7) *P* < 0.05		
Evacuation of hematoma, N (%) **G1**: 1/721 (0.1) **G2a**: 18/12,607 (0.1) RR = 1.0 (0.1, 7.3) **G2b**: 3/3,613 (0.1) RR = 1.7 (0.2, 16.0) **G2c**: 3/1,480 (0.2) RR = 0.7 (0.1, 6.6)		
Early PPH (PP hemorrhage), N (%) **G1**: 28/721 (3.8) **G2a**: 640/12,607 (5.1) RR = 0.8 (0.5, 1.1) **G2b**: 346/3,613 (9.6) RR = 0.4 (0.3, 0.6) *P* < 0.001 **G2c**: 111/1,480 (7.5) RR = 0.5 (0.4, 0.8) *P* < 0.001		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Bergholt et al., 2003 **Setting** Denmark, hospital-based **Study design** Retrospective cohort **Inclusion criteria** • Women delivering by c/d at the University hospitals in Gentofte, Herlev and Glostrup **Exclusion criteria** • NR **Groups** **G1**: **Emergency c/d** (c/d planned less than 8 hrs before operation actually took place) **G2**: **Elective c/d** (c/d planned more than 8 hrs before operation actually took place) **N** **G1**: 636 **G2**: 294	**Objective of the study** To estimate the incidence of intraoperative surgical complications with the impact of the educational level of the surgeon and a history of previous cesarean delivery on intraoperative complications at cesarean childbirth **Definition of elective cesarean** An operation planned more than 8 hours before the operation actually took place Includes labored births, number NR Category includes: • Fetal distress • Dystocia • Placental abruption • Multiple gestation • Fetal anomalous presentation	**Maternal age ± SD** Overall: 30.3 ± 4.9 **Maternal BMI, pre-pregnancy, N** Overall: 23.3 ± 4.3 **Parity overall ± SD** Overall: 0.7 ± 0.9 **N of previous cesareans, N (%)** Overall: 237/929 ± 25.7 **Diabetes** NR **Gestational age ± SD** Overall: 38.7 ± 2.7 **Type of labor** NR **Type of anesthesia** NR **Fetal weight mean kgs ± SD** Overall: 3.315 ± 0.799

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Lacerations, N (%) Cervical laceration **G1**: 29/636 (4.6) **G2**: 4/294 (1.4) *P* < 0.05 Corporal laceration **G1**: 2/636 (0.3) **G2**: 1/294 (0.3) NS Vaginal laceration **G1**: 11/636 (1.7) **G2**: 0/294 (0) *P* < 0.05 Bladder laceration **G1**: 5/636 (0.8) **G2**: 0/294 (0) NS Bowel laceration **G1**: 0/636 (0) **G2**: 0/294 (0) NS All lacerations **G1**: 43/636 (0) **G2**: 5/294 (0) *P* < 0.05 **Blood transfusion, N (%)** **G1**: 7/636 (1.1) **G2**: 2/294 (0.7) NS **Estimated blood loss ≥ 1000ml, N (%)** **G1**: 57/636 (9.0) **G2**: 20/294 (6.8) NS **Hysterectomy, N (%)** **G1**: 1/636 (0.2) **G2**: 1/294 (0.3) NS **All intraoperative surgical complications, N (%)** **G1**: 92/636 (14.5) **G2**: 20/294 (6.8) *P* < 0.001	**Uterine rupture (all had previous cesareans, so outcome of previous cesarean), N (%)** **G1**: 3/636 (0.5) **G2**: 0/294 (0.0) NS	**Relevance** Moderate **Quality rating** Fair

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Bergholt et al., 2003 (continued)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Risk of intraoperative laceration of the cervix, vagina, and bladder from emergency c/d Crude OR: 4.2 Adj OR: 2.3 (0.8-6.7) Variables include educational level of surgeon, previous c/d, pre-pregnancy BMI, duration of regular painful contractions, placental abruption as indication, placenta previa as indication, birthweight		
Risk of intraoperative blood loss ≥ 1000 ml during the cesarean delivery from emergency c/d Crude OR: 1.3 Adj OR: 1.6 (0.7-3.4) Variables include educational level of surgeon, previous c/d, pre-pregnancy BMI, duration of regular painful contractions, pacental abruption as indication, placenta previa as indication, birthweight		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Burrows, Meyn, Weber 2004 **Setting** US, Hospital **Study design** Retrospective-cohort **Inclusion criteria** • Singleton pregnancies at term (≥37 weeks) • One or no deliveries at Magee • Hospital **Exclusion criteria** • NR **Groups** **G1**: Spontaneous vaginal **G2**: Operative vaginal **G3**: Primary cesarean without trial of labor **G4:** Primary cesarean with trial of labor **G5:** Repeat cesarean with trial of labor **G6:** Repeat cesarean without trial of labor **N at enrollment** **G1**: 22,270 **G2**: 4,908 **G3:** 657 **G4:** 3,366 **G5**: 768 **G6**: 865	**Objective of the study** To describe postpartum maternal morbidity associated with mode of delivery in term, singleton pregnancies **Definition of elective cesarean** NR	**Maternal Age, mean yrs ± SD** **G1**: 28.7 ± 6.0 **G2**: 28.4 ± 6.1 **G3:** 30.4 ± 6.0 **G4:** 29.2 ± 6.0 **G5**: 32.3 ± 4.8 **G6**: 32.7± 4.8 *P* < 0.001 **Maternal weight on admission, % >91 kg** **G1**: 16.6 **G2**: 13.9 **G3:** 25.6 **G4:** 25.7 **G5**: 29.2 **G6**: 26.8 *P* < 0.001 **Gravidity, median (range)** **G1**: 39 (37-44) **G2**: 39 (37-43) **G3:** 39 (37-42) **G4:** 40 (37-44) **G5**: 39 (37-42) **G6**: 39 (37-43) *P* < 0.001 **N of previous c/d** NR **Type of Labor** NR **Type of Anesthesia** NR **Gestational Age, median wks (range)** **G1**: 2 (1-18) **G2**: 2 (1-18) **G3:** 1 (1-8) **G4:** 1 (1-11) **G5**: 3 (2-10) **G6**: 1 (1-11) *P* < 0.001 **Fetal weight** NR **Maternal Race, %** White, Black **G1**: 81.2, 15.5 **G2**: 78.2, 17.7 **G3:** 87.5, 9.3 **G4:** 81.7, 14.9 **G5**: 84.1, 16.1 **G6**: 85.7, 12.1 *P0*< 0.001 (white only)

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Endometritis, N (%) **G1**: 97 (0.4) **G2**: 33 (0.7) **G3:** 20 (3.0) **G4:** 315 (9.4) **G5**: 35 (4.6) **G6**: 23 (2.7) **Pneumonia, N (%)** **G1**: 17 (0.1) **G2**: 9 (0.2) **G3:** 2 (0.3) **G4:** 4 (0.1) **G5**: 5 (0.7) **G6**: 4 (0.5) **PP hemorrhage, N (%)** **G1**: 1,105 (5.0) **G2**: 231 (4.7) **G3:** 18 (2.7) **G4:** 131 (3.9) **G5**: 20 (2.6) **G6**: 28 (3.2) **Transfusion, N (%)** **G1**: 40 (0.2) **G2**: 21 (0.4) **G3:** 3 (0.3) **G4:** 36 (1.1) **G5**: 6 (0.8) **G6:** 4 (0.5) **Deep venous thrombosis, N (%)** **G1**: 15 (0.1) **G2**: 2 (0.04) **G3:** 1 (0.2) **G4:** 10 (0.3) **G5**: 1 (0.1) **G6:** 0	NR	**Relevance** Moderate **Quality Ratings** Fair

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Burrows, Meyn, Weber 2004 (continued)		**Marital Status** Married, % **G1**: 61.3 **G2**: 58.7 **G3:** 59.4 **G4:** 66.2 **G5**: 71.7 **G6**: 76.5 **Pregnancy Related Conditions** Preeclampsia, N (%) **G1**: 1.9 **G2**: 2.7 **G3:** 3.5 **G4:** 5.9 **G5**: 1.3 **G6**: 1.2 *P* < 0.001 Episiotomy, % **G1**: 52.1 **G2**: 67.6 **G3:** 0 **G4:** .2 **G5**: .1 **G6**: 0 *P* < 0.001

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Farrell, Allen, and Baskett, 2001 **Country, Setting** Canada, hospital-based **Study design** Prospective cohort **Inclusion criteria** • Nulliparity **Exclusion criteria** • Hx of urinary tract abnormalities, pelvic surgery • Significant medical illness • Medications that would alter urinary tract function **Groups** **G1**: Cesarean delivery **G1a**: Before labor **G1b**: 1st stage **G1c**: 2nd stage **G2**: Spontaneous vaginal delivery **G3**: Instrumental delivery **G3a**: Forceps **G3b**: Vacuum **N at enrollment** Total: 690 Loss participants: 95 delivered at another hospital; 2 withdrawn (stillbirth = 1; neonatal death = 1) **N (%)** **G1**: 147/593 **G1a**: 32/593 **G1b**: 70/593 **G1c**: 45/593 **G2**: 331/593 **G3**: 115/593 **G3a:** 100/395 **G3b**: 15/593 **Follow-up** • At 6 weeks: 559 completers • At 6 months: 484 completers	**Objective of the study** To estimate the incidence and relative risk of postpartum urinary incontinence in primaparas by urinary continency before pregnancy **Definition of elective cesarean** Does not include labored births	**Maternal age, median yrs (range)** Overall: 28 (15-48) **Maternal BMI** NR **Gravidity** NR **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight, grams** NR **Urinary incontinence before pregnancy, N (%)** **G1a**: 5 (6.3) **G1b**: 13 (16.3) **G1c**: 4 (5.0) **G2**: 46 (57.5) **G3a:** 1 (1.3) **G3b**: 11 (13.8)

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
NR	**6 weeks (%):** **G1**: 8 • **G1a**: 4 • **G1b**: NR • **G1c**: 5 **G2**: 23 **G3a:** 35 **G3b**: NR RR for **G2** vs **G1**: 2.8 (1.5, 5.3) RR for **G3a** vs **G1**: 4.3 (2.2, 8.2) **6 months (%):** **G1**: 10 • **G1a**: 5 • **G1b**: NR • **G1c**: 3 **G2**: 22 **G3a:** 33 **G3b**: NR RR for **G2** vs **G1**: 2.1 (1.1, 3.7) RR for **G3a** vs **G1**: 3.1 (1.7, 5.9)	**Relevance** Moderate **Quality Rating** Fair

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Farrell, Allen, and Basket, 2001 **Setting** Canada, Hospital **Study design** Prospective Cohort **Inclusion criteria** • Nulliparity • No tx of urinary or alimentary tract abnormalities • No pelvic surgeries **Exclusion criteria** • Medication with impact on urinary or alimentary tract function • Significant medical illness **Groups** **G1**: Spontaneous vaginal delivery **G2**: Elective c/d **G3**: C/d in labor **G4**: Forceps delivery **N (%)** **G1**: 333 (56) **G2 and G3**: 147 (25) **G4**: 115 (19)	**Objective of the study** To estimate the incidence and relative risk (RR) of postpartum anal incontinence in primiparous women in a tertiary Canadian obstetrical unit **Definition of elective cesarean** NR Category includes:	**Maternal age median yrs (range)** NR **Maternal BMI** NR **Gravidity** NR **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight, median gms** Overall: 3489 **Urinary incontinence before pregnancy, N (%)** NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
NR	**Flatal Incontinence at 6 wks PP, %** **G1:** 16 **G2:** 31 **G3:** 17 **G4:** 34 **Fecal Incontinence at 6 wks PP, %** **G1:** NR **G2:** NR **G3:** NR **G4:** NR **Flatal Incontinence at 6 mos PP, %** **G1:** 17 **G2:** 0 **G3:** 21 **G4:** 44 **Fecal Incontinence at 6 mos PP, %** **G1:** 4 **G2:** 4 **G3:** 2 **G4:** 9	**Relevance** Moderate **Quality Ratings** Fair

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Fawcett, Pollio, and Tully, 1992 **Setting** US, hospital-based **Study design** Prospective cohort **Inclusion criteria** • NR **Exclusion criteria** • NR **Groups** **G1**: Unplanned c/d **G2**: Planned c/d **G3**: Vaginal delivery **N** **G1**: 106/473 (22.4%) **G2**: 113/473 (23.9%) **G3**: 254/473 (53.7%)	**Objective of the study** To examine women's birth experience by replicating Cranley et al., 1983 study **Definition of elective cesarean** Planned by end of 2nd trimester: 59% Planned within 1 to 9 weeks before delivery: 41% Probably includes labored, number NR Category includes **G1**: • Fetopelvic disproportion (37%) • Fetal distress (26%) • Breech presentation (18%) • Failed induction (4%) • Combination (15%) **G2:** • Repeat c/d (60%) • Breech (18%) • Combination (22%)	**Maternal age, mean yrs ± SD** **G1**: 31.04 ± 4.5 **G2**: 31.56 ± 4.6 **G3**: 26.69 ± 4.3 *P* < 0.001 **Maternal BMI** NR **Primipara, %** **G1**: 88 **G2**: 12 **G3**: 90 **G1** vs **G3**: *P* < 0.001 **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** Not reported by group **Fetal weight** NR **Father Not Present at Births, N** **G1**: 1 **G2**: 6 **G3**: 1 **Moms who held baby immediately after delivery, %** **G1**: 18 **G2**: 18 **G3**: 73 *P* < 0.001 **G3** vs **G2** and **G1**: *P* 0.05 **Hospital stay, mean days (range)** **G1**: 4.8 (3-10) **G2**: 4.9 (3-12) **G3**: 2.5 (1-14) *P* < 0.001 **G3** vs **G2** and **G1**: *P* 0.05

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Perception of birth experience, mean score ± SD Day 1 to 2 PP **G1**: 3.40± 0.59 **G2**: 3.45 ± 0.53 **G3**: 3.65 ± 0.48 *P* < 0.001 **G1** vs **G3**: *P* < 0.017 **Pain intensity, mean score ± SD** Day 1 to 2 PP **G1**: 2.64 ± 0.86 **G2**: 2.45 ± 0.73 **G3**: 2.64 ± 0.96 *P:* NS **Physical distress, mean score ± SD** **G1**: 1.39 ± 0.94 **G2**: 1.17 ± 0.87 **G3**: 1.03 ± 0.95 *P* = 0.004 **G1** vs **G3**: *P* < 0.17	NR	**Relevance** Moderate **Quality rating** Poor

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Groutz et al., 2003 **Country, Setting** Israel, hospital-based **Study design** Prospective cohort **Inclusion criteria** • Primiparous • Delivery at Lis Maternity Hospital **Exclusion criteria** • Nonsingleton deliveries • Instrumental vaginal delivery • Those with SUI before pregnancy **Groups** **G1**: Spontaneous vaginal delivery **G2**: Obstructed labor cesarean delivery **G3**: Elective cesarean delivery **N at enrollment** **G1**: 145 **G2**: 100 **G3**: 118 **Follow-up** 1 year **G1**: 145 **G2**: 100 **G3**: 118	**Objective of the study** To compare prevalence of stress urinary incontinence by mode of delivery **Definition of elective cesarean** No trial of labor Category includes: • Breech (70%) • Other indications not specified	**Maternal age, mean yrs ± SD** **G1**: 28 ± 4 **G2**: 32.5 ± 5.3 **G3**: 31.7 ± 5.2 **Maternal height, mean cm ± SD** **G1**: 164 ± 6.6 **G2**: 162 ± 5.6 **G3**: 164 ± 6.7 **Maternal weight, mean kg ± SD** G1: 60 ± 9.0 **G2**: 62.5 ± 1.6 **G3**: 63 ± 13.0 **Parity, %** Primiparous: 100% **N of previous cesareans** NR **Diabetes** NR **Gestational age, wks ± SD** **G1**: 39.7 ± 1.2 **G2**: 40.2 ± 1.3 **G3**: 38.8 ± 1.5 **Type of labor** NR **Type of anesthesia Epidural** **G1**: 134/145 **G2**: NR **G3**: NR **Fetal weight, mean ± SD** **G1**: 325 ± 400 **G2**: 3450 ± 420 **G3**: 3260 ± 617 *P* < 0.05 **SUI during Pregnancy, N (%)** **G1**: 45 (31) **G2**: 25 (25) **G3**: 33 (28)

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
NR	**Stress incontinence at 1 yr, N (%)** **G1**: 15/145 (10.3) **G2**: 12/100 (12) **G3**: 4/118 (3.4) G1 vs G2 *P* = 0.7 G1 vs G3 *P* = 0.02	**Relevance** Moderate **Quality rating** Fair

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Hannah, Hannah, Hewson, et al., 2000 **Setting** Australia, Canada, Chile, Denmark, Finland, Germany, Israel, Netherlands, New Zealand, Poland, Portugal, Romania, Switzerland, U.K., U.S., Yugoslavia; hospital/labor and delivery unit/maternity unit/outpatient clinic/NICU **Study design** RCT **Inclusion criteria** • Singleton, frank or complete breech • ≥ 37 wks **Exclusion criteria** • Evidence of fetopelvic disproportion • Clinically large infant • EFW ≥ 4000 g • Fetal hyperextension of head • Fetal anomaly • Contraindication to either labor or vaginal delivery **Groups** **G1**: Planned c/d **G2**: Planned vaginal delivery **N at randomization** **G1**: • 1,043/1,043 • Lost to F/U: 2 • Analyzed maternal outcomes: 1,041/1,043 **G2**: • 1,045/1,045 • Lost to F/U: 3 • Analyzed maternal outcomes: 1,042/1,045	**Objective of the study** To compare a policy of planned c/d with policy of planned vaginal birth for selected breech presentation **Definition of elective cesarean** Planned cesarean scheduled for 38 or more wks gestation Includes actual vaginal deliveries Category includes: • breech	**Maternal Age, N (%)** ≥ 30 **G1**: 339 (32.6) **G2**: 331 (31.8) < 30 **G1**: 702 (67.4) **G2**: 711 (68.2) **Maternal BMI** NR **Parity, N (%)** 0 **G1**: 547 (52.6) **G2**: 545 (52.3) 1-4 **G1**: 434 (41.7) **G2**: 434 (41.7) > 4 **G1**: 60 (5.8) **G2**: 63 (6.1) **Time from randomization to delivery ≥ 7days, N (%)** **G1**: 156 (15.0) **G2**: 301 (28.9) *P* < 0.0001 **Gestational Age/pregnancy dating ≥ 41 wks, N (%)** **G1**: 67 (6.4) **G2**: 65 (6.2) **Gestational Age, median wks (5th to 95th percentile), N (%)** **G1**: 39.3 (37.5; 41.2) **G2**: 39.6 (37.5; 41.8) *P* < 0.0001 **Presentation, N (%)** Frank **G1**: 655 (62.9) **G2**: 637 (61.1) Complete **G1**: 340 (32.7) **G2**: 362 (34.7) Uncertain **G1**: 46 (4.4) **G2**: 43 (4.1) **In labor** **G1**: 434 (41.7) **G2**: 456 (43.8)

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Maternal Mortality, N (%) **G1**: 0 **G2**: 1 (0.1) **Wound Infection dehiscence or breakdown, N (%)** **G1**: 16 (1.5) **G2**: 10 (1.0) P = .32 Infection **G1**: 15 (1.4) **G2**: 9 (0.9) Dehiscence or breakdown **G1**: 6 (0.6) **G2**: 2 (0.2) Maternal recovery **G1**: 4.0 (1.7-7.4) **G2**: 2.8 (0.8-6.9) *P* < 0.0001 **Postpartum bleeding, N (%)** **G1**: 10 (1.0) **G2**: 13 (1.3) *P* = 0.68 Hemorrhage, N (%) > 1000 ml **G1**: 4 (.4) **G2**: 8 (.8) Hemorrhage > 1500 ml **G1**: 2 (.2) **G2**: 4 (.4) *P* = 0.68 Hemorrhage Requiring transfusion **G1**: 4 (.4) **G2**: 8 (.8) Hemorrhage Requiring D&C **G1**: 3 (.3) **G2**: 4 (.4) Hemorrhage Other **G1**: 2 (.2) **G2**: 1 (.1)	**Early PP depression** **G1**: 3 (.3) **G2**: 0	**Relevance** T **Quality Rating** Fair

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Hannah, Hannah, Hewson, et al., 2000 (continued) **Follow-up** 6 wks PP		**Rupture of membranes (N, %)** **G1**: 253 (24.3) **G2**: 233 (22.4) **FHR abnormalities, N (%)** **G1**: 13 (1.3) **G2**: 156 (15.2) *P* = < 0.0001 **Fetal weight, estimated gms (%)** ≥ 3000 gms **G1**: 689 (66.2) **G2**: 680 (65.3) < 3000 g **G1**: 352 (33.8) **G2**: 362 (34.7) **Method of estimated fetal weight, N (%)** Clinical only **G1**: 418 (40.2) **G2**: 427 (41.0) Ultrasonograph **G1**: 623 (59.9) **G2**: 615 (59.0) **General anesthesia (N, %)** **G1**: 294 (28.2) **G2**: 132 (12.7) *P* < 0.0001 Epidural/spinal, N (%) **G1**: 682 (65.5) **G2**: 482 (46.3) *P* < 0.0001 C/d before labor, N (%) **G1**: 470 (45.2) **G2**: 75 (7.2) C/d after labor, N (%) **G1**: 471 (45.2) **G2**: 376 (36.1) Vag delivery, N (%) **G1**: 100 (9.6) **G2**: 591 (56.7) *P* < 0.0001 **Cord prolapse, N (%)** Before labor **G1**: 0 **G2**: 2 During labor **G1**: 0 **G2**: 12 *P* < 0.0001

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Maternal Systemic Infection, N (%) **G1**: 16 (1.5) **G2**: 13 (1.0) *P* = 0.71		
PP fever, N (%) ≥ 38.0 **G1**: 16 (1.5) **G2**: 13 (1.3)		
≥ 38.5 **G1**: 13 (1.3) **G2**: 10 (1.0)		
Pneumonia, N (%) **G1**: 1 (.1) **G2**: 0		
Infection, N (%) **G1**: 1 (.1) **G2**: 1 (.1)		
Deep vein thromophlebitis or pulmonary embolism **G1**: 0 **G2**: 0		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Hannah, Hannah, Hewson, et al., 2000 (continued)		**Chorioamnionitis, N (%)** **G1**: 3 (0.3) **G2**: 11 (1.1) **Time in hosp before deliv ≥ 48 h, N (%)** **G1**: 74 (7.1) **G2**: 91 (8.8) *P* = 0.19 **Maternal BMI** NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Hannah, Hannah, Hodnett, et al., 2002 **Setting** 26 different countries, 1,596 of 1,940 women from 110 centers worldwide with singleton fetus, in breech presentation at term **Study design** RCT **Inclusion criteria** • Singleton • Frank or complete breech • ≥ 37 weeks **Exclusion criteria** • NR **Groups** **G1**: Planned c/d **G2**: Planned vag **N at randomization** **G1**: 1,043 **G2**: 1,045 **Follow-up** 3 months PP	**Objective of the study** To compare maternal outcomes of planned c/d delivery and planned vaginal birth at 3 mos PP **Definition of elective cesarean** Planned cesarean scheduled for 38 or more wks gestation Includes actual vaginal deliveries Category includes: • breech	**Maternal age, N (%)** **≥ 30 y** **G1**: 286 (35.8) **G2**: 285 (35.7) **Married or stable relationship, N (%)** **G1**: 745 (93.4) **G2**: 747 (93.6) **Nulliparity, N (%)** **G1**: 399 (50.0) **G2**: 403 (50.5) **Previous c/d** **G1**: 24 (3.0) **G2**: 20 (2.5) **In labor at randomization, N (%)** **G1**: 322 (40.4) **G2**: 341 (42.7) **Planning to breastfeed, N (%)** Yes **G1**: 707 (88.6) **G2**: 707 (88.6) No **G1**: 42 (5.3) **G2**: 43 (5.4) Unknown **G1**: 49 (6.1) **G2**: 48 (6.0) **Ruptures of membranes, N (%)** **G1**: 183 (22.9) **G2**: 163 (20.4) **Time from delivery to questionnaire completion, median months (5th to 95th percentile)** **G1**: 3.1 (2.5-7.5) **G2**: 3.1 (2.5-6.7) **Questionnaire method, N (%)** Mail **G1**: 219 (27.4) **G2**: 216 (27.1) Telephone/In person **G1**: 563 (70.6) **G2**: 564 (70.7) Unknown **G1**: 16 (2.0) **G2**: 18 (2.3)

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Breastfed w/in a few hours following birth, N (%) **G1**: 571/779 (73.3) **G2**: 602/776 (77.6) RR: 0.94 (0.89-1.00) *P* = 0.05	**Experienced urinary incontinence, N (%)** **G1**: 36/798 (4.5) **G2**: 58/797 (7.3) RR: 0.62 (.41-.93) *P* = 0.02	**Relevance** T **Quality Rating** Poor
Breastfed at time of completion of questionnaire, N (%) **G1**: 533/781 (68.3) **G2**: 539/776 (69.5) RR: 0.98 (0.92-1.05) *P* = 0.62	No problem at all **G1**: 4/24 (16.7) **G2**: 17/46 (37.0) *P* = 0.09	
Postoperative or postpartum pain (3 months PP), N (%) In back **G1**: 90/796 (11.3) **G2**: 97/797 (12.2) RR: 0.93 (.71-1.22) *P* = 0.64	A little problem **G1**: 15/24 (62.5) **G2**: 23/46 (50.0) *P* = 0.09	
	A big problem **G1**: 5/24 (20.8) **G2**: 6/46 (13.0) *P* = 0.09	
In head **G1**: 38/796 (4.8) **G2**: 34/797 (4.3) RR: 1.12 (0.71-1.76) *P* = 0.63	**Experienced fecal incontinence, N (%)** **G1**: 5/619 (0.8) **G2**: 9/607 (1.5) RR: 0.54 (0.18-1.62) *P* = 0.29	
On outside of abdomen **G1**: 79/796 (9.9) **G2**: 45/797 (5.7) RR: 1.76 (1.24-2.50) *P* = 0.002	No problem at all **G1**: 2/4 (50.0) **G2**: 2/9 (22.2) *P* = 0.53	
Deep inside abdomen **G1**: 70/796 (8.8) **G2**: 37/797 (4.6) RR: 1.89 (1.29-2.79) *P* < 0.001	A little problem **G1**: 2/4 (50.0) **G2**: 7/9 (77.8) *P* = 0.53	
In bottom of genital area **G1**: 14/796 (1.8) **G2**: 44/797 (5.5) RR: 0.32 (0.18-.58) *P* < 0.001	**Experienced incontinence of flatus, N (%)** **G1**: 66/616 (10.7) **G2**: 59/606 (9.7) RR: 1.10 (.79-1.54) *P* = 0.64	
In other location **G1**: 13/796 (1.6) **G2**: 16/797 (2.0) RR: 0.81 (0.39-1.68) *P* = 0.71)	No problem at all **G1**: 40/61 (65.6) **G2**: 23/58 (39.7) *P* = 0.006	
Any pain **G1**: 217/796 (27.3) **G2**: 199/797 (25.0) RR: 1.09 (0.93-1.29) *P* = 0.31	A little problem **G1**: 20/61 (32.8) **G2**: 33/58 (56.9) *P* = 0.006	
	A big problem **G1**: 1/61 (1.8) **G2**: 2/58 (3.5) *P* = 0.006	

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Hannah, Hannah, Hodnett, et al., 2002 (continued)		**Received help answering questionnaire, N (%)** Yes **G1**: 415 (52.0) **G2**: 421 (52.8) No **G1**: 349 (43.7) **G2**: 329 (41.2) Unknown **G1**: 34 (4.3) **G2**: 48 (6.0) **Low perinatal mortality rate, N (%)** **G1**: 396 (49.6) **G2**: 394 (49.4) **High perinatal mortality rate, N (%)** **G1**: 402 (50.4) **G2**: 404 (50.6) **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight, grams** NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Amount of pain, N (%) None **G1**: 579/796 (72.7) **G2**: 598/795 (75.2) Almost none **G1**: 22/796 (2.8) **G2**: 23/795 (2.9) Mild or small amount **G1**: 165/796 (20.7) **G2**: 142/795 (17.9) Quite a lot **G1**: 29/796 (3.6) **G2**: 31/795 (3.9) Severe or excruciating/terrible **G1**: 1/796 (0.1) **G2**: 1/795 (0.1) **Took pills or medicine for pain in last 24 h, N (%)** **G1**: (46/795) **G2**: (46/793) 1.0 (0.67-1.48) RR: *P*>.99 **Experienced PP depression, N (%)** **G1**: 80/793 (10.1) **G2**: 46/454 (10.1) RR: 0.93 (0.70-1.24) *P* = 0.68 **Regarding childbirth experience, N (%)** Liked that it was natural **G1**: 62 (7.8) **G2**: 357 (44.7) RR: 0.17 (.14-.22) *P* < 0.001 Liked that childbirth was not very painful **G1**: 387 (48.5) **G2**: 329 (41.2) RR: 1.18 (1.05-1.31) *P* = 0.004 Liked being able to schedule the delivery **G1**: 261 (32.7) **G2**: 131 (16.4) RR: 1.99 (1.66-2.40) *P* < 0.001	**No sex since birth, N (%)** **G1**: 129/795 (16.2) **G2**: 115/796 (14.5) RR: 1.12 (.89-1.42) *P* = 0.33 **Pain during sex on most recent occasion, N (%)** **G1**: 111/655 (17.0) **G2**: 126/674 (18.7) RR: 0.91 (.72-1.14) *P* = 0.43 **Experienced PP depression, N (%)** **G1**: 80/793 (10.1) **G2**: 46/454 (10.1) RR: 0.93 (0.70-1.24) *P* = 0.68	

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Hannah, Hannah, Hodnett, et al., 2002 (continued)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Liked the method of delivery **G1**: 469 (58.8) **G2**: 478 (59.9) RR: 0.98 (.90-1.06) *P* = 0.68		
Liked actively participating in birth **G1**: 141 (17.7) **G2**: 381 (47.7) RR: 0.37 (.31-.44) *P* < 0.001		
Felt reassured about own health **G1**: 539 (67.5) **G2**: 530 (66.4) RR: 1.02 (.95-1.09) *P* = 0.67		
Felt reassured about infant's health **G1**: 618 (77.4) **G2**: 547 (68.6) RR: 1.13 (1.06-1.20) *P* < 0.001		
Liked that recovering from childbirth was not difficult **G1**: 410 (51.4) **G2**: 488 (61.2) RR: 0.84 (.77-.92) *P* < 0.001		
Liked nothing about childbirth experience **G1**: 37 (4.6) **G2**: 37 (4.6) RR: 1.00 (.64-1.56) *P*>.99		
Disliked that childbirth was very painful **G1**: 62 (7.8) **G2**: 109 (13.7) RR: 0.57 (.42-.76) *P* < 0.001		
Disliked that childbirth was not natural **G1**: 173 (21.7) **G2**: 117 (14.7) RR: 1.48 (1.19-1.83) *P* = < 0.001		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Hannah, Hannah, Hodnett, et al., 2002 (continued)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Disliked the method of delivery **G1**: 113 (14.2) **G2**: 106 (13.3) RR: 1.07 (.83-1.36) *P* = 0.66		
Disliked not being able to actively participate in birth **G1**: 172 (21.6) **G2**: 115 (14.4) RR: 1.50 (1.21-1.85) *P* < 0.001		
Disliked planning for one method of delivery but having another **G1**: 80 (10.0) **G2**: 125 (15.7) RR: 0.64 (.49-.83) *P* < 0.001		
Felt worried about own health **G1**: 112 (14.0) **G2**: 95 (11.9) RR: 1.18 (.91-1.52) *P* = .23		
Felt worried about infant's health **G1**: 136 (17.0) **G2**: 226 (28.3) RR: 1.14 (.93-1.41) *P* = .24		
Disliked that recovering from childbirth was difficult **G1**: 152 (19.1) **G2**: 133 (16.7) RR: 1.14 (.93-1.41) *P* = .24		
Disliked nothing about childbirth experience **G1**: 334 (41.9%) **G2**: 325 (40.7%) RR: 1.03 (.91-1.16) *P* = 0.68		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Hannah, Whyte, Hannah, et al., 2004 **Setting** 26 different countries, 917 of 1,159 women from 85 centers involved in a 2-yr postpartum follow-up study **Study design** RCT **Inclusion criteria** • Singleton • Frank or complete breech • ≥ 37 weeks **Exclusion criteria** • NR **Groups** **G1**: Planned c/d **G2**: Planned vag **N at randomization** **G1**: 1,043 **G2**: 1,045 **Follow-up** 2 yrs PP	**Objective of the study** To compare maternal outcomes at two years postpartum after planned vaginal birth for the singleton fetus in breech presentation at term. **Definition of elective cesarean** Planned cesarean scheduled for 38 or more wks gestation Includes actual vaginal deliveries Category includes: • breech	**Maternal age, N ≥ 30 yrs (%)** **G1**: 184 (40.3) **G2**: 181 (39.3) **Maternal BMI** NR **Nulliparity, N (%)** **G1**: 198 (43.3) **G2**: 221 (48.0) **N of previous cesareans** NR **Previous c/d, N (%)** **G1**: 13.8 (2.8) **G2**: 8 (1.7) **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight** NR **Married or stable relationship, N (%)** **G1**: 439 (96.1) **G2**: 441 (95.9) **In labor at randomization, N (%)** **G1**: 170 (37.2) **G2**: 196 (42.6) **Planning to breastfeed (N, %)** Yes **G1**: 398 (87.1) **G2**: 402 (87.4) No **G1**: 25 (5.5) **G2**: 31 (6.7) Unknown **G1**: 34 (7.4) **G2**: 27 (5.9)

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Breastfed at time of completion of questionnaire, N (%) **G1**: 35 (7.7) **G2**: 24 (5.3) *P* = 0.14 **Duration of breast feeding, median months (5th,95th percentile)** **G1**: 8.0 (1.0, 24.1) **G2**: 8.0 (1.0, 23.0) *P* = 0.57 **Ease of caring for child** **G1**: 430 **G2**: 443 *P* = 0.78 Very easy, N (%) **G1**: 100 (23.3) **G2**: 95 (21.4) Easy, N (%) **G1**: 257 (59.8) **G2**: 270 (60.9) A little difficult, N (%) **G1**: 68 (15.8) **G2**: 75 (16.9) Very difficult, N (%) **G1**: 5 (1.2) **G2**: 3 (0.7)	**Experience of being a mother** **G1**: 428 **G2**: 446 *P* = 0.41 Very easy, N (%) **G1**: 65 (15.2) **G2**: 74 (16.6) Easy, N (%) **G1**: 306 (71.5) **G2**: 310 (69.5) Difficult, N (%) **G1**: 51 (11.9) **G2**: 60 (13.5) Very difficult, N (%) **G1**: 6 (1.4) **G2**: 2 (0.4) **Relationship with husband/partner** **G1**: 430 **G2**: 426 *P* = 0.62 Very happy, N (%) **G1**: 247 (57.4) **G2**: 249 (58.5) Somewhat happy, N (%) **G1**: 152 (35.3) **G2**: 147 (34.5) Somewhat unhappy, N (%) **G1**: 21 (4.9) **G2**: 25 (5.9) Very unhappy, N (%) **G1**: 10 (2.3) **G2**: 5 (1.2) **Relationship with husband/partner now compared to before child** **G1**: 428 **G2**: 424 *P* = 0.39 Better, N (%) **G1**: 92 (21.5) **G2**: 79 (18.6) About the same, N (%) **G1**: 310 (72.4) **G2**: 319 (75.2)	**Relevance** T **Quality Rating** Poor

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Hannah, Whyte, Hannah, et al., 2004 (continued)		**Ruptures of membranes, N (%)** **G1**: 89 (19.5) **G2**: 95 (20.7) **Time from delivery to questionnaire completion, median months (5^{th}, 95th percentile)** **G1**: 24.3 (23.0, 30.8) **G2**: 24.2 (23.0, 29.9) **Method of completing questionnaire, N (%)** Mail **G1**: 190 (41.6) **G2**: 189 (41.1) Telephone/personal interview **G1**: 263 (57.5) **G2**: 267 (58.0) Unknown **G1**: 4 (0.9) **G2**: 4 (0.9) **Received help answering questionnaire, N (%)** Yes **G1**: 240 (52.5) **G2**: 263 (57.2) No **G1**: 214 (46.8) **G2**: 194 (42.2) Unknown **G1**: 3 (0.7) **G2**: 3 (0.7) **Low perinatal mortality rate, N (%)** **G1**: 270 (59.1) **G2**: 262 (57.0) **High perinatal mortality rate, N (%)** **G1**: 187 (40.9) **G2**: 198 (43.0)

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
	Worse **G1**: 26 (6.1) **G2**: 26 (6.1) **No sex, N (%)** **G1**: 32 (7.0) **G2**: 41 (8.9) *P* = 0.33 **Pain during sex** **G1**: 418 **G2**: 412 *P* = 0.84 No pain, N (%) **G1**: 376 (90.0) **G2**: 369 (89.6) Almost no pain, N (%) **G1**: 5 (1.2) **G2**: 8 (1.9) Mild or small amount of pain, N (%) **G1**: 28 (6.7) **G2**: 29 (7.0) Quite a lot of pain, N (%) **G1**: 8 (1.9) **G2**: 6 (1.5) Severe or excruciating/terrible pain, N (%) **G1**: 1 (0.2) **G2**: 0 (0) **Happiness with sexual relations** **G1**: 353 **G2**: 349 *P* = 0.72 Very happy, N (%) **G1**: 181 (51.3) **G2**: 172 (49.3) Somewhat happy, N (%) **G1**: 149 (42.2) **G2**: 151 (43.3) Somewhat unhappy, N (%) **G1**: 18 (5.1) **G2**: 23 (6.6) Very unhappy, N (%) **G1**: 5 (1.4) **G2**: 3 (0.9)	

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Hannah, Whyte, Hannah, et al., 2004 (continued)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
	Tried to become pregnant since the birth of the child, N (%) **G1**: 88 (19.3) **G2**: 105 (22.9) *P* = 0.20	
	Number of pregnancies after the birth in the Term Breech Trial, N (%) 1 or more **G1**: 95 (21.0) **G2**: 102 (22.3) *P* = 0.69	
	0 **G1**: 358 (79.0) **G2**: 356 (77.7) *P* = 0.69	
	Currently pregnant or one or more infants born after the birth in the Term Breech Trial, N (%) **G1**: 78 (17.2) **G2**: 84 (18.3) *P* = 0.67	
	Cesarean for one or more infants born after the birth in the Term Breech Trial, N (%) **G1**: 16 (3.6) **G2**: 13 (2.9) *P* = 0.58	
	Urinary incontinence (N, %) **G1**: 81(17.8) **G2**: 100 (21.8) 0.81 (0.63-1.06) *P* = 0.14	
	Problem caused by urinary incontinence **G1**:81 **G2**: 100 *P* = 0.46	
	No problem at all, N (%) **G1**: 31 (38.3) **G2**: 37 (37.0)	
	A little problem, N (%) **G1**: 47 (58.0) **G2**: 54 (54.0)	
	A big problem, N (%) **G1**: 3 (3.7) **G2**: 9 (9.0)	

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Hannah, Whyte, Hannah, et al., 2004 (continued)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
	Fecal incontinence, N (%) **G1**: 11 (2.4) **G2**: 10 (2.2) *P* = 0.83 1.10 (0.47-2.58)	
	Problem caused by fecal incontinence **G1**: 11 **G2**: 9 *P* = 0.41	
	No problem at all, N (%) **G1**: 3 (27.3) **G2**: 2 (22.2)	
	A little problem, N (%) **G1**: 7 (63.6) **G2**: 4 (44.4)	
	A big problem, N (%) **G1**: 1 (9.1) **G2**: 3 (33.3)	
	Incontinence of flatus, N (%) **G1**: 60 (13.1) **G2**: 53 (11.5) 1.14 (0.80-1.61) *P* = 0.48	
	Problem caused by incontinence of flatus **G1**: 60 **G2**: 53 *P* = 0.50	
	No problem at all, N (%) **G1**: 33 (55.0) **G2**: 34 (64.2)	
	A little problem, N (%) **G1**: 22 (36.7) **G2**: 17 (32.1)	
	A big problem, N (%) **G1**: 5 (8.3) **G2**: 2 (3.8)	
	Post partum depression, (%) **G1**: 47 (10.5) **G2**: 53 (11.6) 0.90 (0.62-1.30) *P* = 0.60	

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Hannah, Whyte, Hannah, et al., 2004 (continued)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
	Painful menstrual periods, N (%) **G1**: 95 (24.7) **G2**: 106 (28.0) 0.88 (0.70-1.12) *P* = 0.32	
	Problem caused by painful menstrual period **G1**: 89 **G2**: 104 *P* = 0.46	
	No problem at all, N (%) **G1**: 13 (14.6) **G2**: 26 (25.0)	
	A little problem, N (%) **G1**: 67 (75.3) **G2**: 63 (60.6)	
	A big problem, N (%) **G1**: 9 (10.1) **G2**: 15 (14.4)	
	Irregular menstrual periods, N (%) **G1**: 39 (11.0) **G2**: 53 (15.0) 0.73 (0.50-1.08) *P* = 0.12	
	Problem caused by irregular menstrual period **G1**: 37 **G2**: 52 *P* = 0.83	
	No problem at all, N (%) **G1**: 15 (40.5) **G2**: 21 (40.4)	
	A little problem, N (%) **G1**: 15 (40.5) **G2**: 23 (44.2)	
	A big problem, N (%) **G1**: 7 (18.9) **G2**: 8 (15.4)	

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Hannah, Whyte, Hannah, et al., 2004 (continued)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
	Heavy menstrual period, N (%) **G1**: 63 (18.4) **G2**: 58 (16.8) 1.10 (0.79-1.51) *P* = 0.62	
	Problem caused by heavy menstrual period **G1**: 62 **G2**: 56 *P* = 0.35	
	No problem at all, N (%) **G1**: 15 (24.2) **G2**: 13 (23.2)	
	A little problem, N (%) **G1**: 38 (61.3) **G2**: 29 (51.8)	
	A big problem, N (%) **G1**: 9 (14.5) **G2**: 14 (25.0)	
	Constipation, N (%) **G1**: 124 (27.2) **G2**: 93 (20.2) 1.35 (1.06-1.70) *P* = 0.02	
	Problem caused by constipation **G1**: 122 **G2**: 93 *P* = 0.32	
	No problem at all, N (%) **G1**: 25 (20.5) **G2**: 24 (25.8)	
	A little problem, N (%) **G1**: 79 (64.8) **G2**: 58 (62.4)	
	A big problem, N (%) **G1**: 18 (14.8) **G2**: 11 (11.8)	
	Sexual problems, N (%) **G1**: 36 (7.9) **G2**: 38 (8.3) 0.96 (0.62-1.49) *P* = 0.90	

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Hannah, Whyte, Hannah, et al., 2004 (continued)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
	Problem caused by sexual problems **G1**: 36 **G2**: 38 *P* = 0.73 No problem at all, N (%) **G1**: 2 (5.6) **G2**: 4 (10.5) A little problem, N (%) **G1**: 20 (55.6) **G2**: 22 (57.9) A big problem, N (%) **G1**: 14 (38.9) **G2**: 12 (31.6)	

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Hillan, 1995 **Setting** UK, hospital-based **Study design** Retrospective cohort **Inclusion criteria** • C/d during study period **Exclusion criteria** • NR **Groups** **G1**: Elective c/d **G2**: Emergent c/d • **G2a:** Emergency, no labor • **G2b:** In labor, no data available • **G2c:** Labor < 12 hrs • **G2d:** Labor ≥ 12 hrs **N** **G2**: 399 • G2a: 42 • G2b: 109 • G2c: 129 • G2d: 119	**Objective of the study** To determine the post operative morbidity associated with caesarean delivery, including comparisons for elective and emergency caesarean delivery, subgroups within emergency caesarean delivery and first vs second stage of labor **Definition of elective cesarean** Does not include labored births	**Maternal age** NR **Maternal BMI** NR **Gravidity** NR **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight, grams** NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Pyrexia, N (%) **G1**:106/220 (48.2) **G2**: 251/399 (62.9) • **G2a:** 24/42 (57.1) • **G2b:** 58/109 (53.2) • **G2c:** 82/129 (63.6) • **G2d:** 87/119 (73.1) *P* < 0.001 for **G1** vs **G2** *P* < 0.025 for **G2** subgroups	NR	**Relevance** Moderate **Quality Rating** Poor
Blood Transfusion, N (%) **G1**: 3/220 (1.4) **G2**: 18/399 (4.5) • **G2a:** 7/42 (16.7) • **G2b:** 2/109 (1.8) • **G2c:** 5/129 (3.9) • **G2d:** 4/119 (3.4) *P* < 0.05 for **G1** vs **G2** *P* < 0.001 for **G2** subgroups		
Antibiotic Therapy, N (%) **G1**:35/229 (15.9) **G2**: 130/399 (32.6) • **G2a:** 15/42 (36.6) • **G2b:** 31/109 (28.4) • **G2c:** 44/129 (34.1) • **G2d:** 40/119 (33.6) *P* < 0.001 for **G1** vs **G2** *P* NS for **G2** subgroups		
Urinary tract infection, N (%) **G1**: 24/220 (10.9) **G2**: 41/399 (10.3) • **G2a:** 4/42 (9.5) • **G2b:** 9/109 (8.3) • **G2c:** 17/129 (13.2) • **G2d:** 11/119 (9.3) *P* NS for **G1** vs **G2** *P* NS for **G2** subgroups		
Wound infection, N (%) **G1**: 9/220 (4.1) **G2**: 33/399 (8.3) • **G2a:** 7/42 (16.7) • **G2b:** 5/109 (4.6) • **G2c:** 10/129 (7.8) • **G2d:** 11/119 (9.3) *P* < 0.05 for **G1** vs **G2** *P* NS for **G2** subgroups		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Hillan, 1995 (continued)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Intrauterine infection, N (%) **G1**: 3/220 (1.4) **G2**: 24/399 (6.0) • **G2a:** 3/42 (7.2) • **G2b:** 9/109 (8.3) • **G2c:** 7/129 (5.4) • **G2d:** 5/119 (4.2) *P* < 0.01 for **G1** vs **G2** *P* NS for **G2** subgroups		
Chest infection N (%) **G1**: 2/220 (0.9) **G2**: 21/399 (5.3) • **G2a:** 2/42 (4.8) • **G2b:** 11/109 (10.1) • **G2c:** 7/129 (5.5) • **G2d:** 1/119 (0.8) *P* < 0.05 for **G1** vs **G2** *P* < 0.025 for **G2** subgroups		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Irion et al 1998 **Setting** Switzerland, hospital-based **Study design** Retrospective cohort **Inclusion criteria** For attempted vaginal delivery • EFW (clinically by U/S) ≤ 3600 gms • BPD (≤ 96 MM) • No hyperextension by U/S • Normal pelvis by digital exam **Exclusion criteria** • NR **Groups** **G1**: Attempted vaginal delivery **G2**: Elective c/d **N** **G1**: 385 **G2**: 320	**Objective of the study** To compare maternal and neonatal outcomes in elective cesarean vs attempted vaginal delivery for breech presentation at term **Definition of elective cesarean** Probably ncludes labored births, number NR. Category not defined	**Mean maternal age, mean yrs ± SD** **G1**: 29.0 ± 4.9 **G2**: 30.1 ± 5.2 *P* = 0.004 **Maternal BMI, mean (IQ range)** **G1**: 25.8 (23.9, 28.2) **G2**: 27.5 (24.9, 30.5) *P* < 0.001 **Mean maternal height, mean cm ± SD** **G1**: 163.8 ± 6.5 **G2**: 161.1 ± 7.1 *P* < 0.001 **Parity, N (%)** 0 **G1**: 273 (70.9) **G2**: 209 (65.3) 1 **G1**: 86 (22.3) **G2**: 81 (25.3) ≥ 2 **G1**: 26 (6.8) **G2**: 30 (9.4) *P* = 0.23 **Fetal biparietal diameter, median (IQ range)** **G1**: 90 (87, 92) **G2**: 91 (88, 96) *P* < 0.001 **N of previous cesareans** NR **Diabetes** NR **Gestational age, median wks (IQ range)** **G1**: 38 4/7 (37 5/7, 39 2/7) **G2**: 38 1/7 (37 6/7, 39 0/7) *P* = 0.02 **Type of labor** NR **Type of anesthesia** NR **Fetal weight, estimated gms, median (IQ range)** **G1**: 3000 (2800, 3300) **G2**: 3300 (3000, 2500) *P* < 0.001

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Endometritis, N (%) **G1**: 7 (1.8) **G2**: 13 (4.1) RR = 0.45 (0.18-1.11) *P* = 0.07 **UTI, N (%)** **G1**: 20 (5.2) **G2**: 40 (12.5) RR = 0.42 (0.25-0.70) *P* < 0.001 **Pulmonary infection, N (%)** **G1**: 3 (0.8) **G2**: 1 (0.3) RR = 2.49 (0.26-23.86) *P* = 0.63 **Surgical complications, N (%)** **G1**: 3 (0.8) **G2**: 1 (0.3) RR = 2.49 (0.26-23.86) *P* = 0.63 **Hysterectomy for hemorrhage, N (%)** **G1**: 0 **G2**: 1 (0.3) RR = 0 *P* = 0.45 **Anaemia, N (%)** **G1**: 35 (9.1) **G2**: 31 (9.7) RR = 0.94 (0.59-1.49) *P* = 0.79 **Pulmonary embolism, N (%)** **G1**: 0 **G2**: 1 (0.3) RR = NR *P* = 0.45 **Cardiorespiratory arrest, N (%)** **G1**: 0 **G2**: 2 (0.6) RR = NR *P* = 0.21 **Total maternal morbidity, N (%)** **G1**: 68 (17.7) **G2**: 90 (28.1) RR = 0.063 (0.48-0.83) *P* = 0.001	NR	**Relevance** Low **Quality Rating** Not rated

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Koroukian 2004 **Setting** US, population-based **Study design** Retrospective cohort **Inclusion criteria** • Participaition in the Ohio Medicaid fee-for-servuce system • Continuous eligibility for Medicaid for 60 days PP **Exclusion criteria** • Multiple births • Women with disabling conditions identified through eligibility for the Medicaid blind and disabled program **Groups** **G1**: Vaginal delivery **G1a**: Spontaneous vaginal delivery • **G1a***: Uncomplicated vaginal delivery (appears to be a subset of **G1a**) • **G1b**: Assisted vaginal delivery **G2**: C/d • **G2a**: Nonelective c/d • **G2b**: Elective c/d **N** **G1a**: 120,107 **G1b**: 17,595 **G1a***: 60,765 **G2a**: 25,641 **G2b**: 5,393	**Objective of the study** To estimate the relative risk of postpartum complications by type of delivery among Ohio Medicaid beneficiaries **Definition of elective cesarean** Performed between 37 and 42 wks GA, birthweight between 2500-4000 gms, in the absence of any documented maternal medical risk factors, or labor and delivery events in the birth certificate Probably includes some women in labor Modes of delivery other than elective c/d include • Febrile condition • Meconium • PROM • Placenta previa • Abruptio placenta • Other excessive bleeding • Seizures during labor • Precipitous labor • Prolonged labor • Dysfunctional labor • Breech malpresentation • Cephalopelvic disproportion • Cord prolapse • Anesthetic complications • Fetal distress • Other labor and delivery events	**Maternal age, N ≥ 35 yrs (%)** **G1**: 4067 (2.95) **G2**: 1416 (4.56) **Maternal BMI** NR **Parity** NR **N of previous cesareans** NR **Diabetes, N (%)** **G1**: 2512 (1.82) **G2**: 1319 (4.25) **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight** NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Major puerperal infection (incidence/100) **G1a**: 0.90 **G1a***: 0.83 **G1b**: 1.11 **G2a**: 4.28 **G2b**: 2.87 RR for **G2** vs **G1**: 4.07 (3.71-4.46) RR for **G2b** vs **G1a***: 3.75 (3.12-4.51)	NR	**Relevance** Low **Quality Rating** Not rated
Thromboembolic events (incidence/100) **G1a**: 0.07 **G1a***: 0.06 **G1b**: 0.11 **G2a**: 0.45 **G2b**: 0.19 RR for **G2** vs **G1**: 4.07 (3.02-5.48) RR for **G2b** vs **G1a***: 3.45 (1.70-7.00)		
Anesthetic complications (incidence/100) **G1a**: 0.09 **G1a***: 0.09 **G1b**: 0.16 **G2a**: 0.36 **G2b**: 0.39 RR for **G2** vs **G1**: 3.64 (2.79-4.76) RR for **G2b** vs **G1a***: 4.43 (2.68-7.34)		
Postpartum hemorrhage (incidence/100) **G1a**: 3.00 **G1a***: 2.42 **G1b**: 3.13 **G2a**: 2.22 **G2b**: 1.74 RR for **G2** vs **G1**: 0.51 (0.46-0.56) RR for **G2b** vs **G1a***: 0.60 (0.48-0.76)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Koroukian 2004 (continued)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Transfusion (incidence/100) **G1a**: 0.11 **G1a***: 0.06 **G1b**: 0.12 **G2a**: 0.37 **G2b**: 0.07 RR for **G2** vs **G1**: 1.86 (1.38-2.52) RR for **G2b** vs **G1a***: 1.16 (0.41-3.25)		
Obstetric trauma (incidence/100) **G1a**: 7.35 **G1a***: 6.94 **G1b**: 7.05 **G2a**: 0.57 **G2b**: 1.09 RR for **G2** vs **G1**: 0.09 (0.07-0.11) RR for **G2b** vs **G1a***: 0.16 (0.16-0.20)		
Obstetric surgical wound complication (incidence/100) **G1a**: 0.25 **G1a***: 0.25 **G1b**: 0.49 **G2a**: 3.61 **G2b**: 3.00 RR for **G2** vs **G1**: 12.10 (10.69-13.69) RR for **G2b** vs **G1a***: 12.50 (10.00-15.63)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Krebs and Langhoff-Roos, 2003 **Setting** Denmark, population-based **Study design** Retrospective cohort **Inclusion criteria** • Singleton • Term • Breech • Delivery in Denmark • 1982-1995 **Exclusion criteria** • NR **Groups** **G1**: Elective c/d **G2**: Vaginal **G3**: Emergency c/d **N** **G1**: 7,503 **G2**: 2,363 **G3:** 5,575 **Follow-up** 5-18 years after first delivery	**Objective of the study** To compare the maternal complications of elective c/d for breech at term with those after vaginal or emergency c/d **Definition of elective cesarean** Excludes labor Category includes: • Hypertension • Diabetes • Fetal death before onset of labor	**Maternal age, N (%)** < 20: **G1**: 215 (2.9) **G2**: 96 (4.1) **G3**: 232 (4.2) *P* < .01 for **G2** vs **G1** *P* < .001 for **G3** vs **G1** ≥ 35 **G1**: 436 (5.8) **G2**: 50 (2.1) **G3**: 217 (3.9) P < .001 for **G2** vs **G1**, **G3** vs **G1** **Maternal BMI** NR **Gravidity** NR **N of previous cesareans** NR **Diabetes, N (%)** **G1**: 59 (0.8) **G2**: 7 (0.3) **G3**: 17 (0.3) *P* < .01 for **G2** vs **G1** *P* < .001 for **G3** vs **G1** **Gestational age** All term **Type of labor** NR **Type of anesthesia** NR **Fetal weight, N (%)** < 2500 gms **G1**: 231 (3.1) **G2**: 117 (5.0) **G3**: 307 (5.5) P < .001 for **G2** vs **G1**, **G3** vs **G1** >4000 gms **G1**: 520 (6.9) **G2**: 47 (2.0) **G3**: 334 (6.0) *P* < .001 for **G2** vs **G1** *P* < .05 for **G3** vs **G1**

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Hemorrhage and/or anemia, N (%) **G1**: 430 (5.7) **G2**: 142 (6.0) **G3**: 393 (7.0) RR for **G1** vs **G2**: 1.0 (0.94 - 1.03) RR for **G1** vs **G3**: 0.91 (0.84-0.97 **Puerperal fever/Pelvic Infection, N (%)** **G1**: 110 (1.5) **G2**: 12 (0.5) **G3**: 126 (2.3) RR for **G1** vs **G2**: 1.2 (1.11-1.25) RR for **G1** vs **G3**: 0.81 (0.7-0.92) **Wound infection, N (%)** **G1**: 65 (0.9) **G2**: 16 (0.7) **G3**: 98 (1.8) RR for **G1** vs **G3**: 0.69 (0.57-0.83) **Bladder injury, N (%)** **G1**: 5 (0.1) **G2**: 0 **G3**: 10 (0.2) RR for **G1** vs **G3**: 0.58 (0.23-1.02) **Thromboembolism, N (%)** **G1**: 6 (0.1) **G2**: 0 **G3**: 7 (0.1) RR for **G1** vs **G2**: 1.31 (0.95-1.32) RR for **G1** vs **G3**: 0.80 (0.38-1.26) **Rupture of the anal sphincter, N (%)** **G1**: 0 **G2**: 41 (1.7) **G3**: 0	**Hospitalization with vaginal descensus or urine incontinence, N (%)** **G1**: 42/7,503 (0.6) **G2**: 13/2363 (0.6) **G3:** 80/5575 (0.5% as reported in article, 1.4% as calculated by authors of this report) NS **Hospitalization for fistula or anal incontinence:** **G1**: 0 **G2**: 0 **G3:** 0 Notes: All outcomes for second or third pregnancy by mode of delivery in first pregnancy **Placenta Previa, N (%)** **G1**: 5 (0.1) **G2**: 1 (0.06) **G3**: 3 (0.08) RR for **G1** vs **G2**: 1.14 (0.61-1.35) RR for **G1** vs **G3**: 1.12 (0.52-1.60) **Abruptio, N (%)** **G1**: 19 (0.4) **G2**: 6 (0.3) **G3**: 25 (0.6) RR for **G1** vs **G2**: 1.04 (0.78-1.22) RR for **G1** vs **G3**: 0.77 (0.52-1.04) **Future Ob/Gyn Issues, N (%)** Subsequent delivery **G1**: 4126 (55.0) **G2**: 1451 (61.4) **G3**: 3270 (58.7) RR for **G1** vs **G2**: 0.94 (0.92-0.96) RR for **G1** vs **G3**: 0.94 (0.91-0.97) Admissions for infertility **G1**: 79 (1.1) **G2**: 23 (1.0) **G3**: 61 (1.1)	**Relevance** Low **Quality Rating** Not rated

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Krebs and Langhoff-Roos, 2003 (continued)		**Other:** **Medical conditions** HTN, N (%): **G1**: 293 (3.9) **G2**: 56 (2.4) **G3**: 219 (3.9) *P* < .001 for **G2** vs **G1**, **G3** vs **G1** NS Smoker (%) **G1**: 29.9 **G2**: 29.4 **G3**: 30.5 **Characteristics of Delivery Technique (%)** **G1**: NA **G2**: • Forceps: 5.1 • Episiotomy: 47.6 **G3**: NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
	Ectopic pregnancy **G1**: 184 (2.5) **G2**: 66 (2.8) **G3**: 144 (2.6)	
	Hospitalization for miscarriage **G1**: 508 (6.8) **G2**: 167 (7.1) **G3**: 409 (7.3)	
	Fecundity (proportion of women having a second birth) for low risk mothers < 30, without diabetes, HTN, or perinatal death at first delivery, N (%) **G1**: 3296 (61) **G2**: 1204 (64) **G3**: 2682 (64) RR for **G1** vs **G2**: 0.93 (0.91-0.96) RR for **G1** vs **G3**: 0.91 (0.88-0.95)	
	Preterm delivery < 37 wks **G1**: 177 (3.6) **G2**: 101 (5.6) **G3**: 242 (6.2) RR for **G1** vs **G2**: 0.86 (0.78-0.94) RR for **G1** vs **G3**: 0.75 (0.66-0.83)	
	Fetal death before onset of labor **G1**: 11 (0.2) **G2**: 5 (0.2) **G3**: 11 (0.3) RR for **G1** vs **G2**: 0.94 (0.61-1.19) RR for **G1** vs **G3**: 0.90 (0.54-1.25)	
	Intrapartum death **G1**: 3 (0.06) **G2**: 1 (0.06) **G3**: 4 (0.1) RR for **G1** vs **G2**: 1.02 (0.38– 1.34) RR for **G1** vs **G3**: 0.77 (0.23-1.38)	

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Krebs and Langhoff-Roos, 2003 (continued)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
	5-min Apgar < 7 **G1**: 58 (1.1) **G2**: 20 (1.1) **G3**: 50 (1.2) RR for **G1** vs **G2**: 1.01 (0.87-1.14) RR for **G1** vs **G3**: 0.96 (0.79-1.23)	
	Early neonatal death **G1**: 19 (0.4) **G2**: 4 (0.2) **G3**: 11 (0.3) RR for **G1** vs **G2**: 1.13 (0.87-1.29) RR for **G1** vs **G3**: 1.13 (0.82-1.42)	

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Lal et al., 2003 **Setting** UK, hospital-based **Study design** Prospective cohort **Inclusion criteria** • Consecutive primiparas with live singleton pregnancies between April 1997 and Sept 1998 **Exclusion criteria** • Pregnant again • Had an operation, severe psychiatric or medical problem, neurologic problem, urinary tract anomaly, or diversion, ill infant **Groups** **G1**: Emergency c/d **G2**: Elective c/d **G3**: Vaginal delivery (non instrumental) **N retained** **G1**: 104 **G2**: 84 **G3**: 100	**Objective of the study** To compare the incidence and severity of anal incontinence in primiparas after cesarean delivery versus spontaneous vaginal delivery **Definition of elective cesarean** Planned procedure or immediately after the onset of labor in anyone due for a planned delivery Does not include labored births Category includes: Fetal distress **G1**: 53 **G2**: 0 **G3**: NA Breech **G1**: 10 **G2**: 48 **G3**: NA Preeclampsia **G1**: 5 **G2**: 5 **G3**: NA Failure to progress **G1**: 27 **G2**: 0 **G3**: NA Cephalopelvic disproportion **G1**: 0 **G2**: 12 **G3**: NA Fetal growth restriction **G1**: 0 **G2**: 3 **G3**: NA Maternal request **G1**: 0 **G2**: 3 **G3**: NA Miscellaneous **G1**: 9 **G2**: 9 **G3**: NA	**Maternal age median yrs ± SD** **G1**: 28.2 ± 5 **G2**: 28.8 ± 5 **G3**: 27.5 ± 4 **Maternal BMI** NR **Gravidity** NR **N of previous cesareans** NR **Diabetes** **G1**: 0 **G2**: 2 **G3**: NR **Gestational age, median wks (range)** **G1**: 39 (27-41) **G2**: 38 (27-41) **G3**: 39 (32-41) **Type of labor** NR **Type of anesthesia** NR **Fetal weight, kg, ± SD** **G1**: 3.1 ± 0.7 **G2**: 3.1 ± 0.7 **G3**: 3.2 ± 0.4 **Urinary incontinence before pregnancy, N (%)** NR **Maternal race (N)** White **G1**: 98 **G2**: 77 **G3**: 96 Asian **G1**: 3 **G2**: 2 **G3**: 4 Afro-Caribbean **G1**: 3 **G2**: 1 **G3**: 0

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
NR	**New anal incontinence, N (%)** **G1**: 6/104 (5.8) **G2**: 3/80 (3.8) **G3**: 8/100 (8) **Anal incontinence severe enough to require pad use, N (%)** **G1**: 0 **G2**: 2/80 (2.5) **G3**: 1/100 (1) Authors also compare c/d not in labor (emergency + elective) to vaginal delivery and find that the difference is not statistically significant	**Relevance** Moderate **Quality Rating** Fair

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Lal et al., 2003 (continued)		**Maternal age** NR **Maternal BMI** NR **Gravidity** NR **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** **Induced labor** **G1**: NR **G2**: NR **G3**: 16 **Type of anesthesia** NR **Fetal weight, mean kg ± SD** **G1:** 3.1 ± 0.7 **G2:** 3.1 ± 0.7 **G3:** 3.2 ± 0.4 **Urinary incontinence before pregnancy** NR **Maternal medical condition:** Irritable Bowel Syndrome **G1**: 10 **G2**: 4 **G3**: 6

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Lal et al., 2003 (continued)		**Time to delivery** Not in labor **G1**: 21 **G2**: 80 **G3**: NA Early labor (cervix < 8 cm) **G1**: 63 **G2**: 0 **G3**: NA Late labor (cervix > 8 cm) **G1**: 20 **G2**: NA **G3**: NA Mean **Fetal head circumference, mean cm ± SD** **G1**: 34 ± 4 **G2**: 35 ± 3 **G3**: 34 ± 2

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Leiberman et al., 1995 **Setting** Israel hospital (2 Depts of Ob/Gyn that differ in their management to breech) **Study design** Prospective Cohort **Inclusion criteria** • Nulliparous • Frank breech **Exclusion criteria** • Multiparity • Preterm • Complete or footling breech • Multiple gestation • Antepartum death • Major congenital malformations **Groups** **G1**: Planned trial of labor **G2**: Planned c/d **N at assignment** **G1**: 135 **G2**: 129	**Objective of the study** To examine pregnancy outcome in nulliparous women with single term breech presentation **Definition of elective cesarean** Includes labored births, number NR Category includes: • Placenta previa • Fetal anomalous presentation	**Maternal age** NR **Maternal BMI** NR **Gravidity** NR **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight** NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Maternal morbidity (temperature > 38 at 2 or more days PP, endometritis, wound infection, UTI, thrombophlebitis **G1:** 24/135 **G2:** 40/129 OR = 0.48 (0.25-0.89) *P* = 0.01	NR	**Relevance** T **Quality Rating** Fair

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author MacArthur, Bick, and Keighley, 1997 **Setting** UK, hospital-based **Study design** Case-control **Inclusion criteria** • Women who had postpartum symptoms (backache, headaches, neckache, paraesthesias in hands, pain legs, visual disturbances, dizziness or fainting, stress incontinence, fatigue, fecal incontinence, sexual problems, and depression and randomly selected women without symptoms **Exclusion criteria** • NR **Groups** **G1a**: Primiparous, new incontinence **G1b**: Multiparous, new incontinence **G2a**: Primiparous, never had incontinence **G2b**: Multiparous, never had ncontinence Each group further divided into elective, emergency, forceps, vacuum, spontaneous, vaginal **N** Contacted for interview at 45 wks PP: 1,156 Interviewed: 906	**Objective of the study** To measure the prevalence and severity of postpartum fecal incontinence, especially new incontinence and to identify obstetric risk factors **Definition of elective cesarean** Probably includes labored births, number NR. Category not specified	**Maternal age, mean yrs ± SD** **G1a**: 27.9 yrs ± 5.5 **G1b**: 30.9 yrs ± 4.8 **G2a**: 26.7 ± 5.2 **G2b**: 29.6 ± 4.6 **Maternal BMI** NR **Gravidity, N (%)** One **G1a**: NR **G1b**: 10 (65.6) **G2a**: NR **G2b**: 305 (61.5) Two **G1a**: NR **G1b**: 7 (38.9) **G2a**: NR **G2b**:115 (23.2) ≥ Three **G1a**: NR **G1b**: 1 (5.6) **G2a**: NR **G2b**: 76 (15.3) **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor, N (%)** Induced onset of labor **G1a**: 5 (27.8) **G1b**: 3 (16.7) **G2a**: 49 (14.2) **G2b**: 42 (8.5) **Type of anesthesia** NR **Fetal weight, mean gms ± SD** **G1a**: 3306 ± 804.7 **G1b**: 3444 ± 435.4 **G2a**: 3318 ±861.3 **G2b**: 3432 ± 633.5

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
NR	**Fecal incontinence, N (%)** Elective Total: 0/61 (0) Primip: 0/13 (0) Multip: 0/48 (0) Emergency Total: 6/113 (5.3) Primp: 5/59 (8.5) Multip: 1/54 (1.9) Forceps Total: 8/110 (7.2) Primp: 5/86 (5.8) Multip: 3/24 (12.5) Vacuum Total: 4/18 (22.2) Primp: 3/14 (21.4)) Multip: 1/4 (25.0) Spontaneous vaginal delivery Total: 18/568 (3.2) Primp: 5/189 (2.6) Multip: 13/379 (3.4)	**Relevance** Low **Quality Rating** Not rated

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author MacArthur, Bick, and Keighley, 1997 (continued) **N for analysis** Elective: 61 Emergency: 113 Forceps: 110 Vacuum: 18 Spontaneous vaginal: 568 Total: 870		**Fetal head circumference, mean cm ± SD** **G1a**: 34 ± 2.3 **G1b**: 34.6 ± 1.2 **G2a**: 34.5 ± 2.7 **G2b**: 34.7 ± *2.5* **Second or greater perineal tear, N (% of new incontinence primiparous)** **G1a**: 5 (27.8) **G1b**: 5 (27.8) **G2a**: 91 (26.4) **G2b**: 113 (22.8) **First stage of labor ≥ 10 hrs (% of new incontinence primiparous)** **G1a**: 9 (60.0) **G1b**: 4 (22.2) **G2a**: 136 (47.1) **G2b**: 79 (19.8) **Second stage of labor ≥ 2 hrs (% of new incontinence primiparous)** **G1a**: 7 (38.9) **G1b**: NR **G2a**: 99 (28.5) **G2b**: 24 (4.8) **Active second stage of labor ≥2 hrs (% of new incontinence primiparous)** **G1a**: 4 (22.2) **G1b**: NR **G2a**: 41 (11.8) **G2b**: 19 (3.8)

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author MacArthur, Glazener, and Wilson, 2001 **Setting** UK, Hospital **Study design** Cross Sectional **Inclusion criteria** • All women **Exclusion criteria** • NR **Groups** **G1**: SVD **G2**: Forceps **G3**: Vacuum **G4**: Breech **G5:** Elective c/d **G6:** Emergency c/d **N** **G1**: 4,963 **G2**: 654 **G3**: 329 **G4:** 65 **G5:** 496 **G6:** 664	**Objective of the study** To determine whether obstetric and maternal factors relate to fecal incontinence at three months PP **Definition of elective cesarean** NR	NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
NR	**Fecal Incontinence at 3 mos PP, %** All Women **G1:** 9.6 **G2:** 13.6 **G3:** 10.3 **G4:** 13.8 **G5:** 7.3 **G6:** 7.5 Primiparae **G1: 8.8** **G2:** 13.9 **G3:** 9.3 **G4:** 12.0 **G5:** 5.4 **G6:** 4.8 Multiparae **G1:** 10.0 **G2:** 12.2 **G3:** 14.3 **G4:** 15.0 **G5:** 8.0 **G6:** 12.3	**Relevance** Low **Quality Ratings** Not rated

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Mason et al., 1999 **Setting** England, hospital-based **Study design** Prospective cohort **Inclusion criteria** • Consented to participate at prenatal visit • 34 wks pregnant (Questionnaire 1) • 8 mos postpartum (Questionnaire 2) **Exclusion criteria** • If any doubt that still pregnant • Miscarriage/stillbirth/ neonatal death • Birth outcome unknown to team **Groups** **G1**: Vaginal delivery **G2**: Planned c/d **G3**: Emergency c/d **G4**: Forceps **G5**: Ventouse **N at enrollment** At 34 wks of pregnancy: 717/918 Response rate = 78% **Follow-up at 8-10 wks PP** **G1**: 358/571 **G2**: 44/571 **G3**: 41/571 **G4**: 28/571 **G5**: 27/571 Total N at 8 wks PP = 572/894 Response rate = 64%	**Objective of the study** To undertake a prospective survey of the prevalence of stress incontinence during pregnancy and following childbirth **Definition of elective cesarean** Unspecified	**Maternal age, N (%)** < 20: 34/717 (4.8) 20-29: 357/717 (49.8) 30-39: 304/717 (42.3) ≥ 40: 22/717 (3) **Maternal BMI** NR **Parity, N (%)** Nullip: 316/717 (44) ≥ Para 1: 401/717 (56) **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight** NR **Urinary Incontinence, N (%)** At 34 weeks GA: 419/717 (59) At 8 wks PP: 179/572 (31) **Extent of reported SUI at 34 weeks GA, N (%)** Daily leak of several time/wk: 207/419 (49.4) Pad daily or most days: 46/419 (11) Change underwear most or everyday (38/419 (9.1) **Onset of SUI measured at 34 weeks GA, N (%)** Symptoms began before any pregnancy: 25/419 (6) During this pregnancy: 264/419 (63.0) Symptoms began in connection to prior pregnancy or delivery: 127/419 (30)

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Stress urinary incontinence, N (%) **G1**: 125/358 (34.9) **G2**: 7/44 (15.9) **G3**: 7/41 (17.1) **G4**: 9/28 (32.1) **G5**: 11/27 (40.1) **G1** vs **G4** or **G5**: NS **G2** vs **G3**: NS **G1** vs **G2** and **G3** (cesarean):χ^2 = 10.85, *P* = 0.0009	NR	**Relevance** Low **Quality Rating** Not rated

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Nice et al., 1996 **Setting** UK, community-based hospital **Study design** Prospective cohort **Inclusion criteria** • All c/d at 5 hospitals in 3 month period **Exclusion criteria** • NR **Groups** **G1**: Elective c/d **G2**: Emergency c/d **N at start of study** **G1**: NR **G2**: NR **Follow-up** 10 days for all patients who had c/d **G1**: 220 **G2**: 408	**Objective of the study** To determine the cesarean rates, wound infection rates, and whether any procedures or prophylactic antibiotics influenced the outcome **Definition of elective cesarean** Planned by obstetrician in antenatal clinic and performed at scheduled time or sooner if onset of labor accelerated time of delivery, as compared to emergency c/d which is performed for immediate or compelling clinical reasons and not planned in advance Includes labored births, number NR, indications for c/d unspecified	**Maternal age** NR **Maternal BMI** NR **Gravidity** NR **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight** NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Wound complications ("infection") **G1**: 14/220 **G2**: 31/408 *P* = NS	NR	**Relevance** Moderate **Quality rating** Poor

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Persson, Wølner-Hanssen, and Rhydstroem, 2000 **Setting** Sweden, population-based **Study design** Case-control **Inclusion criteria** • Females born 1932 to 1977 in Sweden who had surgery for stress urinary incontinence between 1987 and 1996 • For women who had more than 1 operation for stress incontinence, only 1st event of surgery was included **Exclusion criteria** • Women born outside of Sweden • Women who had first delivery < 1973 • Women who had been operated on before their 1st delivery • Women who had unknown or absurd birth weight, or erroneous yr of delivery **Groups** **G1**: Women who had surgery for stress urinary incontinence (1987 to 1996) **G2**: All women in population who met inclusion/exclusion criteria **N at enrollment** **G1**: 1942 **G2**: 876,768 **Follow-up** NR	**Objective of the study** To evaluate obstetric and maternal risk factors for stress urinary incontinence **Definition of elective cesarean** Undefined, probably includes labored births, number NR	**Maternal age (yrs at 1st birth)** ≤ 19 **G1**: 146 **G2**: 74,459 20-24 **G1**: 598 **G2**: 334,156 25-29 **G1**: 755 **G2**: 357,123 30-34 **G1**: 329 **G2**: 117,206 35-39 **G1**: 107 **G2**: 29,430 40-44 **G1**: 7 **G2**: 4,273 ≥ 45 **G1**: 0 **G2**: 121 **Maternal BMI** NR **Parity** 1 **G1**: 336 **G2**: 251,027 2 **G1**: 949 **G2**: 412,984 3 **G1**:499 **G2**: 164,102 4 **G1**: 113 **G2**: 37,639 ≥ 5 **G1**: 46 **G2**: 11,016 **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
NR	**Stress Urinary Incontinence Surgery** OR for elective cesarean vs. non-instrumental vaginal singleton births among primiparous women: 0.21 (95% 0.13-0.34) OR for any cesarean vs. non-instrumental vaginal delivery: 0.34 (95% CI 0.23-0.52)	**Relevance** Low **Quality rating** Not rated

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Persson, Wølner-Hanssen, and Rhydstroem, 2000 (continued)		**Type of labor** NR **Type of anesthesia** NR **Fetal weight** NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Phipps et al., 2005 **Setting** US, hospital-based **Study design** Case-control **Inclusion criteria** • All women who underwent c/d at Women and Infant's Hospital during study period (1/95 to 12/02) Cases • Women with bladder injury Controls • Two random controls per case **Exclusion criteria** • NR **Groups** **G1**: Cesarean delivery-elective and nonelective, primary and repeat with bladder injury **G2**: Cesarean delivery, no bladder injury Data reported for scheduled, urgent, emergency c/d for cases and controls **N** **G1**: 42 **G2**: 84	**Objective of the study** To identify risk factors for bladder injury during cesarean delivery **Definition of elective cesarean** Scheduled surgery All groups include: • Previous cesarean deliveries • Preterm deliveries	**Maternal age, mean yrs ± SD** **G1**: 33.6 ± 3.7 **G2**: 29.3 ± 6.3 **Maternal BMI ± SD** **G1**: 29.9 ± 5.4 **G2**: 33.0 ± 6.7 **Parity %,** Nulliparous **G1**: 21 **G2**: 48 Multiparous (≥1) **G1**: 79 **G2**: 52 **N of previous cesareans** 0 **G1**: 33 **G2**: 68 1 **G1**: 43 **G2**: 27 ≥2 **G1**: 24 **G2**: 5 **Diabetes** NR **Gestational age, mean wks ± SD** **G1**: 38.5 ± 1.9 **G2**: 37.5 ± 3.4 **Type of labor (%)** Presence of labor **G1**: 83 **G2**: 61 **Type of anesthesia** NR **Fetal weight** NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Bladder injury Scheduled c/d **G1**: 14% **G2**: 27% Urgent c/d **G1**: 55% **G2**: 62% Emergency c/d **G1**: 31% **G2**: 11% *P* = 0.01	NR	**Relevance** Low **Quality rating** Not rated

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Reichert, Baron, and Fawcett, 1993 **Setting** US, hospital-based **Study design** Retrospective cohort **Inclusion criteria** • Cesarean delivery • Married/living with partner • Full term deliveries • English **Exclusion criteria** • NR **Groups** **G1**: Cesarean deliveries, in 1973-80 **G2**: All deliveries, in 1981-82 **G3**: All deliveries, in 1989-90 G3 further subdivided into planned and unplanned, outcomes listed for G3 alone **N at enrollment** **G1**: 24 **G2**: 15 **G3**: 173 Planned: 84 Unplanned: 89 **Follow-up** **G1**: From a few months to 6 years **G2**: 6 weeks PP **G3**: 6 weeks PP	**Objective of the study** To compare findings of three studies of women's responses to planned and unplanned cesarean birth **Definition of elective cesarean** Labored births, number NR Groups (each includes both elective and emergency cesarean deliveries) include: **G1:** • Cephalopelvic disproportion (63%) • Dystocia (17%) • Fetal distress (8%) • Placenta previa (4%) • Toxemia (4%) • Genital herpes (4%) **G2:** • Dystocia (40%) • Breech presentation (20%) • Cephalopelvic (13%) • Fetal distress (13%) • Purse string suture of the cervix (7%) • Previous myomectomy (7%) **G3:** • Previous c/d (27%) • Breech presentation (19%) • Cephalopelvic (19%) • Combination of factors (15%) • Failed induction (2%) • Other reasons (failed vaginal birth after c/d, failed forceps delivery, genital herpes) (3%)	**Maternal age, mean yrs (range)** **G1**: 29 (22-39) **G2**: 29.7 (25-37) **G3**: 31.5 (19-44) **Maternal BMI** NR **Primipara** **G1**: 17/24 **G2**: 15/15 **G3**: 93/173 **Planned c/d** Primiparas **G1**: 4/17 **G2**: 6/15 **G3**: 12/93 Multiparas **G1**: 7/7 **G2**: NA, no multiparas **G3**: 72/80 **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight** NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
NR	**Physiologic Mode** **Woman's goals achieved** Unplanned: 43 Planned: 49 **Not achieved** Unplanned: 134 Planned: 94 **Self concept mode** **Woman's goals achieved** Unplanned: 145 Planned: 154 **Not achieved** Unplanned: 113 Planned: 94 **Role function mode** **Woman's goals achieved** Unplanned: 10 Planned: 4 **Not achieved** Unplanned: 22 Planned: 10 **Interdependence mode*** **Woman's goals achieved** Unplanned: 47 Planned: 33 **Ineffective mode** Unplanned: 30 Planned: 17 Test of effective vs. iNot achieveds by planned vs. unplanned cesarean for Group 3: X^2 = 5.59, P = 0.0173 Test of effective vs. iNot achieveds by planned vs. unplanned for Group 1 (data NR): X^2 = 13.12, P = 0.0006 Test of effective vs. iNot achieveds by planned vs. unplanned for Group 2 (data NR, X^2 NR) NS *See article for description of items within each mode; too lengthy to include here	**Relevance** Low **Quality Rating** Not rated

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Ryding, Wijma, and Wijma, 1998 **Country, Setting** Sweden, hospital-based **Study design** Prospective cohort **Inclusion criteria** • Swedish speaking • Women subjected to cesarean delivery • Instrumental vaginal delivery or normal vaginal delivery • Delivered live child **Exclusion criteria** • Transferred to another hospital • Randomly selected for different study and excluded from this study (n = 53) • Artificial rupture of membranes • Oxytocin stimulation of spontaneous labor **Groups** • **G1**: Emergency cesarean • **G2**: Elective cesarean • **G3**: Instrumental vaginal delivery • **G4**: Normal vaginal delivery **N at few days PP** **G1**: 75 G2: 79 G3: 104 G4: 104 **Follow-up** **1 month PP** • **G1**: 71 • **G2**: 70 • **G3**: 96 • **G4**: 96	**Objective of the study** To compare the psychological reactions of women after different modes of delivery **Definition of elective cesarean** Includes women who had had a date set for elective delivery but were operated on as an emergency procedure because of the onset of labor Includes labored births, but number NR	**Maternal age, mean yrs** **G1**: 31 **G2**: 30 **G3**: 28 **G4**: 28 All groups: 29 **Maternal BMI** NR **Primiparous, %** **G1**: 34 **G2**: 58 **G3**: 87 **G4**: 52 All Groups: 58 **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight** NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Median post-traumatic stress reactions measured by Impact of Event Scale (range) 2 days PP **G1**: 10.8 (4.0-21.8) **G2**: 6.0 (3.0-12.0) **G3**: 13.0 (5.0-18.3) **G4**: 10.0 (4.0-16.8) **G1** vs **G2**: *P* = 0.001 1 month PP **G1**: 8.0 (3.8-15.0) **G2**: 5.0 (1.0-11.0) **G3**: 9.0 (5.0-18.6) **G4**: 6.0 (3.0-11.0) **G1** vs **G2**: *P* < 0.01 **Median mental distress measured by subset of Symptoms Check List (range)** 2 days PP **G1**: 19.0 (10.2-30.0) **G2**: 16.0 (10.1-21.5) **G3**: 20.0 (10.0-33.8) **G4**: 11.1 (6.0-17.0) **G1** vs **G2**: *P* < 0.05 on anxiety only 1 month PP **G1**: 13.0 (7.0-23.0) NS **G2**: 11.0 (6.0-17.0) **G3**: 15.0 (5.8-28.3) NS **G4**: 14.0 (4.5-19.5) NS **G1** vs **G2**: *P* = NS **Median appraisal of delivery measured by Vaginal Delivery Expectancy Questionnaire** 2 days PP **G1**: 59.3 (47.8-68.8) **G2**: 41.0 (31.0-51.0) **G3**: 52.0 (37.0-64.0) **G4**: 33.9 (28.5-45.0) **G1** vs **G2**: *P* < .0001 1 month PP **G1**: 52.0 (40.5-64.8) **G2**: 32.3 (24.0-42.0) **G3**: 44.0 (31.5-53.5) **G4**: 26.0 (19.5-39.5) **G1** vs **G2**: *P* < 0.01 Change over time by groups were all statistically significant (*P* < 0.05 to *P* < .0001) for each type of questionnaire except for **G2** for post -traumatic stress and **G4** for mental distress	NR	**Relevance** Low **Quality Rating** Not rated

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Sanchez-Ramos et al, 2001 **Setting** US, hospital-based **Study design** Retrospective cohort **Inclusion criteria** • Singleton • Breech • Planned c/d offered; offered trial of labor if following criteria were met: singleton, frank or complete breech; EFW 2000 to 4000 g; adequate pelvis by exam or CT; non extended fetal head by U/S or CT **Exclusion criteria** • NR **Groups** **G1**: Attempted vaginal breech **G2**: Elective c/d **N** **G1**: 272 **G2**: 576	**Objective of the study** To compare maternal and neonatal outcomes in elective cesarean vs attempted vaginal delivery for breech presentation at or near term **Definition of elective cesarean** Probably includes labored births, number NR Category includes: • Patient choice (40.8%) • Repeat (% NR) • Incomplete breech (25.0%) • Abnormal pelvimetry (10.1%) • Macrosomia (4.9%) • Hyperextension (3.3%) • Non-reassuring fetal testing (3.8%)	**Maternal age, mean yrs ± SD** **G1**: 24.2 ± 5.7 **G2**: 24.0 ± 5.9 *P* = 0.62 **Maternal BMI** NR **Nulliparity, N (%)** **G1**: 122 (44.8%) **G2**: 265 (46%) *P* = 0.81 **Previous cesareans, N (%)** **G1**: 16 (5.9) **G2**: 92 (16%) *P* = 0.0003 **Diabetes** NR **Gestational age, mean wks ± SD** **G1**: 38.7 ± 1.9 **G2**: 38.3 ± 2.4 *P* = 0.03 **Augmentation of labor via oxytocin, N (%)** **G1**: 106 (39) **G2**: 4 (0.7) *P* = 0.0001 **Type of anesthesia** NR **Fetal weight estimated gms ± SD** **G1**: 3028 ± 522 **G2**: 3096 ± 687 *P* = 0.26

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Length of stay, median days (interquartile range) **G1**: 2 (2, 3) **G2**: 4 (4, 4) *P* = 0.001 **Febrile morbidity, N (%)** **G1**: 23/272 (8.4) **G2**: 79/576 (13.7) *P* = 0.03 **Hemorrhage, N (%)** **G1**: 3/272 (1.1) **G2**: 7/576 (1.2) *P* = 1.00 **Anesthesia complications, N (%)** **G1**: 3/272 (1.1) **G2**: 6/576 (1.0) *P* = 1.00 **No morbidity, N (%)** **G1**: 241/272 (88.6) **G2**: 476/576 (82.6) *P* = 0.02	NR	**Relevance** Moderate **Quality rating** Poor

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Schindl et al., 2003 **Setting** Austria, hospital-based **Study design** Prospective cohort **Inclusion criteria** • Gestation week 38 **Exclusion criteria** • < 19 yrs • Inability to complete questionnaire • Unwillingness to participate • Severe internal problems (e.g., HELLP syndrome) **Groups** **G1**: Intended vaginal delivery **G2**: Elective c/d • **G2a**: Elective c/d (medical reasons) • **G2b**: Elective c/d ("on demand") **N at enrollment** **G1**: 903 **G2**: 147 • **G2a**: 103 • **G2b**: 44 **Follow-up** 3 days PP NR 4 mos PP 23.9% response rate	**Objective of the study** To investigate birth experience and medical outcome in women with elective cesarean delivery compared with intended vaginal delivery **Definition of elective cesarean** Probably includes labor, number NR Elective c/d on demand includes: • Anxiety, nulliparae (16/44) • Previous traumatic birth (20/44) • Other (coordination problems, safety considerations) (8/44) Elective c/d for medical indications includes: • Breech (40/103) • Twins (7/103) • Preeclampsia (6/103) • CS interval < 15 mos (19/103) • Cephalopelvic disproportion (4/103) • HIV and hepatitis C (5/103) • Neurological problems (e.g., epilepsy) (10/103) • Internal problems (e.g., heart failure) (9/103) • Others (e.g., pelvic failure) (3/103)	**Maternal age, mean yrs (range)** **G1**: 28 (15-43) **G2a**: 32 (20-44) **G2b**: 30 17-44) *P* < 0.05 **Maternal BMI** NR **N of previous births mean (range)** **G1**: 0 (0-9) **G2a**: 1 (0-5) **G2b**: 0 (0-3) **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight** NR **Other** NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Blood transfusion required, N (%) **G1**: 6/903 (0.6) **G2**: 0 **Sepsis, N (%)** **G1**: 1/903 (0.1) **G2**: 0 **Perineal laceration III/IV, N (%)** **G1**: 2/903 (0.2) **G2**: 0 **Labial, vaginal, perineal laceration I/II, N (%)** **G1**: 302/903 (33.4) **G2**: 0 **Complications of peridural anesthesia, N (%)** **G1**: 18/903 (2.0) **G2**: 6/147 (4.0) **Pain, VAS scale (results presented graphically in article)** • At birth, significantly higher median pain level during birth in the vaginal or assisted vaginal delivery groups compared to the cesarean group ("peridural" anesthesia was offered to every woman but only chosen in 11% of patients • At 3 days PP, pain significantly lower among spontaneous vaginal group compared to all C/d, no difference between c/d groups • At 4 mos PP, no difference in momentary birth-related pain was observed between all groups (Kruskal–Wallis test, $P = 0.192$)	NR	**Relevance** Moderate **Quality rating** Fair

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Schindl et al., 2003 (continued)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Birth experience, Zerrsen test for momentary personal feelings (results presented graphically in article) • Before birth, no differences in momentary personal feelings before birth • At 3 days PP, women in the assisted vaginal delivery and emergency cesarean delivery groups experienced strong negative feelings • At 4 mos PP, no difference between groups **Birth experience, modified version of Salmon and Drew's birth experience questionnaire (results presented graphically in article)** • Before birth, women planning a cesarean delivery without medical indications had an expectation of a more pleasant birth compared to women planning a vaginal delivery or a cesarean for medical indications • At 3 days PP, most positive birth experiences in descending order: elective c/d on demand, elective c/d for medical indications, vaginal delivery, emergency c/d and assisted vaginal delivery • At 4 mos PP, most positive birth experiences in descending order: elective c/d on demand, elective c/d for medical indications, vaginal delivery, emergency c/d and assisted vaginal delivery		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Schytt, Lindmark, Waldenstrom, 2004 **Setting** Western Europe, hospital-based **Study design** Cross Sectional at 1yr PP **Inclusion criteria** • Attending antenatal clinic **Exclusion criteria** • Miscarriages • Non-Swedish speaking • Twin deliveries **Groups** **G1**: Elective c/d **G2**: Emergency c/d **G3**: Vaginal **G4:** Forceps & vacuum **N at 1 yr PP** **G1**: 133 **G2**: 185 **G3**: 1893 **G4:** 172	**Objective of the study** To describe the prevalence of stress incontinence, as described by the women themselves, one year after childbirth in a national sample of Swedish-speaking women, and to identify possible predictors **Definition of elective cesarean** NR	**Maternal age, mean yrs ± SD** Overall: 29.5 ± 4.6 Median: 29.0 **Maternal BMI** NR **Gravidity** NR **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight, grams** NR **Urinary incontinence before pregnancy, N (%)** NR **Pregravida BMI ≥ 30** Primaparous: 25% RR: 1.5(1.1-2.0) Multiparous: 29.3% RR: 1.3 (1.0-1.6) **Parity** Primiparous: 44% **Previous cesarean/s** Multiparous: 13% **Fetal weight, mean gms** > 4500 Primaparous: 17.9% RR: 1.0(0.4-2.3) Multiparous: 23% RR: 1.3 (0.8-2.0)

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
NR	**Stress incontinence at 1 yr PP**, % Primiparas **G1:** 0 **G2:** 11.5 RR: 0.6 (0.3-1.0) **G3:** 19.9 **G4:** 21.8 RR: 1.1 (0.8-1.6) Multiparas **G1:** 12.9 RR: 0.5 (0.3-0.9) **G2:** 12.7 RR: 0.5 (0.3-1.0) **G3:** 25.4 **G4:** 38.5 RR: 1.5 (1.0-2.3)	**Relevance** Low **Quality Ratings** Not rated

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author van Ham, van Dongen, and Mulder, 1997 **Setting** Netherlands, hospital-based **Study design** Retrospective cohort **Inclusion criteria** • All c/d performed in the Dept of Ob/Gyn in University Hospital, Netherlands, between 1983 and 1992 **Exclusion criteria** • None **Groups** **G1**: Primary elective c/d-planned operation, admitted 8 hr before c/d w/o symptoms of ruptured membranes, contractions, or bleeding (i.e., election) **G2**: Primary acute c/d-time between decision to deliver abdominally and actual performance < 8 hr ignoring stage of labor, no attempt to deliver vaginally (i.e., c/d, unclear whether labored or not, emergency) **G3**: Secondary acute c/d - c/d following failed vaginal delivery (i.e., labored emergency c/d) **N at selection** **G1**: 718/2,647 **G2**: 859/2,647 **G3**: 1,070/2,647 **Follow-up** NR	**Objective of the study** To assess intraoperative surgical complications and postoperative maternal morbidity rate of cesarean delivery **Definition of elective cesarean** Primary: planned operation, patient admitted ≥ 8 hrs before c/d without symptoms of ruptured membranes, regular uterine contractions or vaginal bleeding	**Maternal age, mean (range)** **G1**: 30.5 (18-43) **G2**: 28.9 (16-49) **G3**: 29.3 (17-47) **Maternal BMI** NR **Parity, mean (range)** **G1**: 1.0 (0-9) **G2**: 0.7 (0-11) **G3**: 0.4 (0-6) **N of previous cesareans (repeat), N (%)** **G1**: 64 (8.9) *P* < 0.001 **G2**: 23 (2.5) **G3**: 15 (1.4) **Diabetes** NR **Gestational age, N (%)** < 28 weeks **G1**: 5 (0.7) **G2**: 51 (5.9) **G3**: 10 (0.9) 28-37 wks **G1**: 95 (13.2) **G2**: 52 (65.4) **G3**: 115 (10.7) > 37 wks **G1**: 618 (86.1) **G2**: 246 (28.7) **G3**: 945 (88.4) **Type of labor** NR **Type of anesthesia** NR **Fetal weight** NR

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Thrombosis, N (%) **G1**: 4 (0.6) **G2**: 9 (1.0) **G3**: 3 (0.3) Total 16 (1.5) **Thrombophlebitis, N (%)** **G1**: 8 (1.1) **G2**: 16 (1.8) **G3**: 41 (3.8) Total: 65 (2.5) **Pneumonia, N (%)** **G1**: NR **G2**: 5 (0.6) **G3**: 4 (0.4) Total: 9 (0.3) **Fever, N (%)** **G1**: 113 (15.7) *P* < 0.001 **G2**: 217 (25.3) **G3**: 322 (30.1) Total: 652 (24.6) **Coagulation disorders, N (%)** **G1**: NR **G2**: 1 (0.1) **G3**: NR Total: 1 (0.1) **Ileus, N (%)** **G1**: 8 (1.1) **G2**: 18 (1.9) **G3**: 14 (1.2) Total: 40 (1.5) **Other post-op major complications, N (%)** Major **G1**: 1 (0.2) **G2**: 4 (0.5) **G3**: NR Total: 5 (0.2) Minor **G1**: 14 (1.9) **G2**: 19 (2.2) **G3**: 23 (2.1) Total: 56 (2.1)	**Maternal death** **G1**: NR **G2**: NR **G3**: NR Total: 3/2,647 **Intra-operative complications, N (%)** **G1**: 65 (9.1) *P* < 0.001 **G2**: 77 (9.0) **G3**: 250 (23.4) *P* < 0.001 Total: 392/2,647 (14.8) **Uterine laceration, N (%)** **G1**: 43 (6.0) **G2**: 47 (5.5) **G3**: 176 (6.5) *P* < 0.001 Total: 226 (10.1) **Bladder lesion, N (%)** **G1**: 9 (1.3) **G2**: 3 (0.4) **G3**: 10 (0.9) Total: 22 (0.8) **Lesions of uterine arteries/ ligamentum latum/bowels, N (%)** **G1**: 3 (0.4) **G2**: 5 (0.6) **G3**: 6 (0.6) Total: 14 (0.5) **Cervical vaginal lesions, N (%)** **G1**: NR **G2**: 2 (0.2) **G3**: 6 (0.6) Total 8 (0.3) **Bladder paralysis, N (%)** **G1**: 8 (1.1) **G2**: 5 (0.6) **G3**: 10 (0.1) Total: 23 (0.9)	**Relevance** Moderate **Quality rating** Poor

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author van Ham, van Dongen, and Mulder, 1997 (continued)		**Other indications to c/d** Ruptured Membranes, N (%) **G1**: NR **G2**: 135 (15.7) Sig diff at *P* < 0.00 **G3**: 889 (93.0) < 12 h **G1**: NR **G2**: 63 (7.3) **G3**: 542 (50.6) 12 to 24 h **G1**: NR **G2**: 26 (3.0) **G3**: 261 (24.4) > 24 h **G1**: NR **G2**: 46 (5.4) **G3**: 86 (8) **Mode of delivery, N (%)** **G1**: 100% **G2**: 100% **G3**: 100% **Disproportion, N (%)** **G1**: 303 (42.2) *P* < 0.001 **G2**: 70 (8.1) **G3**: 200 (18.7) Total 573 (21.6) **Obstructed labor, N (%)** **G1**: NR **G2**: NR **G3**: 453 (42.3) Total: 453 (17.1) **Fetal distress, N (%)** **G1**: NR **G2**: 260 (30.3) *P* < 0.001) **G3**: 178 (16.6) Total: 438 (16.5) **Resident, N (%)** **G1**: 464 (65) **G2**: 518 (60) **G3**: 654 (61) **Obstetrician, N (%)** **G1**: 254 (35) **G2**: 341 (40) **G3**: 416 (39)

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Other intraoperative complications, N (%) **G1**: 10 (1.4) **G2**: 18 (2.1) **G3**: 23 (2.2) Total: 51 (1.9)		
Post-operative stay in hospital, days ± SD **G1**: 7.2 ± 2.1 **G2**: 78 ± 3.1 **G3**: 7.6 ± 1.9		
Relapocrotomy, N (%) **G1**: 6 (0.8) **G2**: 29 (3.4) **G3**: 8 (0.8) Total: 43 (1.6)		
Sepsis, N (%) **G1**: NR **G2**: 5 (0.6) **G3**: 2 (0.2) Total: 7 (0.3)		
Wound infection, N (%) **G1**: 7 (1.0) **G2**: 15 (1.7) **G3**: 30 (2.8) Total: 52 (2.0)		
Pelvic infection, N (%) **G1**: 4 (0.6) **G2**: 1 (0.1) **G3**: 11 (1.0) Total: 16 (1.5)		
Endometritis, N (%) **G1**: 9 (1.3) **G2**: 4 (0.5) **G3**: 17 (1.6) Total: 30 (1.1)		
UTI, N (%) **G1**: 18 (2.5) **G2**: 29 (3.4) **G3**: 33 (3.1) Total: 80 (3.0)		
Haematoma, N (%) **G1**: 19 (2.6) **G2**: 48 (5.6) **G3**: 26 (2.4) Total: 93 (3.5)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author van Ham, van Dongen, and Mulder, 1997 (continued)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratingss
Blood loss, N (%) Intraoperative **G1**: 34 (4.7) *P* < 0.001 **G2**: 67 (7.8) **G3**: 93 (8.7) Total: 194 (7.3) Post-operational ≥ 1500 ml **G1**: 11 (1.5) **G2**: 25 (2.9) **G3**: 28 (2.6) Total: 64 (2.4) Post-operational 1000 to 1500 ml **G1**: 20 (2.8) **G2**: 32 (3.7) **G3**: 53 (4.9) Total: 105 (4.0)		
Post-operation complications N (%) Summary of major/minor **G1**: 189 (26.3) *P* < 0.001 **G2**: 311 (36.2) **G3**: 446 (41.7) Total: 946 (35.7) Major **G1**: 19 (2.6) *P* < 0.001 vs emergency (G2 + G3) **G2**: 55 (6.4) **G3**: 46 (4.3) Total: 120 (4.5) Minor **G1**: 170 (23.7) *P* < 0.001 vs emergency (G2 + G3) **G2**: 256 (29.8) **G3**: 400 (37.4) Total: 826 (31.2)		

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Wilson, Herbison, and Herbison, 1996 **Setting** New Zealand, hospital-based **Study design** Retrospective cohort **Inclusion criteria** • All women 3 months PP • Delivered in Queen Mary Maternity Centre • Resident in Dunedin area **Exclusion criteria** • NR **Groups** **G1**: Spontaneous vertex **G2**: Forceps **G3**: Elective c/d **G4**: C/d in 1st stage of labor **G5**: C/d in 2nd stage of labor **N** **G1**: 1104 **G2**: 190 **G3**: 87 **G4**: 94 **G5**: 31	**Objective of the study** To examine the relation between obstetric factors and the prevalence of urinary incontinence three months after delivery **Definition of elective cesarean** Unclear whether elective c/d includes labored births since referent groups include c/d in labor All groups include: • Repeat • Breech • Multiple gestation	**Maternal age, mean yrs** Overall: 27.8 **Maternal BMI, mean** Overall: 22.7 **Parity for all women, N (%)** 1 180/607 (29.7) 2 188/498 (37.8) 3 98/256 (38.3) 4 28/80 (35.0) ≥ 5 15/31 (48.4) **N of previous cesareans** NR **Diabetes** NR **Mean gestational age** 39.6 **Spontaneous onset of labor (%)** Overall: 79.3 **Type of anesthesia** NR **Fetal birthweight, mean gms** Overall: 3432

Evidence Table 1. Maternal outcomes of cesarean delivery on maternal request (continued)

Short Term Maternal Outcomes	Long term Maternal Outcomes	Relevance and Quality Ratings
Urinary incontinence, all women at 3 mo PP, N (%) **G1**: 400/1104 (36.2) **G2**: 67/190 (35.3) **G3**: 20/87 (23.0) **G4**: 22/94 (23.4) **G5**: 8/31 (25.8) **Urinary incontinence, women with no previous incontinence, N (%)** **G1**: 112/459 (24.4) **G2**: 27/100 (27) **G3**: 4/45 (8.9) **G4**: 6150 (12.0) **G5**: 1/13 (7.7) **OR for urinary incontinence, all women with no previous incontinence** **G1**: 1.00 **G2**: 1.3 (0.8-2.3) **G3**: 0.3 (0.1-0.6) **G4**: NR **G5**: NR **Urinary incontinence, only primiparae, N (%)** **G1**: 115/356 (32.3) **G2**: 48/145 (33.1) **G3**: 3/22 (13.6) **G4**: 11/61 (18.0) **G5**: 4/24 (16.7) **Urinary incontinence, only primiparae with no previous incontinence, N (%)** **G1**: 49/200 (24.5) OR: 1.00 **G2**: 22/87 (25.2) OR: 1.0 (0.5-1.9) **G3**: 0/13 (0.0) OR: 0.2 (0.0-0.6) **G4**: 2/33 (6.1) OR: NR **G5**: 1/12 (8.3) OR: NR	NR	**Relevance** Low **Quality Rating** Not rated

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Badawi et al., 1998 **Setting** Australia, population-based **Study design** Case-control **Inclusion criteria** • Term (≥ 37 ws) infants born in metro Perth 6/93 to 9/95 • Cases: moderate/severe newborn encephalopathy defined by seizures alone OR any 2 of the following lasting for > 2 hrs: abnormal consciousness, difficulty maintaining respiration (of presumed central origin), difficulty feeding (of presumed central origin), abnormal tone and reflexes within the 1st week of life • Controls: randomly selected for population of term births in Perth, same time period **Exclusion criteria** • Down's syndrome • Open neural tube defects **Groups** **G1**: Infants of moderate or severe newborn encephalopathy **G2**: Randomly selected control **N at enrollment** **G1**: 164 **G2**: 400	**Objective of the study** To identify intrapartum predictors of newborn encephalopathy in term infants **Definition of elective cesarean** "Planned at least 24 hrs before procedure," probably includes labored, number NR Indications include: • Previous cesarean delivery • Malpresentation • Previous difficult labor • Intrauterine growth retardation • Placenta previa • Other	**Maternal age median yrs** NR **Maternal BMI** NR **Gravidity** NR **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor, N (%)** Spontaneous **G1**: 90 (54.9) **G2**: 220 (55.0) Unadjusted OR: 1 Adjusted OR: 1 Induced **G1**: 68 (41.5) **G2**: 122 (30.5) Unadjusted OR: 1.36 Adjusted OR: 0.97 (0.57-1.68) None **G1**: 6 (3.7) **G2**: 58 (14.5) Unadjusted OR 0.25 Adjusted OR: 0.17 (0.06-0.49) **Type of anesthesia, N (%)** General anesthesia **G1**: 18/164 (11.0) **G2**: 11/400 (2.8) Unadjusted OR: 4.40 Adjusted OR: 3.08 1.16, 8.17) Epidural **G1**: 19/164 (11.6) **G2**: 69/400 (17.2) Unadjusted OR: 0.64 Adjusted OR: 0.51 (0.26, 1.02) **Fetal weight** NR

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and Quality Ratings
Newborn encephalopathy, N (%) SVD **G1**: 49 (29.9) **G2**: 261 (40.3) Unadjusted OR: 1.0 (reference category) Adjusted OR: 1.0 (reference category) Induced VD **G1**: 32 (19.5) **G2**: 80 (20) Unadjusted OR: 1.31 Adjusted OR: 1.0 (0.55, 2.18) Instrumental VD **G1**: 42 (25.6) **G2**: 62 (15.5) Unadjusted OR: 2.23 Adjusted OR: 2.34 (1.16, 4.70) Elective c/d **G1**: 4 (2.4) **G2**: 58 (14.5) Unadjusted OR: 0.23 Adjusted OR: 0.17 (0.05, 0.56) Emergency c/d **G1**: 34 (20.7) **G2**: 38 (9.5) Unadjusted OR: 2.94 Adjusted OR: 2.17 (1.01, 4.64) Breech maneuver **G1**: 3 (1.8) **G2**: 1 (0.3) Unadjusted OR: 9.86 Adjusted OR: 1.54 (0.10, 25.14)	NR	**Relevance** Moderate **Quality rating** Fair

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Badawi et al., 1998 (continued)		**Risk factors in newborn encephalopathy, N (%)** Occiptoposterior presentation **G1**: 17/164 (10.4) **G2**: 15/400 (3.8) Unadjusted OR: 2.97 Adjusted OR: 4.29 (1.74-10.54) Membrane rupture to delivery interval > 12 hrs **G1**: 32/164 (19.5) **G2**: 53/400 (13.2) Unadjusted OR: 1.59 Adjusted OR: 1.31 (0.69, 2.47) Cord prolapse **G1**: 1/164 (0.6) **G2**: 1/400 (0.2) Unadjusted OR: 2.45 Adjusted OR: 4.71 (0.21-105.02) Maternal pyrexia ≥ 37.5 **G1**: 18/164 (11.0) **G2**: 9/400 (2.2) Unadjusted OR: 5.34 Adjusted OR: 3.82 (1.44, 10.12)

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and Quality Ratings

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Dani et al., 1999 **Setting** Italy, community-based **Study design** Case-control **Inclusion criteria** • Infant born between 2/1/95-1/31/98 in one of 65 hospitals included (Italy) (level II or III nursery) • TT or RDS diagnosed **Exclusion criteria** • Total pneumonia or not having TT or RDS **Groups** **G1**:Vaginal **G2**: Operative vaginal **G3:** Elective c/d **G4:** Emergent c/d **N** **G1**: 43,941 **G2**: 1,621 **G3:** 11,021 **G4:** 1,351	**Objective of the study** To investigate maternal and perinatal risk factors for RDS and TT in newborn infants. **Definition of elective cesarean** Includes labored births. Category not defined, but may include • Twins • Unspecified "maternal diseases" • Gestosis • Placenta previa • Placental abruption • IUGR • PROM • Preconceptional diabetes • Isoimmunization	**Maternal age** < 32 yrs Overall: 40,152 ≥32 yrs Overall: 22,556 **Maternal BMI** NR **Gravidity** First 28,066 Second 20,335 Third 7,230 Fourth 2,395 Fifth or more 1,351 **N of previous cesareans** NR **Diabetes** NR **Gestational age, mean wks** < 36 Overall: 3,407 36-42 wks Overall: 59,990 > 42 wks NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight, mean gms** < 1500 Overall: 1,036 1500-2499 Overall: 3,864 > 2500 Overall: 58,224 **Maternal disease** Not abstractable

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and Quality Ratings
RDS **G1**: 215/43,941 **G2**: 1/1621 **G3:** 158/11,021 **G4:** 360/1,351 OR for **G3** vs **G1**: 1.88 (1.42-2.48) *P* < 0.0001 OR for **G4** vs **G1**: 3.46 (2.69-4.44) *P* < 0.0001 **TTN** **G1**: 226/43,941 **G2**: 13/1,621 **G3**: 157/11,021 **G4**: 198/1,351 OR for **G3** vs **G1**: 1.86 (1.48-2.33) *P* < 0.0001 OR for **G4** vs **G1**: 2.86 (2.25-3.63) *P* < 0.0001	NR	**Relevance** Low **Quality Rating** Not rated

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Dessole et al., 2004 **Setting** Italy, hospital-based **Study design** Retrospective cohort **Inclusion criteria** • All c/d at institution from Jan 1995–Dec 2002 **Exclusion criteria** • None **Groups** **G1**: Emergency c/d **G2**: Scheduled c/d **G3**: Unscheduled c/d **N** **G1**: 1421 **G2**: 1242 **G3**: 445	**Objective of the study** To investigate the incidence, type, location, and risk factors of accidental fetal lacerations during cesarean delivery **Definition of elective cesarean** Includes labored births, number NR Category includes: • Repeat, macrosomia, placenta previa (32%) • Multiple gestation (51%) • Fetal anomalous presentation (17%)	**Maternal age** NR **Maternal BMI** NR **Gravidity** NR **N of previous cesareans** NR **Diabetes** NR **Gestational age, mean yrs (range)** Overall: 38.7, 29-42 **Type of labor** NR **Type of anesthesia** NR **Fetal weight, gms (range)** Overall: 3033.8, 825-4350

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and Quality Ratings
Mild laceration **G1:** 73/1421 **G2:** 13/1242 **G3:** 8/445 **Moderate laceration** **G1:** 2/1421 **G2:** 0/1242 **G3:** 0/445 **Severe laceration** **G1:** 1/1421 **G2:** 0/1242 **G3:** 0/445 **Total lacerations** **G1:** 76/1421 OR: 1.7, compared to all fetal laceration/all cesarean deliveries **G2:** 13/1242 OR: 0.34, compared to all fetal laceration/all cesarean deliveries **G3:** 8/445 OR: 0.57, compared to all fetal laceration/all cesarean deliveries *P* < 0.001	NR	**Relevance** Moderate **Quality Rating** Fair

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Durik, Hyde, and Clark, 2000 **Setting** US, hospital-based **Study design** Prospective cohort **Inclusion criteria** • ≥ 18 yrs • Between 12 and 21 wks gestation • Living with partner although not necessarily married • Working/having working partner • Possessing telephone • Able to speak English • Literate **Exclusion criteria** • Student • Unemployed **Groups** **G1**: Vaginal delivery **G2**: Planned cesarean **G3**: Unplanned cesarean **N at enrollment** **G1**: 477 **G2**: 37 **G3**: 56 Total: 96.1% % enrollment at 4 mos PP: 98.7%	**Objective of the study** To examine delivery related differences in relation to women's appraisal of their birth experience **Definition of elective cesarean** Undefined "planned" cesareans	**Maternal age, mean yrs ± SD** **G1**: 30.12 ± 4.47 **G2**: 30.54 ± 4.16 **G3**: 28.63 ± 4.12 **Education (on scale of 1, less than high school, to 8, graduate degree) ± SD** **G1**: 5.8 ± 1.54 **G2**: 5.0 ± 1.53 **G3**: 5.61 ± 1.03 **Maternal BMI** NR **Primiparous (%)** **G1**: 35 **G2**: 16 **G3**: 66 **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight, mean gms ± SD** **G1**: 3467 ± 465 **G2**: 3437 ± 604 **G3**: 3783 ± 532 **Self-esteem, Rosenberb's self-esteem scale ± SD** **G1**: 34.72 ± 4.86 **G2**: 34.81 ± 5.67 **G3**: 35.75 ± 3.23 **Depression CES-D Scale ± SD** **G1**: 8.46 ± 7.51 **G2**: 1.03 ± 7.44 **G3**: 6.88 ± 4.60 **Neuroticism measured by Eysende Personality Inventory Form A Score, ± SD** **G1**: 8.69 ± 5.40 **G2**: 9.97 ± 5.15 **G3**: 8.82 ± 5.12

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and Quality Ratings
NR	NR	**Relevance** Low **Quality Rating** Not rated

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Golfier et al., 2001 **Setting** Western Europe, France Hospital-based **Study design** Retrospective cohort **Inclusion criteria** • 37-42 wks • Breech, singleton **Exclusion criteria** • Maternal or fetal pathology that could have affected the state of the mother or child at birth **Groups** **G1**: Planned vaginal **G2**: Elective c/d **Actual mode of delivery** **G1**: 342/414 delivered vaginally **G2**: 695/702 delivered by c/d **N** **G1**: 414 **G2**: 702	**Objective of the study** To compare neonatal and maternal morbidity and mortality between planned vaginal delivery and elective cesarean delivery for term breech presentation **Definition of elective cesarean** Probably includes labored births, number NR All groups include: • Breech	**Mean maternal age, mean yrs** Overall: 29 **Maternal BMI** NR **Primiparous, %** **G1**: 54 **G2**: 68 *P* = 0.05 **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Anesthesia, %** General **G1**: 5.8 **G2**: 23.5 Regional **G1**: 57.7 **G2**: 76.5 No anesthesia **G1**: 36.5 **G2**: 0 **Birth weight, mean gms** **G1**: 3164 **G2**: 3206 *P* > 0.05 **Macrosomia, > 4000 gms** **G1**: NR **G2**: NR RR = 3.09 (1.46-6.5) Higher in elective c/d group **Episiotomy, %** **G1**: 83 **G2**: NR

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and Quality Ratings
NA	NA	**Relevance** Low **Quality Rating** Not rated

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Groutz et al., 2003 **Country, Setting** Israel, hospital-based **Study design** Prospective cohort **Inclusion criteria** • Primiparous • Delivery at Lis Maternity Hospital **Exclusion criteria** • Nonsingleton deliveries • Instrumental vaginal delivery • Those with SUI before pregnancy **Groups** **G1**: Spontaneous vaginal delivery **G2**: Obstructed Labor cesarean delivery **G3**: Elective cesarean delivery **N at enrollment** **G1**: 145 **G2**: 100 **G3**: 118 **Follow-up** 1 year **G1**: 145 **G2**: 100 **G3**: 118	**Objective of the study** To compare prevalence of stress urinary incontinence by mode of delivery **Definition of elective cesarean** No trial of labor Category includes: • Breech (70%) • Other indications not specified	**Maternal age, mean yrs ± SD** **G1**: 28 ± 4 **G2**: 32.5 ± 5.3 **G3**: 31.7 ± 5.2 **Maternal height, mean cm ± SD** **G1**: 164 ± 6.6 **G2**: 162 ± 5.6 **G3**: 164 ± 6.7 **Maternal weight, mean kg ± SD** G1: 60 ± 9.0 **G2**: 62.5 ± 1.6 **G3**: 63 ± 13.0 **Parity, %** Primiparous: 100% **N of previous cesareans** NR **Diabetes** NR **Gestational age, wks ± SD** **G1**: 39.7 ± 1.2 **G2**: 40.2 ± 1.3 **G3**: 38.8 ± 1.5 **Type of labor** NR **Type of anesthesia Epidural** **G1**: 134/145 **G2**: NR **G3**: NR **Fetal weight, mean ± SD** **G1**: 325 ± 400 **G2**: 3450 ± 420 **G3**: 3260 ± 617 *P* < 0.05 **SUI during Pregnancy, N (%)** **G1**: 45 (31) **G2**: 25 (25) **G3**: 33 (28)

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and Quality Ratings
Apgar at 1 minute, N ± SD **G1**: 8.9 ± 0.45 **G2**: 9.0 ± 0.14 **G3**: 9.0 ± 0.06 **Apgar at 5 minutes, N ± SD** **G1**: 9.97 ± 0.2 **G2**: 9.98 ± 0.14 **G3**: 10.0 ± 0	NR	**Relevance** Moderate **Quality rating** Fair

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Levine et al., 2001 **Setting** US, hospital-based **Study design** Retrospective cohort **Inclusion criteria** • Consecutive deliveries at the Illinois Masonic Medical Center between 1/1992 and 12/1999 • Singleton, live newborns **Exclusion criteria** • Pre-term (≤ 35 wks) • Congenital heart disease • Congenital diaphragmatic hernia • Meconium aspiration **Groups** **G1**: Vaginal deliveries **G2**: All c/d • **G2a**: Elective c/d **N at enrollment** **G1**: 21,017 **G2**: 4,301 **G3**: 1889	**Objective of the study** To determine whether there is an increased incidence of persistent pulmonary hypertension in neonates delivered by cesarean, with or without labor, compared with those delivered vaginally **Definition of elective cesarean** Does not include labored births Category includes: • Breech • Placenta previa • Genital herpes • Macrosomia • Multiple gestation • Prior cesareans	**Maternal age** NR **Maternal BMI** NR **Gravidity** NR **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight** NR

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and Quality Ratings
Persistent pulmonary hypertension, N (%) **G1**: 17 (0.08) **G2**: 17 (0.40) *P* < 0.001 OR 4.9 (2.2-8.8) C/d vs. vaginal • **G2a**: 7 (0.37) *P* < 0.01 OR 4.6 (1.3-11) Elective vs. vaginal **TTN, N (%)** **G1**: 238 (1.1) **G2**: 151 (3.5) *P* < 0.001 OR 3.3 (2.6-3.9) C/d vs. vaginal • **G2a**: 59 (3.1) *P* < 0.001 OR: 2.8 (2.1-3.8) Elective vs. vaginal **RDS, N (%)** **G1**: 33 (0.16) **G2**: 20 (0.47) *P* < 0.001 OR 3.0 (1.6-5.3) C/d vs. vaginal **G3**: 4 (0.2) *P* < 0.18 OR 1.3 (0.5-3.8) Elective vs. vaginal	NR	**Relevance** Moderate **Quality rating** Fair

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Morrison, Rennie, and Milton, 1995 **Setting** UK, hospital-based **Study design** Retrospective cohort **Inclusion criteria** • Required admission to NICU at gest age ≥ 37 wks with RDS or TTN (Avery et al, 1966-grunting, nasal flaring, retraction, tachypnea, poor air entry, radiographic features of either TTN or reticulogranular pattern of RDS) • Only those planned to be delivered at the teaching hosp included • Required oxygen **Exclusion criteria** • Evidence of infection including meconium aspiration or pneumonia **Groups** **G1**: Vaginal **G2**: Prelabor c/d **G3**: C/d in labor **N** **G1**: 28578 **G2**: 2341 **G3**: 2370	**Objective of the study** To establish whether the timing of delivery between 37 and 42 weeks gestation influences neonatal respiratory outcome and thus provide information which can be used to aid planning of elective delivery at term **Definition of elective cesarean** Does not include ”labored” births (defined as regular contractions and effacement plus dilation ≥ 3cm) Category includes: • Repeat • Breech • Uncomplicated previa • Other malpresentation • Suspected CPD • Chorioamnionitis • Rhesus sensitization • IUGR • Preeclampsia • Fetal distress	**Maternal age** NR **Maternal BMI** NR **Gravidity/parity** NR **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight** NR

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and Quality Ratings
TTN **G1**: 118/28578 **G2**: 53/2341 **G3**: 20/2370 **RDS** **G1**: 32/28578 **G2**: 30/2341 **G3**: 9/2370 **Respiratory morbidity (RDS+TTN), N (range)** **G1**: 5.3/1000 (4.4-6.2) OR: 1.0 **G2**: 35.5/1000 (28.4-43.8) OR: 6.8 (5.2-8.9) **G3**: 12.2/1000 (8.2-17.5) OR: 2.3 (1.6-3.5)	NR	**Relevance** Moderate **Quality rating** Fair

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Rubaltelli et al., 1998 **Setting** Italy, population-based **Study design** Prospective cohort **Inclusion criteria** • All live infants born in selected hospitals including neonates who died in maternity wards before their transfer to a neonatal unit, in a 3 month survey of 65 hospitals in 17 regions • Births from Feb 1 to April 30, 1995 **Exclusion criteria** • None **Groups** **G1**: Vaginal • **G1a**: Forceps **G2**: Elective c/d **G3**: Emergency c/d **N** **G1**: 12,463 • **G1a**: NR **G2**: 2,984 **G3**: 1,569	**Objective of the study** To evaluate the incidence of neonatal respiratory disorders and their risk factors **Definition of elective cesarean** Undefined	**Maternal age** NR **Maternal BMI** NR **Gravidity** NR **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight** NR

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and Quality Ratings
TTN (%) **G1**: NR • **G1a**: 3.8 **G2**: 1.5 (*P* < 0.0001 compared to vaginal) **G3**: 4.2	NR	**Relevance** Low **Quality Rating** Not rated

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Schindl et al., 2003 **Setting** Austria, hospital-based **Study design** Prospective cohort **Inclusion criteria** • Gestation week 38 **Exclusion criteria** • < 19 yrs • Inability to complete questionnaire • Unwillingness to participate • Severe internal problems (e.g., HELLP syndrome) **Groups** **G1**: Intended vaginal delivery **G2**: Elective c/d • **G2a**: Elective c/d (medical reasons) • **G2b**: Elective c/d ("on demand") **N at enrollment** **G1**: 903 **G2**: 147 • **G2a**: 103 • **G2b**: 44 **Follow-up** 3 days PP NR 4 mos PP 23.9% response rate	**Objective of the study** To investigate birth experience and medical outcome in women with elective cesarean delivery compared with intended vaginal delivery **Definition of elective cesarean** Probably includes labor, number NR Elective c/d on demand includes: • Anxiety, nulliparae (16/44) • Previous traumatic birth (20/44) • Other (coordination problems, safety considerations) (8/44) Elective c/d for medical indications includes: • Breech (40/103) • Twins (7/103) • Preeclampsia (6/103) • CS interval < 15 mos (19/103) • Cephalopelvic disproportion (4/103) • HIV and hepatitis C (5/103) • Neurological problems (e.g., epilepsy) (10/103) • Internal problems (e.g., heart failure) (9/103) • Others (e.g., pelvic failure) (3/103)	**Maternal age, mean yrs (range)** **G1**: 28 (15-43) **G2a**: 32 (20-44) **G2b**: 30 17-44) *P* < 0.05 **Maternal BMI** NR **N of previous births mean (range)** **G1**: 0 (0-9) **G2a**: 1 (0-5) **G2b**: 0 (0-3) **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight** NR **Other** NR

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and Quality Ratings
Paresis of recurrens nerve, N (%) **G1**: 1/903 (0.1) **G2**: 0 **Respiratory adaptation problems, N (%)** **G1**: 0 **G2**: 1/147 (0.7)	NR	**Relevance** Moderate **Quality rating** Fair

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Sutton et al., 2001 **Setting** New South Wales (NSW), Australia, population-based study **Study design** Case-control **Inclusion criteria** Cases • Singleton infants ≥ 37 gestational age born between 1/1/1996 and 12/31/1996 • Mothers resident in the area • Require mechanical ventilation for at least 4 hrs • Admitted to tertiary NICU in NSW with the first 96 hrs of life • Controls • Randomly and independently selected **Exclusion criteria** Cases • No major congenital anomaly • Controls • No mechanical ventilation • No admission to tertiary NICU **Groups** **G1**:Neonates requiring mechanical ventilation **G2**: Neonates not requiring mechanical ventilation **N** **G1**: 99 **G2**: 550	**Objective of the study** To ascertain antenatal and intrapartum risk factors for term neonates ventilated primarily for respiratory problems. And describe the neonatal morbidity and mortality **Definition of elective cesarean** Does not include labored births, but probably include mix of planned and unplanned, defined as “cesarean delivery before labor has commenced”	**Maternal age, ≥ 35 yrs (%)** **G1**: 24/99 (24.2) **G2**: 84/550 (15.3) **Maternal BMI** NR **Primagravida, N (%)** **G1**: 54/99 (54.6) **G2**: 230/550 (41.8) **N of previous cesareans** NR **Insulin dependent diabetes, N (%)** **G1**:2/99 (2.0) **G2**: 0/550 **Gestational diabetes, N (%)** **G1**:9/99 (9.1) **G2**: 18/550 (3.3) **Gestational age, N of those at 37-38 wks (%)** **G1**:38/99 (38.4) **G2**: 123/550 (22.4) **Type of labor** NR **Type of anesthesia** NR **Birth weight, N (%)** < 3rd percentile **G1**: 8/99 (8.1) **G2**: 13/550 (24) > 90th percentile **G1**: 20/99 (20.2) **G2**: 64/550 (11.6) **Maternal pyrexia, N (%)** **G1**: 4/99 (4.0) **G2**: 4/550 (0.73)

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and Quality Ratings
Ventilation for mainly respiratory causes (controlling for maternal age, maternal pyrexia, gestational age 37-38 wks, birth weight < 3rd percentile) OR for elective c/d vs. vaginal: 2.64 (1.42, 4.90) OR for emergency c/d vs. vaginal: 4.07 (2.13, 7.78) OR for forceps delivery vs. vaginal: 4.47 (2.11, 9.44)	NR	**Relevance** Low **Quality Rating** Not rated

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Towner et al., 1999 **Setting** US, population based **Study design** Cross-deliveryal **Inclusion criteria** • All liveborn singleton neonates born to nulliparous women • Jan 1 1992 to Dec 31 1994 • Birthweight 2500g to 4000g **Exclusion criteria** • Vaginal breech **Groups** **G1**: Spontaneous vaginal **G2**: Vacuum extraction **G3**: Forceps **G4:** Forceps and vacuum **G5:** Cesarean delivery • **G5a**: Labored cesareans • **G5b**: Labored c/d with attempt at vacuum or forceps • **G5c**: Labored c/d, no attempt at vacuum or forceps • **G5d**: Unlabored cesareans **N** **G1**: 387,799 **G2**: 59,354 **G3**: 15,945 **G4**: 2817 **G5:** 117,425 • **G5a**: 84,417 • **G5b**: 2,343 • **G5c:** 82,075 • **G5d**: 33,008	**Objective of the study** To determine the incidence of rare neonatal disorders and their association with various modes of delivery, particularly vacuum extraction **Definition of elective cesarean** "Cesarean before labor," probably includes a mix of planned and unplanned	**Maternal age** NR **Maternal BMI** NR **Gravidity** NR **N of previous cesareans** NR **Diabetes** NR **Gestational age** NR **Type of labor** NR **Type of anesthesia** NR **Fetal weight** NR

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and Quality Ratings
Death before discharge (per 1,000 deliveries) **G1**: 0.2 **G2**: 0.3 OR: 1.5 (0.8-2.8) **G3**: 0.5 OR: 1.9 (0.6-5.4) **G4**: 0.6 OR: 2.6 (0.4-5.4) **G5**: 0.8 OR: 3.7 (2.6-5.4) • **G5a**: NR • **G5b**: NR • **G5c**: NR • **G5d**: 0.8, OR NR, but "no difference between infants born by cesarean delivery during labor and those born by cesarean delivery with no labor"	NR	**Relevance** Low **Quality Rating** Not rated
Subdural or cerebral hemorrhage (per 10,000 deliveries) **G1**: 2.9 **G2**: 8 OR: 2.7 (1.9–3.9) **G3**: 9.8 OR: 3.4 (1.9–5.9) **G4**: 21.3 OR: 7.3 (2.9–17.2) **G5**: 6.7 OR: 2.3 (1.7–3.1) • **G5a**: 7.4 OR: 2.5 (1.8–3.4) • **G5b**: 25.7 OR: 8.8 (3.9–19.9) • **G5c**: 6.8 OR: 2.3 (1.7–3.2) • **G5d**: 4.1 OR: 1.4 (0.8–2.6)		
Intraventricular hemorrhage (per 10,000 deliveries) **G1**: 1.1 **G2**: 1.5 OR: 1.4 (0.7–3.0) **G3**: 2.6 OR: 2.5 (0.9–6.9) **G4**: 3.7 OR: 3.5 (1.5–25.2) **G5**: 2.1 OR: 2 (1.2–3.3) • **G5a**: 2.5 OR: 2.3 (1.4–4.0) • **G5b**: 0 OR: 0 (0.0–1.1) • **G5c**: 2.6 OR: 2.4 (1.4–4.1) • **G5d**: 0.8 OR: 0.6 (0.1–2.5)		
Subarachnoid hemorrhage (per 10,000 deliveries) **G1**: 1.3 **G2**: 2.2 OR: 1.7 (0.9–3.2) **G3**: 3.3 OR: 2.5 (0.9–6.6) **G4**: 10.7 OR: 8.2 (2.1–27.4) **G5**: 0.9 OR: 0.7 (0.4–1.4) • **G5a**: 1.2 OR: 0.9 (0.4–1.9) • **G5b**: 4.3 OR: 3.3 (0.5–23.9) • **G5c**: 1.1 OR: 0.9 (0.4–1.7) • **G5d**: 0 OR: 0 (0.0–19.7)		

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Towner et al., 1999 (continued)		

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and Quality Ratings
Facial nerve injury (per 10,000 deliveries) **G1**: 3.3 **G2**: 4.6 OR: 1.7 (0.9–2.1) **G3**: 45.4 OR: 13.6 (10.0–18.4) **G4**: 28.5 OR: 8.5 (3.9–18.0) **G5**: 3.5 OR: 1.1 (0.7–1.5) • **G5a**: 3.1 OR: 0.9 (0.6–1.4) • **G5b**: 12.8 OR: 3.8 (1.2–12.1) • **G5c**: 2.8 OR: 0.8 (0.5–1.3) • **G5d**: 4.9 OR: 1.5 (0.8–2.6)		
Brachial plexus (per 10,000 deliveries) **G1**: 7.7 **G2**: 17.6 OR: 2.3 (1.8–2.9) **G3**: 25 OR: 3.2 (2.3–4.6) **G4**: 46.4 OR: 6 (3.3–10.7) **G5**: 3 OR: 0.4 (0.3–0.5) • **G5a**: 1.8 OR: 0.2 (0.1–0.4) • **G5b**: 8.6 OR: 1.1 (0.3–4.4) • **G5c**: 1.6 OR: 0.2 (0.1–0.4) • **G5d**: 4.1 OR: 0.5 (0.3–1.0)		
Convulsions (per 10,000 deliveries) **G1**: 6.4 **G2**: 11.7 OR: 1.8 (1.4–2.4) **G3**: 9.8 OR: 1.6 (0.9–2.7) **G4**: 24.9 OR: 3.9 (1.7–8.6) **G5**: 18.7 OR: 2.9 (2.4–3.6) • **G5a**: 21.3 OR: 3.3 (2.8–4.1) • **G5b**: 68.8 OR: 10.8 (6.5–17.8) • **G5c**: 19.9 OR: 3.1 (2.6–3.8) • **G5d**: 8.6 OR: 1.4 (0.9–2.1)		
CNS depression (per 10,000 deliveries) **G1**: 3.1 **G2**: 9.2 OR: 2.9 (2.1–4.1) **G3**: 5.2 OR: 1.4 (0.6–2.8) **G4**: 21.3 OR: 6.9 (2.7–16.2) **G5**: 8.9 OR: 2.9 (2.2–3.7) • **G5a**: 9.6 OR: 3.1 (2.3–4.1) • **G5b**: 17.1 OR: 5.5 (1.7–15.5) • **G5c**: 9.4 OR: 3 (2.3–4.0) • **G5d**: 6.7 OR: 2.2 (1.3–3.6)		

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Towner et al., 1999 (continued)		

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and Quality Ratings
Feeding difficulty (per 10,000 deliveries) **G1**: 68.5 **G2**: 72.1 OR: 1.1 (1.0–1.2) **G3**: 74.6 OR: 1.1 (0.9–1.3) **G4**: 60.7 OR: 0.9 (0.5–1.5) **G5**: 114.7 OR: 1.7 (1.6–1.8) • **G5a**: 117.2 OR: 1.7 (1.6–1.8) • **G5b**: 94.8 OR: 1.4 (0.9–2.1) • **G5c**: 117.9 OR: 1.7 (1.6–1.8) • **G5d**: 106.3 OR: 1.6 (1.4–1.8)		
Mechanical ventilation (per 10,000 deliveries) **G1**: 25.8 **G2**: 39.1 OR: 1.5 (1.3–1.8) **G3**: 45.4 OR: 1.8 (1.4–2.3) **G4**: 50 OR: 1.9 (1.1–3.4) **G5**: 96 OR: 3.7 (3.4–4.1) • **G5a**: 103.2 OR: 4 (3.6–4.3) • **G5b**: 156.1 OR: 6 (4.3–8.3) • **G5c**: 101.7 OR: 2.6 (2.2–3.0) • **G5d**: 71.3 OR: 2.8 (2.4–3.3)		

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Zanardo, Simbi, Franzoi, et al., 2004 **Setting** Italy, hospital-based **Study design** Case control **Inclusion criteria** • 37 0/7 to 41 6/7 weeks (LMP ± U/S) • No conditions that could increase neonatal risk **Exclusion criteria** • Acute or chronic maternal disease: hypertension, renal disease, cardiac disease, infectious disease, "etc." • Pregnancy induced hypertension, hydramnios, gestational diabetes, etc. • Fetal abnormalities, malformations, fetal distress, potential fetal asphyxia or fetal growth retardation **Groups** **G1**: Elective cesarean delivery **G2**: Vaginal delivery **N** **G1**: 1284/2361 **G2**: NR **Follow-up** NR	**Objective of the study** To determine the incidence of RDS and TTN in infants electively delivered by cesarean delivery at term, to correlate their incidence with the vaginal or cesarean mode of delivery, and to examine the risk during each week of gestation between 37 + 0 and 41 + 6 weeks **Definition of elective cesarean** Excludes labor, defined as regular contractions and effacement plus dilation≥ 3cm (Zanardo, Simbi, Franzoi et al 2004) Category includes: • Repeat (prior c/d) (51%) • Multiple gestation (twins) (8%) • Breech (25%) • Suspected CPD (5%) • Nulliparous and > 35 yrs (2%) • Fear of labor (1%) • Miscellaneous (other malpresentations, uncomplicated placenta previa, retinopathy and myopathies) (6%)	**Maternal age, mean yrs, mean yrs ± SD** **G1**: 30.9 ± 2.3 **G2**: 29.7 ± 2.5 **Maternal BMI** NR **Nulliparae (%)** **G1**: 42 **G2**: 51 **N of previous cesareans** NR **Diabetes** NR **Gestational age mean wks ± SD** **G1**: 38.8 ± 1.2 **G2**: 38.8 ± 1.6 **Type of labor** NR **Type of anesthesia** **G1**: Spinal for all elective **G2**: NR **Fetal weight, mean kg ± SD** **G1**: 3.16 ± 0.5 **G2**: 3.18 ± 0.6 **Fetal sex, male (%)** **G1**: 55 **G2**: 53

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and Quality Ratings
Neonatal mortality **G1**: 0/1,284 **G2**: 0/1,284 **Apgar** **≤ 5 at 1 min** **G1**: 21/1,284 **G1**: 13/1,284 **Respiratory distress syndrome** **G1**: 29/1,284 **G2**: 5/1,284 OR = 2.60 (1.35-5.90) *P* < 0.01 **Respiratory complications resuscitation-Phase II, N (%)** **G1**: 71 (5.5) **G2**: 44 (3.4) P < 0.01 **Transient tachypnea of the newborn** **G1**: 12/1,284 **G2**: 11/1,284 **Pneumonia** **G1**: 1/1,284 **G2**: 1/1,284 **Length of hospital stay, mean days ± SD** **G1**: 6 ± 0.9 **G2**: 4 ± 1.1 **NICU admission** **G1**: 17/1,284 **G2**: 8/1,284 OR = 2.14 (1.91-5.90) *P* < 0.01 **Mortality/Death** **G1**: 0 **G2**: 0	NR	**Relevance** Moderate **Quality rating** Fair

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request

Study characteristics	Objective and definitions	Labor and delivery characteristics
Author Zanardo, Simbi, Vedovato et al., 2004 **Setting** Italy, hospital **Study design** Case-control **Inclusion criteria** • Term pregnancies (37 to 42 wks), estimated by last menstrual period or sonogram, retaining women undergoing elective cesareans before labor for the elective group (i.e., when c/d was performed on clear maternal request) and matching vaginal deliveries **Exclusion criteria** • Excludes women with prenatally identified factors: not complicated by conditions that might increase risk to the neonates, including acute and chronic maternal illnesses, disorders of preg, fetal abnormalities, fetal distress, or potential fetal asphysia insult, and fetal growth retardation **Groups** **G1**: Elective cesarean **G2**: Vaginal delivery **N** **G1**: 1,284 **G2**: 1,284	**Objective of the study** To examine the association between timing of delivery between 37 and 42 weeks and neonatal resuscitation risk in elective c/d **Definition of elective cesarean** Excludes labor, defined as regular contractions and effacement plus dilation ≥ 3cm Cases includes: • Repeat c/d • Breech • Twin • Cephalopelvic disproportion • Fear of labor • Uncomplicated placenta previa • Retinopathy • Myopathies	**Maternal age, mean yrs ± SD** **G1**: 30.9 ± 2.3 **G2**: 29.7 ± 2.5 **Maternal BMI** NR **Nulliparae (%)** **G1**: 42 **G2**: 51 **N of previous cesareans** NR **Diabetes** NR **Gestational age, mean wks ± SD** **G1**: 38.8 ± 1.2 **G2**: 38.8 ± 1.6 **Type of labor** NR **Type of anesthesia** **G1**: Spinal for all elective **G2**: NR **Fetal weight, mean kg ± SD** **G1**: 3.16 ± 0.5 **G2**: 3.18 ± 0.6 **Fetal sex, male (%)** **G1**: 55 **G2**: 53

Evidence Table 2. Neonatal outcomes of cesarean delivery on maternal request (continued)

Short Term Neonatal Outcomes	Long Term Neonatal Outcomes	Relevance and QualityRating
Apgar ≤ 5 at 1 min **G1**: 21/1,284 **G2**: 13/1,284 ≤ at 5 min **G1**: 4/1,284 **G2**: 3/1,284 **PPV resuscitation** **G1**: 44/1,284 **G2**: 18/1,284 OR = 2.05 (1.25-5.67) *P* < 0.01 **Respiratory distress syndrome** **G1**: 29/1,284 **G2**: 5/1,284 OR = 2.60 (1.35-5.90) *P* < 0.01 **Transient tachypnea of the newborn** **G1**: 12/1,284 **G2**: 11/1,284 **Pneumonia** **G1**: 1/1,284 **G2**: 1/1,284 **Length of hospital stay, mean days ± SD** **G1**: 6 ± 0.9 **G2**: 4 ± 1.1 **NICU admission** **G1**: 17/1,284 **G2**: 8/1,284 OR = 2.14 (1.91-5.90) *P* < 0.01	NR	**Relevance** Moderate **Quality Rating** Fair

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Rec #: 9598

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Appendix D
Listing of Excluded Studies

Listing of Excluded Studies

Codesheet for Cesarean Reasons for Exclusion

Code	Meaning of Code
BKGRD	Background
DA	Decision analysis
FTE3	Not original research
FTE4	Ineligible geographic location
FTE5	Incorrect population of study participants
FTE6	Does not address study questions
FTE7	Ineligible study design
FTE8	Sample size too small
FTE9	Unabstractable
FTE10	Could not acquire
FTE11	Not relevant to previa update

1. Prevalent urinary incontinence as a correlate of pregnancy, vaginal childbirth and obstetric techniques. J Wound Ostomy Continence Nurs 1999; 26(3):28A-9A.
Notes: Urinary Incontinence Search; Journal Article
AI
FTE6

2. Rates of cesarean delivery--United States, 1993. MMWR Morb Mortal Wkly Rep 1995;44(15):303-7.
Notes: HAND SEARCH
AI
FTE11

3. Abu-Heija AT, Jallad MF, Abukteish F. Maternal and perinatal outcome of pregnancies after the age of 45. J Obstet Gynaecol Res 2000; 26(1):27-30.
Notes: PREVIA UPDATE
AI
FTE11

4. Acien P. Breech presentation in Spain, 1992: a collaborative study. Eur J Obstet Gynecol Reprod Biol 1995; 62(1):19-24.
Notes: KQ1 Search Journal Article
AI
FTE6

5. Al-Abdulhadi O, Biehl D, Ong B, Boker A. A comparison of spinal hyperbaric ropivacaine and hyperbaric bupivacaine for elective cesarean section. Can J Anesth 2004; 51(Suppl 1):A55.
Notes: (39) CCT
(42) Cochrane CCTR Search;
Label: PBS Record: 10
AI
FTE6

6. Albrechtsen S , Rasmussen S, Reigstad H, Markestad T, Irgens LM, Dalaker K. Evaluation of a protocol for selecting fetuses in breech presentation for vaginal delivery or cesarean section. Am J Obstet Gynecol 1997; 177(3):586-92.
Notes: Comparison Studies Journal Article
AI
FTE5
FTE6

7. Alcalay M, Hourvitz A, Reichman B *et al*. Prelabour rupture of membranes at term: early induction of labour versus expectant management. Eur J Obstet Gynecol Reprod Biol 1996; 70(2):129-33.
Notes: Neonate outcome study Clinical Trial Journal Article
Randomized Controlled Trial
AI
FTE6

8. Allen J, Hippisley-Cox J, Pringle M, Groom L. Assisted delivery in the teenage population: the effect of inter-hospital variation, deprivation, and age. Int J Adolesc Med Health 2003; 15(4):341-7.
Notes: KQ1 Search Journal Article
AI
FTE6

9. Amarin VN, Akasheh HF. Advanced maternal age and pregnancy outcome. East Mediterr Health J 2001; 7(4-5):646-51.
Notes: PREVIA UPDATE
AI
FTE11

10. Amoa AB, Klufio CA, Wat S, Kariwiga G, Mathias A. A retrospective survey of patients with one previous caesarean section delivered at the Port Moresby General Hospital: a comparative study of those delivered vaginally and those delivered by repeat caesarean section. P N G Med J 1997; 40(3-4):127-35.
Notes: Outcomes Studies; Harms Search; KQ1 Search Journal Article
AI
FTE4
FTE6

11. Amu O, Rajendran S, Bolaji I. Should doctors perform an elective caesarean section on request? Maternal choice alone should not determine method of delivery. Br Med J 1998; 317(7156):463-5.
Notes: Harms Search; Journal Article
AI
FTE3
FTE4
FTE5
FTE6
FTE7
FTE8
BKGRD

12. Ananth CV, Demissie K, Smulian JC, Vintzileos AM. Placenta previa in singleton and twin births in the United States, 1989 through 1998: a comparison of risk factor profiles and associated conditions. Am J Obstet Gynecol 2003; 188(1):275-81.
Notes: PREVIA UPDATE
AI
FTE11

13. Ananth CV, Smulian JC, Vintzileos AM. The association of placenta previa with history of cesarean delivery and abortion: a metaanalysis. Am J Obstet Gynecol 1997; 177(5):1071-8.
Notes: Journal Article
Meta-Analysis Placenta Previa Search
AI
FTE3
FTE6

14. Ananth CV, Wilcox AJ, Savitz DA, Bowes WAJr, Luther ER. Effect of maternal age and parity on the risk of uteroplacental bleeding disorders in pregnancy. Obstet Gynecol 1996; 88(4 Pt 1):511-6.

Notes: Journal Article Placenta Previa Search
AI
FTE6
DA

15. Annibale DJ, Hulsey TC, Wagner CL, Southgate WM. Comparative neonatal morbidity of abdominal and vaginal deliveries after uncomplicated pregnancies. Arch Pediatr Adolesc Med 1995; 149(8):862-7.
Notes: Harms Search; Journal Article
AI
FTE6

16. Appleby J. Data briefing. Caesarean births. Health Serv J 2001; 111(5756): 31.
Notes: infant and c-section additions
AI
FTE9

17. Armstrong CA , Harding S, Matthews T, Dickinson JE. Is placenta accreta catching up with us? Aust N Z J Obstet Gynaecol 2004; 44(3):210-3.
Notes: Journal Article Placenta Previa Search
AE
FTE12

18. Arsiradam N, Maliti Z, Rocke D. Ropivacaine 7.5 mg/ml for epidural anesthesia in elective Cesarean section: a comparison with 5mg/ml bupivacaine. Anesth Analg 1998; 86(Suppl):S361.
Notes: Cochrane CCTR Search; EMBASE Search; Label: PBS Record: 400
AI
FTE4
FTE6

19. Avva R, Shah HR, Angtuaco TL. US case of the day. Placenta increta. Radiographics 1999; 19(4):1089-92.
Notes: Case Reports
Journal Article Placenta Previa Search
AI
FTE3
FTE6

20. Bagnoli F, Bruchi S, Garosi G, Pecciarini L, Bracci R. Relationship between mode of delivery and neonatal calcium homeostasis. Eur J Pediatr 1990; 149(11):800-3.
Notes: infant and c-section additions
AI
FTE6
BKGRD

21. Bagratee JS, Moodley J, Kleinschmidt I, Zawilski W. A randomised controlled trial of antibiotic prophylaxis in elective caesarean delivery. Br J Obstet Gynaecol 2001; 108(2):143-8.
Notes: RCT Search; Clinical Trial
Journal Article
Randomized Controlled Trial
AI
FTE4

22. Bahl R, Strachan B, Murphy DJ. Pelvic floor morbidity at 3 years after instrumental delivery and cesarean delivery in the second stage of labor and the impact of a subsequent delivery. Am J Obstet Gynecol 2005; 192(3):789-94.
Notes: Urinary Incontinence Search; Journal Article
AI
FTE6

23. Bahl R, Strachan BK. Mode of delivery in the next pregnancy in women who had a vaginal delivery in their first pregnancy. J Obstet Gynaecol 2004; 24(3):272-3.
Notes: Outcomes Studies; KQ1 Search Journal Article
AI
FTE6
DA

24. Bai SW, Lee HJ, Cho JS, Park YW, Kim SK, Park KH. Peripartum hysterectomy and associated factors. J Reprod Med 2003; 48(3):148-52.
Notes: Harms Search; KQ1 Search Journal Article
AI
FTE6

25. Bailit JL, Love TE, Mercer B. Rising cesarean rates: are patients sicker? Am J Obstet Gynecol 2004; 191(3):800-3.
Notes: Harms Search; KQ1 Search Journal Article
AI
FTE6

26. Bais JM, van der Borden DM, Pel M *et al*. Vaginal birth after caesarean section in a population with a low overall caesarean section rate. Eur J Obstet Gynecol Reprod Biol 2001; 96(2):158-62.
Notes: Outcomes Studies; KQ1 Search Journal Article
AI
FTE6

27. Bamigboye AA , Hofmeyr GJ. Non-closure of peritoneal surfaces at caesarean section--a systematic review. S Afr Med J 2005; 95(2):123-6.
Notes: Outcomes Studies; Journal Article
AI
FTE3
FTE6

28. Bashore RA, Phillips WHJr, Brinkman CR3. A comparison of the morbidity of midforceps and cesarean delivery. Am J Obstet Gynecol 1990; 162(6):1428-34; discussion 1434-5.
Notes: infant and c-section additions

AI
FTE6

29. Bekku S, Mitsuda N, Ogita K, Suehara N, Fujimura M, Aono T. High incidence of respiratory distress syndrome (RDS) in infants born to mothers with placenta previa. J Matern Fetal Med 2000; 9(2):110-3.
Notes: Harms Search; Journal Article
AE
FTE12

30. Ben-Aroya Z, Hallak M, Segal D, Friger M, Katz M, Mazor M. Ripening of the uterine cervix in a post-cesarean parturient: prostaglandin E2 versus Foley catheter. J Matern Fetal Neonatal Med 2002; 12(1):42-5.
Notes: Comparison Studies Clinical Trial Journal Article
AI
FTE6

31. Berchuck A, Sokol RJ. Previous cesarean section, placenta increta, and uterine rupture in second-trimester abortion. Am J Obstet Gynecol 1983; 145(6):766-7.
Notes: Case Reports
Journal Article Placenta Previa Search
AI
FTE3
FTE6
FTE7
FTE8

32. Bewley S, Cockburn J. II. The unfacts of 'request' caesarean section. Br J Obstet Gynaecol 2002; 109 (6):597-605.
Notes: Urinary Incontinence Search; Harms Search; KQ1 Search Comment
Journal Article
AI
FTE3
FTE5
FTE6
FTE7
FTE8
BKGRD

33. Bhat SM, Hamdi IM, Bhat SK. Placenta previa in a referral hospital in Oman. Saudi Med J 2004; 25(6):728-31.
Notes: PREVIA UPDATE
AI
FTE11

34. Blackwell SC , Hassan SS, Wolfe HM, Michaelson J, Berry SM, Sorokin Y. Vaginal birth after cesarean in the diabetic gravida. J Reprod Med 2000; 45(12):987-90.
Notes: Comparison Studies Journal Article
AI
FTE6

35. Blanchette H . Comparison of obstetric outcome of a primary-care access clinic staffed by certified nurse-midwives and a private practice group of obstetricians in the same community. Am J Obstet Gynecol 1995; 172(6):1864-8; discussion 1868-71.
Notes: Comparison Studies Journal Article
AI
FTE6

36. Blanchette H , Blanchette M, McCabe J, Vincent S. Is vaginal birth after cesarean safe? Experience at a community hospital. Am J Obstet Gynecol 2001; 184(7):1478-84; discussion 1484-7.
Notes: Outcomes Studies; Journal Article
AI
FTE6

37. Bollapragada SS, Edozien LC. Apparent absence of lochia after elective caesarean section. J Obstet Gynaecol 2002; 22(5):558.
Notes: Harms Search; Case Reports
Journal Article
AI
FTE3
FTE6
FTE7
FTE8

38. Boyers SP, Gilbert WM. Elective repeat caesarean section versus trial of labour: the neonatologist's view. Lancet 1998; 351(9097):155.
Notes: Harms Search; KQ1 Search Journal Article
AI
FTE3
FTE7
BKGRD

39. Brubaker L. Postpartum urinary incontinence. Br Med J 2002; 324(7348):1227-8.
Notes: Urinary Incontinence Search; Comment Editorial
AI
FTE3

40. Brubaker L. Vaginal delivery and the pelvic floor. Int Urogynecol J Pelvic Floor Dysfunct 1998; 9(6):363-4.
Notes: Urinary Incontinence Search; Editorial
AI
FTE3
FTE4
FTE5
FTE6
FTE7

41. Brueckner-Schmid B, Petzold I, Bruekner J. Rapacuronium for rapid sequence induction in elective cesarean section. Society for Obstetric Anesthesia and Perinatology 33rd Annual Meeting. Anesthesiology, 2001: A84.
Notes: Cochrane CCTR Search;
Label: PBS Record: 180
AI
FTE6
FTE8

42. Brumfield CG , Hauth JC, Andrews WW. Puerperal infection after cesarean delivery: evaluation of a standardized protocol. Am J Obstet Gynecol 2000;182(5):1147-51.
Notes: HAND SEARCH
AI
FTE6

43. Bryan H, Hawrylyshyn P, Hogg-Johnson S *et al*. Perinatal factors associated with the respiratory distress syndrome. Am J Obstet Gynecol 1990; 162(2):476-81.
Notes: infant and c-section additions
AI
FTE5
FTE6

44. Buist R. Induction of labour: indications and obstetric outcomes in a tertiary referral hospital. N Z Med J 1999; 112(1091):251-3.
Notes: Outcomes Studies; KQ1 Search Journal Article
AI
FTE6

45. Bunin GR, Buckley JD, Boesel CP, Rorke LB, Meadows AT. Risk factors for astrocytic glioma and primitive neuroectodermal tumor of the brain in young children: a report from the Children's Cancer Group. Cancer Epidemiol Biomarkers Prev 1994; 3(3):197-204.
Notes: infant and c-section additions
AI
FTE6

46. Burnett M. Optional Caesarean: what do some Canadian physicians say? J Obstet Gynaecol Can 2002; 24(3):219-20.
Notes: Harms Search; KQ1 Search Journal Article
AI
FTE3
FTE5
FTE6
BKGRD

47. Busch FW, Hamdorf JM, Carroll CSSr, Magann EF, Morrison JC. Acute colonic pseudo-obstruction following cesarean delivery. J Miss State Med Assoc 2004; 45(11):323-6.
Notes: infant and c-section additions
AI
FTE3
FTE6

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Meta-Analysis
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Meta-Analysis
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FTE7
BKGRD

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Journal Article
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Journal Article
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BKGRD

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Editorial
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Journal Article
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FTE5

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FTE7

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BKGRD

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Journal Article
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Meta-Analysis
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FTE3

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Letter
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FTE8
BKGRD

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BKGRD

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Label: PBS Record: 570
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Journal Article
Randomized Controlled Trial
AI
FTE4

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Letter
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Journal Article
Randomized Controlled Trial
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Letter
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Journal Article
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BKGRD

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Journal Article
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Journal Article
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FTE8

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AI
FTE6

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BKGRD

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Article
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DA

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Multicenter Study
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Notes: HAND SEARCH
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Notes: KQ1 Search Journal Article
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AI
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Clinical Trial
Journal Article
Multicenter Study
Randomized Controlled Trial
AI
FTE6

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Journal Article
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FTE3
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Notes: infant and c-section additions
AI
FTE11

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AI
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AI
FTE6

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AI
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AI
FTE10

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AI
FTE6

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AI
FTE6

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AI
FTE3
FTE4
FTE5
FTE6
FTE7
FTE8

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AI
FTE6

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Journal Article
Randomized Controlled Trial
AI
FTE6

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AI
FTE3
BKGRD

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AI
FTE6

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AI
FTE6

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Review
AI
FTE3
FTE6

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Notes: Harms Search; Clinical Trial
Journal Article
Randomized Controlled Trial
AI
FTE6

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Letter
AI
FTE3
FTE6
FTE4
FTE5
FTE7
FTE8
BKGRD

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Journal Article
Randomized Controlled Trial
AI
FTE5
FTE6

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AI
FTE6
FTE8
BKGRD

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AI
FTE6
DA

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FTE7

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AE
FTE12

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Journal Article
AI
FTE6

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Letter
AI
FTE3
FTE6
BKGRD

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Clinical Trial
Journal Article
Randomized Controlled Trial
AI
FTE6

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Label: PBS Record: 270
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FTE6
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AI
FTE6

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FTE5
FTE6

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AE
FTE6

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FTE4

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Notes: PREVIA UPDATE
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Notes: PREVIA UPDATE
AI
FTE

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AI
FTE4
FTE6

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AI
FTE6

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AI
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AI
FTE6

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AI
FTE4
FTE6

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Notes: Harms Search; Comment
Editorial
AI
FTE3
FTE5
FTE6
FTE7
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FTE8
BKGRD

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AI
FTE4
FTE6

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FTE6

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AI
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FTE6

Appendix E
Acknowledgments

Appendix E. Acknowledgments

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Technical Expert Panel

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